



The Effect of Mathematical Disposition on Basic Mathematical Abilities in the Online Learning

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ABSTRAK

Masalah yang muncul dari pembelajaran online adalah menurunnya hasil belajar atau rendahnya kemampuan dalam bermatematika. Masalah ini dapat diatasi dengan mencari berbagai variabel dalam pembelajaran online. Peneliti menduga bahwa disposisi matematis ini memiliki pengaruh terhadap kemampuan dasar bermatematika. Dengan demikian, tujuan penelitian ini adalah untuk mengetahui pengaruh disposisi matematis terhadap kemampuan dasar matematika di masa pembelajaran online. Jenis penelitian ini merupakan penelitian kuantitatif dengan pendekatan kausal komparatif. Sampel penelitian ini yaitu 65 mahasiswa calon guru matematika di Universitas Islam Malang. Data penelitian ini berupa hasil pengisian angket disposisi matematis dan hasil mengerjakan soal kemampuan dasar matematika. Instrumen penelitian ini terdiri dari angket dan soal. Angket dan soal yang digunakan ini telah memenuhi kriteria valid dan reliabel. Teknik analisis data yang digunakan dalam penelitian ini adalah analisis korelasi dan regresi sederhana dengan berbantuan SPSS. Hasil penelitian menunjukkan bahwa disposisi matematis (rasa percaya diri, kreativitas, kegigihan, rasa ingin tahu, nilai positif, dan menghargai) berpengaruh positif terhadap kemampuan dasar matematika sebesar 14,5%. Dari hasil penelitian dapat disimpulkan bahwa variabel disposisi metafisik berkorelasi positif dengan variabel kemampuan dasar matematika. Hasil penelitian juga menunjukkan bahwa disposisi matematis berpengaruh positif terhadap kemampuan dasar matematika pada pembelajaran daring. Komponen disposisi matematika yang penting untuk diperhatikan selama pembelajaran daring adalah kreativitas, ketekunan, rasa ingin tahu, nilai positif, dan rasa hormat terhadap matematika. Komponen-komponen tersebut menjadi tolak ukur pengaruh disposisi matematis terhadap kemampuan dasar matematika.

ABSTRACT

The problem that arises from online learning is decreased learning outcomes or low ability in mathematics. This problem can be overcome by looking for various variables in online learning. Researchers suspect that this mathematical disposition influences basic mathematical abilities. Thus, the purpose of this study was to analyze the effect of mathematical disposition on basic mathematical abilities in online learning. This type of research is quantitative research with a comparative causal approach. The sample of this research is 65 prospective mathematics teacher students at the Islamic University of Malang. The research data is in the form of the results of filling out the mathematical disposition questionnaire and the results of working on basic math skills questions. The research instrument consisted of a questionnaire and questions. The questionnaire and questions used have met valid and reliable criteria. The data analysis technique used in this study is a simple correlation and regression analysis with the help of SPSS. The results showed that mathematical disposition (self-confidence, creativity, persistence, curiosity, positive values, and respect) had a positive effect on basic mathematical abilities by 14.5%. From the research results, it can be concluded that the metaphysical disposition variable is positively correlated with the mathematical basic ability variable. The results of the study also show that mathematical disposition has a positive effect on basic mathematical abilities during online learning. The important mathematical disposition components to pay attention to during online learning are creativity, persistence, curiosity, positive value, and respect for mathematics. These components are the benchmarks for the influence of mathematical disposition on basic mathematical abilities.

1. INTRODUCTION

Since 2019, the world has been hit by the spread of COVID-19. As an effort to prevent the spread of this dangerous virus, learning in the world is carried out online. Learning in Indonesia is done online. However, the change in learning from what was originally carried out face-to-face to online learning hurt some students. The results of the research show that in online learning, students experience conceptual misunderstandings, principle misunderstandings, and factual misunderstandings (Y. E. Setiawan, 2022; Y. E. Setiawan & Surahmat, 2021). Various problems also arise in online learning, including difficulty adapting

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to online learning, lack of student understanding, saturation occurs in online learning, and limited interaction between teachers and students, resulting in decreased student understanding of the material being studied. The results of the research show that teachers experience problems with communication, learning methods, materials, and the high costs of using technology (Agustin et al., 2021). Most of students experience technical difficulties and difficulty adapting to online learning. The results of the research also show that the teacher's problems are in the form of weak IT mastery and limited access to student supervision (Annur & Hermansyah, 2020; Asmuni, 2020). Students are less active in participating in learning, due to limited supporting facilities and access to internet networks (Basar, 2021; Oktawirawan, 2020; Pawicara & Conilie, 2020; Suriadi et al., 2021). This problem is important to overcome so that online learning can be carried out successfully. One way is to recognize the variables that are related to online learning.

Researchers suspect that one of the variables related to the success of online learning is mathematical disposition. The results of the study show that mathematical disposition has a relationship and has a positive effect on learning achievement during face-to-face learning (Awofala et al., 2020; Feldhaus, 2014; Wilson, 2011). Other studies link mathematical dispositions to learning styles, where the results of other studies show that students with visual learning styles have better mathematical dispositions than students with auditory and kinaesthetic learning styles (Fitrianna et al., 2018; Kamid et al., 2021; Putra et al., 2017).

Mathematical disposition also influences one's success in learning mathematics. The results of the research show that mathematical disposition influences problem-solving abilities (Hutajulu et al., 2019; Kusmaryono et al., 2016, 2019). The results of other studies show that the productive disposition of mathematics has a significant relationship and the 8 dimensions of productive disposition contribute 84.5% to achievement (Fitrianna et al., 2018). The results of the study also show that mathematical disposition has a positive effect on critical thinking skills (Lin & ChunTai, 2016; Minarti et al., 2020). The results of the study show that beliefs have a significant effect on students' abilities (Almerino et al., 2019). There is a significant relationship between mathematical disposition and learning achievement (Lin & ChunTai, 2016). The results of the study show that the mathematical productive disposition is a key component of mathematical proficiency (Feldhaus, 2014). The results of the study show that mathematical disposition has a significant correlation with student achievement (Awofala et al., 2020). From the various results of these studies it can be concluded that mathematical disposition includes components that must be considered so that someone can be successful in learning mathematics. Mathematics disposition in this study is a conscious behaviour that supports a person to be successful in solving math problems.

Therefore, it is important to further analyse whether there is an effect of mathematical disposition on basic mathematical abilities. Thus the purpose of this study was to determine the influence of mathematical dispositions on basic mathematical abilities. The materials used to determine basic mathematical abilities in this study are integers, fractions, decimals, ratios and proportions, measurements, algebra, and solving equations (Blume et al., 2021; Mckeague, 2010). The results of this study will be useful to find out to what extent mathematical dispositions have the same or different effects when learning online. In addition, the results of this study will be useful to know that the mathematical disposition variable is also a predictor of success for online learning.

2. METHODS

This research approach is quantitative. This type of research is causal comparative, namely to find out the possibility of a causal relationship. The population of this study was students of the mathematics education study program at the Islamic University of Malang. The sample in this study consisted of 65 prospective mathematics education students in the first semester. The sample selection technique in this study used a random sampling technique, namely the sample was selected randomly. The independent variable in this study is a mathematical disposition (X), while the dependent variable is the basic mathematical ability (Y). The measurement of the independent variable in the form of a mathematical disposition in this study uses a Likert scale.

The research instrument consisted of a questionnaire and questions. Questionnaires are used to measure mathematical disposition and questions are used to measure basic mathematical abilities. The questionnaire in this study consisted of 43 statements about mathematical dispositions. This is because mathematical disposition is an attitude that is measured by asking the respondent's consent to fill out a questionnaire in which each question consists of four possible answers, namely strongly agree, agree, disagree, and strongly disagree. Each answer choice is given a score of 4, 3, 2, and 1. Thus the maximum score for each respondent is $43 \times 4 = 172$ and the score obtained by each respondent is converted into a rating scale of 0-100 with the way the score obtained/maximum score is multiplied by 100. While the

measurement of the dependent variable in the form of basic mathematical abilities uses an interval score between 0-100. In research on certain thinking dispositions, one should consider the components of thinking disposition (Clark et al., 2014; Crow & Castello, 2016; Driscoll et al., 2017). The disposition components considered in this study consisted of 7 components, namely self-confidence, creativity, persistence, curiosity, reflective thinking, values, and respect. The results of the preliminary research show that these seven components of disposition are correlated with each other lain (Setiawan, Choirudin, et al., 2022; Setiawan, Surahmat, et al., 2022; Setiawan & Surahmat, 2022). While the questions to measure the ability of basic mathematics is a matter of description. Indicators of each of these variables can be seen in Table 1.

Table 1. Indicators of Predictor Variables and Independent Variable

Variable	Sub Variable	Indicators
Predictor Variables: Mathematical Disposition	Self-confident	Have confidence in solving mathematical problems, through the communication of ideas and reasons or reasoning.
	Creativity	Have a creative attitude in exploring mathematical ideas and trying different ways to solve problems.
	Persistence	Have a strong persistence in solving difficult problems.
	Curiosity	Have an interest and curiosity to try to find alternative solutions to solving problems.
	Reflection thinking	Having an attitude tends to reflect on the process and results of problem solving.
	Values	Have an attitude that mathematics can be applied or useful in other fields and in everyday life.
	Respect	Have an attitude of respecting the role of mathematics in culture and language.
Dependent variable: Basic mathematical abilities	-	Ability to solve mathematical problems by applying basic mathematical skills to the material of integers, fractions, decimals, ratios and proportions, measurements, algebra, and solving equations.

Before using this research instrument, validity and reliability tests were first carried out. Testing the validity of this research instrument uses the product moment with SPSS. Testing the validity of the product moment perason correlation uses the principle of correlating between the item score and the total score. There are 35 respondents used for testing this item. The test results of 15 questions to measure basic mathematical ability obtained 8 items that fulfilled the validity of the instrument, this was due to the Sig. (2-tailed) < 0.05. Thus these 8 questions are used to measure basic mathematical abilities. Furthermore, from the 8 valid questions, the reliability test was carried out using the Alpha Cronbach technique. The results of the reliability test showed that the 8 research instruments had a Cronbach's Alpha value of 0.621. Because $0.621 > 0.60$, it can be said that the 8 questions are reliable or consistent. Thus the instrument in the form of 8 questions is used to measure students' basic mathematical abilities.

The data collected in this study is quantitative data from the results of filling out the questionnaire and the results of basic mathematical ability tests. Furthermore, the two data were analyzed using two stages. The first stage is to change the questionnaire scores and test scores respectively into mathematical disposition values and mathematical basic ability values by dividing the score obtained by the maximum score and then multiplying by 100. The second stage is to carry out a correlation and regression analysis between the two variables. Correlation analysis in this study used the Pearson product moment correlation, while the regression analysis used simple linear regression with the help of SPSS. The significance level of correlation and regression testing in this study is 5%. Therefore, the criteria for the results of the correlation and regression tests in this study are that H_a is accepted if the Sig. < 0.05. this means that there is a correlation and a significant influence of the mathematical disposition variable on basic mathematical abilities.

3. RESULT AND DISCUSSION

Results

The first analysis is correlation test was carried out between mathematical dispositions and basic mathematical abilities. This correlation test aims to determine whether there is a relationship between the independent variable (mathematical disposition) and the independent variable (basic mathematical

ability). Correlation testing in this study used the Pearson correlation technique with the help of the SPSS program. The results of the correlation test can be seen in [Table 2](#).

Table 2. The Result of Correlations Analysis

		Mathematical Disposition	Basic Math Skills
Mathematical Disposition	Pearson Correlation	1	0.381
	Sig. (2-tailed)		0.002
	N	65	65
Basic Math Skills	Pearson Correlation	0.381	1
	Sig. (2-tailed)	0.002	
	N	65	65

From [Table 2](#). It can be seen that the value of Sig. (2-tailed) is $0.002 < 0.05$. this means that there is a significant correlation or relationship between mathematical disposition and basic mathematical abilities. The second analysis is to do a simple regression test. Furthermore, it is known that there is a significant correlation between mathematical disposition and basic mathematical ability. Then a simple regression test was carried out with the help of SPSS. The magnitude of the influence of mathematical disposition on basic mathematical abilities can be seen from the results of the simple regression analysis in [Table 3](#).

Table 3. Model Summary from the Results of the Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.381	0.145	0.132	12.980

From [Table 3](#) it can be seen that the magnitude of the influence of mathematical disposition on basic mathematical abilities can be seen from the R Square value, which is equal to 0.145. This value means that the effect of mathematical disposition on the basic ability of mathematics is 14.5% and 85.5% is influenced by other factors not identified in this study. The results of the hypothesis test indicating that there is an influence or not mathematical disposition on basic mathematical abilities can be seen from the results of the simple regression test which can be seen in [Table 4](#).

Table 4. The Results of Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	21.743	18.554		1.172	0.246
	Mathematical Disposition	0.792	0.242	0.381	3.270	0.002

From [Table 4](#) it can be seen that the value of Sig. from a mathematical disposition of $0.002 < 0.05$. This means that it can be concluded that H_0 is rejected and H_a is accepted, that is, there is a significant effect of mathematical disposition on basic mathematical abilities. From [Table 4](#) it can also be seen that the constant value of the Unstandardized Coefficients is 21.743. This means that if there is no mathematical disposition value, then the value of the basic mathematical ability is 21.743. Meanwhile, the regression coefficient is 0.792 which means that for every 1% addition to the level of mathematical disposition, the basic mathematical ability will increase by 0.792. Because the value of the regression coefficient is positive, it can be said that mathematical disposition has a positive effect on basic mathematical abilities. Thus the regression equation is $Y = 21.743 + 0.792X$. For example, someone who has a low mathematical disposition score (for example 30), then by using the regression equation the basic mathematical ability is 45.503. Whereas someone who gets a high mathematical disposition score (for example 90), then a basic mathematical ability score is 93.023. So it can be said that the more students' mathematical disposition increases, the value of basic mathematical abilities will increase. Thus it is important for students to improve their mathematical disposition during online learning, so that their basic mathematical abilities are also increasing.

Discussion

The results of this study generally contribute to developing the results of previous research on the effect of mathematical disposition on learning achievement ([Awofala et al., 2020](#); [Feldhaus, 2014](#); [Fitrianna et al., 2018](#)) by showing that mathematical disposition also has a positive effect on students' basic mathematical abilities, which is equal to 14.5%. The findings of this study substantially contribute to the

impact of mathematical dispositions on mathematical abilities in online learning. From the mathematical disposition variables used in this study, it was found that self-confidence, creativity, persistence, curiosity, reflective thinking, values, and respect have a positive effect on mathematical abilities. This means that in the world of education, attention is needed to the disposition of mathematics as a supporter of the success of education in the present and the future (Anggoro, 2016; Kirbaşlar & Özsoy-Güneş, 2015; Susilo et al., 2020).

The results of the study show that there are four components of thinking disposition that students need to succeed in online learning, namely: persistence, motivation, communication, and self-regulation (Almerino et al., 2019; Feldaus, 2018). The results of other studies also show that a positive score in mathematics is a predictor of appreciating mathematics by 55.2% (Y. E. Setiawan, Surahmat, et al., 2022). Curiosity also influences mathematical creativity by 43%. This curiosity also affects self-confidence by 19.6% and also affects persistence by 38.4%. The research results also show that an important component in distance learning or online learning is learner motivation (Yildirim & Cirak-kurt, 2022). Departing from previous studies, it was found that the results of this study should be considered when carrying out online learning. Where it is worth considering the components of a mathematical disposition that support the successful implementation of online learning which will also have an impact on increasing basic abilities in mathematics.

Although the value of the influence of mathematical disposition on basic mathematical abilities is small, the results of this study have shown that mathematical dispositions contribute to students' basic mathematical abilities in the online learning period. There are several factors that cause this mathematical disposition to have little effect on mathematical abilities during online learning. The first factor is the problems that arise in online learning. The small influence of mathematical disposition is caused by various online learning problems. The results of the study show that online learning has problems in the form of network constraints, technical constraints, and difficulty adapting to online learning (Setiawan, Zauri, et al., 2022). The results of other studies also show that students' mathematical dispositions in distance learning are in the moderate category (Ulía & Kusmaryono, 2021). This means that another factor that also determines basic math skills is fluency in carrying out online learning. Therefore, the problems that arise in online learning must be overcome, so that students' basic mathematical abilities are increasing. Nonetheless, research results show that the use of technology can increase the effectiveness of online learning or distance learning (Yildirim & Cirak-kurt, 2022). Therefore, apart from the mathematical disposition component, it is also necessary to consider the ability to use technology that supports success in implementing online learning.

The second factor is online learning causes interaction between students and teachers and student-student interaction decreases. The results of previous research indicate that an interactive learning atmosphere (teacher-students and students), fast feedback from the teacher, use of technology, and mathematical content are factors forming mathematical dispositions (Ulía & Kusmaryono, 2021). In addition, the results of previous research also show that learning factors have an influence on mathematical dispositions, while basic abilities have no influence on mathematical dispositions (Miliyawati & Herman, 2019). This can be interpreted that the interaction between teachers and students, as well as interactions between students and students can shape students' mathematical dispositions. For example, a teacher who always provides reinforcement during learning can cause students to be more confident in answering questions. Teacher interaction with students in explaining ways to answer questions can make students more creative in answering questions (Hajhosseiny, 2012; Novantri et al., 2020). Thus interaction plays an important role in improving mathematical disposition and increasing basic mathematical abilities.

The third factor is the teacher's lack of mathematical disposition in online learning. This teacher's mathematical disposition is defined as the tendency of the teacher's professional behavior that encourages the emergence of students' mathematical dispositions in learning mathematics. The results of the study show that the teacher's mathematical disposition shapes the students' mathematical disposition (Feldhaus, 2014). The results of other studies also show that teacher professionalism has a positive correlation with students' thinking dispositions (Sahin et al., 2016). For example, in online learning, the teacher only gives explanations about the material, gives assignments, or shows only learning videos. Of course, this does not support students' mathematical dispositions in learning mathematics. Thus the teacher's mathematical disposition has an important role to improve students' mathematical dispositions which in turn students can improve their abilities in mathematics.

Thus in general it has been proven that mathematical dispositions (especially creativity, persistence, curiosity, positive value, and respect for mathematics) need to be considered in the implementation of online learning. This will have a positive impact on increasing students' abilities in learning or in solving math problems (Awofala et al., 2020; Putra et al., 2017). In addition, other factors need to be addressed during online learning, namely: (1) frequent problems arise during online learning,

(2) lack of interaction between teachers and students and also between students and students, and (3) online learning causes a lack of mathematical dispositions owned by teachers, which has an impact on students' low mathematical dispositions. Although the results of this study indicate that this mathematical disposition has little effect, the results of this study have shown that mathematical disposition is also a predictor variable that must be considered when conducting online learning. Therefore, online learning also pays attention to mathematical dispositions in the form of self-confidence, creativity, persistence, curiosity, reflective thinking, values, and respect (Clark et al., 2014; Fadillah et al., 2020). With the hope that basic mathematical abilities will increase.

This research is limited to quantitative research which aims to determine the correlation and influence of mathematical disposition variables on basic mathematical abilities. Thus the recommendation for further research is to examine basic mathematical abilities in terms of the level of mathematical disposition possessed by students. Where the results of this study provide benefits in improving basic mathematical abilities based on the level of mathematical disposition possessed by students. In addition, researchers also provide recommendations to teachers or lecturers to motivate students when learning online. It is hoped that students' mathematical dispositions can increase, which in turn will have an impact on increasing students' basic mathematical abilities.

4. CONCLUSION

From the research results, it can be concluded that the metaphysical disposition variable is positively correlated with the mathematical basic ability variable. The results of the study also show that mathematical disposition has a positive effect on basic mathematical abilities during online learning. The important mathematical disposition components to pay attention to during online learning are creativity, persistence, curiosity, positive value, and respect for mathematics. These components are the benchmarks for the influence of mathematical disposition on basic mathematical abilities. In addition, three factors need to be addressed during online learning, namely the problems that arise in online learning, the lack of interaction between teachers and students, students and students in online learning, and the lack of teachers' mathematical disposition in online learning. Because the world of education in the future will use a lot of technology. So that the problems caused by the use of technology must be overcome.

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