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Sociomathematical Norm, Mathematical Resilience and Mathematical Representation Ability in Mathematics Learning

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ABSTRAK

Sifat matematika yang abstrak perlu direpresentasikan dalam berbagai macam representasi yang komprehensif terhadap matematika itu sendiri. Salah satu soft skill yang dapat medukung kemampuan representasi matematis adalah sociomathematical norm *dan resiliensi matematis. Penelitian ini bertujuan untuk menganalisis pengaruh sociomathematical norm dan resiliensi terhadap kemampuan representasi matematis pada pembelajaran. Metode yang digunakan dalam penelitian ini adalah kuantitaif dengan desain korelasional menggunakan teknik survey dan struktur* equestion *model. Sampel yang digunakan sebanyak 100 siswa SMP dengan menggunakan teknik proportional* random sampling*. Instrumen tes kemampuan representasi matematik terdiri dari 5 item tes. Sedangkan, instrumen* sociomathematical norm *berbentuk angket dengan skala Likert. Analisis data dilakukan dengan menggunakan* Structural Equestion Modeling (SEM) *dengan n uji t-student untuk mengetahui berapa pengaruh antar variable menggunakan* software *SmartPLS. Hasil pengujian instrument kemampuan representasi matematis,* sociomathematical norm *dan resilensi matematik menunjukan indikator pada setiap instrument dikatakan valid. Hasil pengujian realibilitas menunjukan semua intrumen memenuhi persyaratan reliabilitas. Hasil pengujian hipotesi menunjukan terdapat pengaruh positif yang signifikan* sociomathematical norm *terhadap kemampuan representasi matematis, terdapat pengaruh positif yang signifikan resiliensi matematika terhadap kemampuan representasi matematis; dan terdapat pengaruh positif yang signifikan* sociomathematical norm *terhadap representasi matematis dengan mediasi resiliensi matematik.*

ABSTRACT

The abstract nature of mathematics needs to be represented in various comprehensive representations of mathematics itself. One of the soft skills that can support mathematical representation ability is sociomathematical norm and mathematical resilience. This study aims to analyze the effect of sociomathematical norms and resilience on mathematical representation ability in learning. The method used in this study is quantitative with a correlational design using survey techniques and question model structures. The sample used was 100 junior high school students using proportional random sampling techniques. The mathematical representation ability test instrument consists of 5 test items. Meanwhile, the sociomathematical norm instrument is in the form of a questionnaire with a Likert scale. Data analysis was carried out using structural equation modelling (SEM) with n student t-tests to determine the influence between variables using SmartPLS software. The results of testing the mathematical representation ability instrument, sociomathematical norm and mathematical resilience showed that the indicators on each instrument were said to be valid. The reliability test results showed that all instruments met the reliability requirements. The results of the hypothesis testing show that there is a significant favourable influence of sociomathematical norms on mathematical representation ability, there is a significant favourable influence of mathematical resilience on mathematical representation ability, and there is a significant favourable influence of sociomathematical norms on mathematical representation with mathematical resilience mediation.

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1. INTRODUCTION

The process of learning mathematics as a process of forming mathematical competence must continue to be improved. The mathematical competence that is formed shows students' comprehensive understanding of mathematics towards abstract mathematics. The abstract nature of mathematics needs to be represented in various representations, both symbols, diagrams, images and in semantic language as a representation of a comprehensive understanding of mathematics itself (Maarif et al., 2018). Mathematical representation in the process of learning mathematics is needed by students as an effort to communicate an idea in the form of a mathematical model in various ways in order to solve mathematical problems (PR Utami et al., 2018). In addition, with mathematical representation skills, students face a challenging problem by trying to simplify complex mathematical problems so that they can find the expected solution (Minarni et al., 2016). Therefore, mathematics learning must present an activity to develop the representation process in every mathematical material. The learning process with a representation approach to a mathematical material in the form of sentences, images, graphs and tables will provide students with experience in expressing their ideas in the form of mathematical representation skills (Fitrianna et al., 2018).

Mathematical representation ability is a person's ability to connect an object and mathematical symbols using ideas in various ways (Utami et al., 2018). The process of mathematical representation will allow students to construct a mathematical model of the mathematical problem being faced so that a solution can be found. Mathematical representation ability is the ability to configure images or concrete objects including manipulative materials, to then be symbolized into abstract ideas in the form of spoken language or written symbols (Ayu et al., 2020; Nasrullah et al., 2021). Mathematical representation skills are important to develop to help someone solve complex mathematical problems so that they are easy to understand and comprehend and then written down in the form of a solution (Hwang et al., 2007; Minarni et al., 2016; PR Utami et al., 2018). Mathematical representation ability is one of the mathematical competencies that need to be developed and requires supporting competencies in the form of soft skills or affective abilities. In the process of learning mathematics, good affective abilities can support students' success in developing mathematical competencies (Ignacio et al., 2006; Maarif & Fitriani, 2023). To develop mathematical representation skills, a learning treatment is needed that emphasizes interaction between students, student interaction with mathematical materials so that ideas can be expressed in the form of images, symbols, or tables (Jitendra et al., 2016). Interaction in learning is needed in developing ideas from each other so that mathematical ideas can be represented according to solutions to solve certain problems. This social interaction will give rise to a norm called sociomathematical norm (Partanen & Kaasila, 2015).

Resilience as the ability to encourage oneself, recover, adapt to problems to form social intelligence, academic and vocational competence despite bearing the burden of environmental conditions (Whitney et al., 2008). The process of a person adapting to a traumatic situation, an incident or event that can cause stress in his life (Mahmood & Ghaffar, 2014). Resilience as a person's resilience to the difficulties faced, able to collaborate in cooperation, have language skills in communicating weaknesses and strengths, and be resilient in facing difficulties related to learning problems (Johnston-Wilder et al., 2018). A person with good resilience skills is seen as having a positive outlook on problems, responding positively to the difficulties faced with ease, and the ability to adapt to the challenges faced for the continuity of work in the future (Chirkina et al., 2020; Gürefe & Akçakın, 2018; Kooken et al., 2013). The indicators of mathematical resilience include a persistent attitude, working hard, having a willingness to discuss, seeking various alternative solutions in solving problems, self-reflection, working together with peers, motivating oneself from experiences of failure, and having the ability to control oneself (Hendriana et al., 2019; Johnston-Wilder et al., 2018; Kooken et al., 2013).

Socio mathematical norms is a normative aspect of a person in understanding mathematics in dealing with mathematical differences. In the learning process, differences in ideas are undeniable. Therefore, these differences must be seen as a positive side to develop ideas in a mathematics learning process (Kang & Kim, 2016). Sociomathematical norms can foster students' self-confidence in facing the challenges of learning mathematics and values are basic values for students to act in their thinking process (Zembat et al., 2015). Thus, fostering sociomathematical norms can play a role in developing mathematical representation skills. Mathematical representation skills that require students to express their ideas in the form of symbols, pictures, tables and mathematical models require an attitude that is not easy in exploring problems. For this reason, the ability to not give up easily in trying to express ideas is needed, which is often called mathematical resilience. Resilience is resistance to difficulties with positive attitudes including working together, being tough, adapting to challenges, and being positive in responding to all kinds of learning problems (Johnston-Wilder & Brindley, 2015;Gurefe & Akçakın, 2018; Kooken et al., 2013; Chirkina et al., 2020). A person with good mathematical resilience will be able to adapt to the mathematical problems they face and then try to find a solution with the learning experience they have gained (Thornton et al., 2012). Mathematical resilience also has an impact on students' motivation to overcome the challenges of learning difficulties towards a productive attitude in developing their ideas in the form of mathematical competence (Johnston-Wilder et al., 2018). Therefore, in developing mathematical representation skills, it is necessary to balance this with an attitude of not giving up easily when facing mathematical problems to foster productive thinking in developing solutions (Sari et al., 2018).

Research on sociomathematical norms, mathematical resilience and mathematical representation ability has been conducted by several studies. Characteristics of mathematical representation ability based on sociomathematical norms (Renaldy & Maarif, 2022). Characteristics of mathematical communication skills based on sociomathematical norm aspects (Saputri & Maarif, 2022). From these studies, research that examines the contribution of socio-thematical norm aspects to mathematical representation ability has not been conducted. Furthermore, several studies related to mathematical resilience in mathematics learning have been conducted. There is a positive influence of mathematical resilience on problem-solving ability (Syafira et al., 2023). There is a positive relationship between mathematical resilience and mathematical connection ability (Monariska & Komala, 2020). There is a positive contribution of mathematical resilience to mathematical connection skills in mathematics learning using blended learning (Khairiyyah et al., 2021).

From several research results, mathematical resilience has a contribution to mathematical abilities. From several studies that have been mentioned, there has been no research that tries to find the influence of sociomathematical norms and mathematical resilience on mathematical representation abilities, so it is necessary to conduct a more in-depth study of the relationship between these variables. This research is important to determine the contribution of soft skills, namely sociomathematical norms and mathematical resilience to mathematical representation abilities in mathematics learning, so that soft skill factors supporting the mathematics learning process can be identified and applied in the mathematics learning process. Thus, this study will reveal the novelty of the contribution of sociomathematical norms and mathematical resilience to other mathematical abilities including mathematical representation abilities. The purpose of this study is to analyze the influence of sociomathematical norms and resilience on mathematical representation abilities in learning.

2. METHOD

The research procedure was conducted using a survey-based correlational research design with an equestion model structure approach (Karakus et al., 2021). The research was conducted with the aim of examining and analyzing influence sociomathematical norms and mathematical resilience towards students' mathematical representation abilities Senior High School (SMA)in DKI Jakarta.The subjects of this study involved high school students. The number of samples in this study was 100 students consisting of 67 male students and 33 female students. The sampling technique used was proportional random sampling. The method and instrument for data collection used a sociomathematical norm questionnaire and mathematical resilience, as well as a representation ability test that was distributed manually to high schools in DKI Jakarta.The data collection method was carried out by distributing instruments in the form of sociomathematical norm questionnaires and mathematical resilience, as well as mathematical representation ability tests to high school mathematics students. The instruments consisted of: mathematical representation ability tests, sociomathematical norm questionnaires and mathematical resilience questionnaires. The mathematical representation ability test instrument consisted of 5 test items. Mathematical representation ability testarranged based on with grid indicators, namely visual representation: constructing mathematical models of real or real-world situations to be used in understanding problems and determining solutions to problems (Hwang et al., 2007;Utami et al., 2019). Verbal representation: writing down the solution to a problem orally or in written language using mathematical concepts; and symbolic representation: writing down the solution to a problem using mathematical concepts and arithmetic symbols (Sari et al., 2018).

The sociomathematical norm instrument is in the form of a questionnaire consisting of 21 items using 5 answer choices with a scale Likert. The sociomathematical norm instrument is compiled with a grid of indicators, namely experience of mathematics contributes carefully and actively in discussion activities in the mathematics learning process, explanation of mathematics understands ideas and is able to explain ideas from solutions systematically, mathematical difference identifies similarities and differences in ideas from several alternative solutions, and compares similarities and differences in ideas from several alternative solutions that have been constructed, mathematical communication makes sense as a basis for communication in the learning process and submits statements to understand an idea with easy-to-understand language, mathematical effectiveness finds the most effective alternative solutions and explains problem solutions clearly, mathematical insight, interacts deeply in discussion activities and uses various sources in the discussion process to solve problems (Yackel & Cobb, 1996;Zembat et al., 2015; Kang & Kim, 2016; Widodo et al., 2020; (Ningsih & Maarif, 2021). Furthermore, the mathematical resilience questionnaire instrument consists of 26 items using 5 answer choices with a Likert scale. The mathematical resilience instrument is arranged based on the indicator grid: Persistent attitude, working hard, having the willingness to discuss, looking for various alternative solutions in solving problems, self-reflection, working together with peers, motivating oneself based on failure, and having the ability to control oneself (Kooken et al., 2013; Johnston-Wilder et al., 2018;Hendriana et al., 2019).

Before being used in research, the instruments that have been prepared are tested for validity and reliability. Validity testing is carried out to determine whether the instrument is able to measure what should be measured. Convergent validity is carried out by looking at the loading factor value and Average Variance Extracted (AVE), while discriminant validity is carried out by looking at the Fornell & Larcker Criterion value (Hermanda et al., 2019). Item Criteria for eachvariable said to be valid if outer loading > 0.7 (Wong, 2013). Next, discriminant validity testing was carried out with the Fornell & Larcker criterion on each research instrument. Criteriavariable discriminant with Fornell & Larcker Criterion, namely the AVE value on the diagonal is higher than the other values (Karakus et al., 2021). After the research instrument is declared valid. The next step is to carry out the SEM PLS reliability test with Cronbach's Alpha. The reliability testing criteria are Cronbach's Alpha (CA) value > 0.7 and Composite Reliability (CR) > 0.7 (Wong, 2013). Data analysis was carried out by testing the hypothesis through Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3 software. Use of the PLS-SEM methodgot applied in various fields, including the field of mathematics education, with reliable analysis results (Xu & Zhou, 2022). The use of SmartPLS software is because it is appropriate for analyzing a research model that integrates theory and empirical facts (Wong, 2013). Before testing the hypothesis, convergent validity and reliability tests are first carried out, as well as external model discriminants (Karakus et al., 2021) Hypothesis testing was conducted to test the relationship between latent variables, namely sociomathematical norms, mathematical resilience, and mathematical representation ability.

3. RESULT AND DISCUSSION

Result

The description of statistical data from the research results of sociomathematical norms, mathematical resilience, and mathematical representation ability is presented by showing the maximum score, minimum score, average, kurtosis and skewenes, as shown in Table 1.

Table 1. The Statistical Description of Research Data

Variables	Item Code	Min	Max	Average	Standard Deviation	Quart.	Skew.
Mathematical Representation Ability	Rep 1	0	5	3.12	1.37	0.24	-0.56
	Rep 2	0	5	3.19	1.48	-0.42	-0.61
	Rep 3	0	5	3.26	1.23	-0.50	-0.83
	Rep 4	0	4	2.31	0.90	0.81	-0.56
	Rep 5	0	5	3.01	1.67	-1.08	-0.21
Sociomathematical Norm	SN 1	2	5	4.09	0.71	1.37	-0.82
	SN 2	1	5	3.67	0.92	1.18	-0.87
	SN 3	1	5	2.59	1.06	-0.90	0.26
	SN 4	1	5	3.68	1.01	0.41	-0.86
	SN 5	1	5	3.19	0.91	-0.04	-0.31
	SN 6	1	5	3.97	0.76	3.61	-1.23
	SN 7	1	5	3.22	1.06	-0.68	-0.19
	SN 8	1	5	2.96	1.07	-0.70	0.13
	SN 9	2	5	3.53	0.74	-0.19	-0.48
	SN 10	1	5	3.6	0.74	1.00	-0.74
	SN 11	1	5	2.52	0.94	-0.52	-0.02
	SN 12	1	5	3.98	0.70	2.83	-0.89
	SN 13	2	5	4.04	0.71	0.66	-0.58
	SN 14	1	5	2.81	0.97	-0.35	-0.08
	SN 15	1	5	3.97	0.74	2.81	-1.15
	SN 16	1	5	3.9	0.78	2.04	-1.10
	SN 17	3	5	4.23	0.58	-0.37	-0.08
	SN 18	1	5	3.21	0.89	0.31	-0.52
	SN 19	2	5	4.27	0.62	0.78	-0.50

Variables	Item Code	Min	Max	Average	Standard Deviation	Quart.	Skew.
	SN 20	1	5	3.27	0.98	0.10	-0.37
	SN 21	2	5	4.2	0.55	1.87	-0.30
Mathematical Resilience	R 1	1	5	3.99	0.70	3.20	-1.05
	R 2	1	5	3.29	0.97	0.44	-0.89
	R 3	1	5	4.14	0.70	3.69	-1.11
	R 4	1	5	3.57	0.93	0.39	-0.78
	R 5	2	5	4.05	0.67	1.33	-0.67
	R 6	1	5	2.86	0.97	-0.38	0.22
	R 7	1	5	2.75	1.03	-0.85	0.18
	R 8	1	5	3.1	1.12	-0.77	-0.20
	R 9	2	5	4.1	0.63	1.55	-0.58
	R 10	2	5	3.97	0.72	0.80	-0.63
	R 11	1	5	3.18	1.04	-0.38	-0.32
	R 12	1	5	3.9	0.78	2.04	-1.10
	R 13	1	5	2.82	0.95	-0.42	0.30
	R 14	1	5	3.71	0.86	0.51	-0.78
	R 15	1	5	2.86	0.97	-0.54	-0.05
	R 16	1	5	2.96	1.09	-0.76	-0.01
	R 17	1	5	2.79	0.92	-0.64	-0.11
	R 18	1	5	4.14	0.71	6.19	-1.59
	R 19	2	5	4.03	0.64	1.07	-0.49
	R 20	1	5	2.54	0.88	-0.30	0.24
	R 21	1	5	3.14	0.97	-0.18	-0.09
	R 22	1	5	3.94	0.65	4.08	-1.08
	R 23	1	5	2.84	0.99	-0.42	0.20
	R 24	1	5	3.16	1.00	-0.34	-0.45
	R 25	2	5	3.87	0.69	1.63	-0.95
	R 26	1	5	3.66	0.92	0.70	-0.76

Based on Table 1, it can be seen that each item on the sociomathematical norm instrument, mathematical resilience, and mathematical representation ability all have a value.kurtosis between -7 to 7 and skewness between -2 to 2 (Levasseur & Cuoco, 2003). This means that all items on each instrument are alldistributed normally. SEM PLS convergent validity test and discriminant validity were conducted on each item of the mathematical representation ability instrument, sociomathematical norms and mathematical resilience.

The results of the analysis show that each item of the mathematical representation ability instrument has a loading factor value of >0.7, which means that each item is valid. The sociomathematical instrument items shown in Figure 1 contain two items, namely SN 3 and SN 4, which have a loading factor value of <0.7, which means they are invalid, while all other items have a loading factor value of*factor*>0.7Whichinterpreted as valid. Meanwhile, for the mathematical resilience instrument, 24 items are declared valid because the loading factor value is >0.7, while for items R1 and R7, the loading factor value is <0.7, meaning it is declared invalid. The loading factor value can be clearly seen in Table 2.

Table 2. The Modification Results of Convergent Validity Test

Variables	Item Code	Outer Loading	Conclusion	Variables	Item Code	Outer Loading	Conclusion
Mathematical Representation Ability	Rep 1	0.761	Valid	Mathematical Resilience	R 1	0.663	Invalid
	Rep 2	0.822	Valid		R 2	0.716	Valid
	Rep 3	0.790	Valid		R 3	0.706	Valid
	Rep 4	0.721	Valid		R 4	0.734	Valid
	Rep 5	0.781	Valid		R 5	0.715	Valid
Sociomathematical Norm	SN 1	0.796	Valid		R 6	0.707	Valid
	SN 2	0.807	Valid		R 7	0.608	Invalid
	SN 3	0.095	Invalid		R 8	0.723	Valid
	SN 4	0.024	Invalid		R 9	0.703	Valid
	SN 5	0.850	Valid		R 10	0.703	Valid
	SN 6	0.788	Valid		R 11	0.705	Valid

Variables	Item Code	Outer Loading	Conclusion	Variables	Item Code	Outer Loading	Conclusion
	SN 7	0.813	Valid		R 12	0.755	Valid
	SN 8	0.792	Valid		R 13	0.787	Valid
	SN 9	0.782	Valid		R 14	0.791	Valid
	SN 10	0.807	Valid		R 15	0.797	Valid
	SN 11	0.802	Valid		R 16	0.775	Valid
	SN 12	0.766	Valid		R 17	0.768	Valid
	SN 13	0.745	Valid		R 18	0.792	Valid
	SN 14	0.803	Valid		R 19	0.817	Valid
	SN 15	0.716	Valid		R 20	0.788	Valid
	SN 16	0.715	Valid		R 21	0.790	Valid
	SN 17	0.717	Valid		R 22	0.806	Valid
	SN 18	0.792	Valid		R 23	0.787	Valid
	SN 19	0.795	Valid		R 24	0.785	Valid
	SN 20	0.786	Valid		R 25	0.785	Valid
	SN 21	0.782	Valid		R 26	0.761	Valid

Instrument test resultsmathematical representation ability, sociomathematical norms and mathematical resiliencehas an AVE value > 0.05 as shown in Table 3. This means that the indicators on each instrument are said to be valid.

Table 3. The Average Variance Extracted (AVE) Value Results

Variable	AVE	Criteria	Conclusion
Mathematical Representation Ability	0.602	>0.500	Valid
Sociomathematical Norm	0.563	>0.500	Valid
Mathematical Resilience	0.555	>0.500	Valid

Next, discriminant validity testing was conducted with the Fornell & Larcker criterion on mathematical representation ability, sociomathematical norms and mathematical resilience. The results of the discriminant validity test are as shown in Table 4.

Table 4. The Discriminant Validity: Fornell & Larcker Criterion

	Mathematical Representation Ability	Sociomathematical Norm	Mathematical Resilience
Mathematical Representation Ability	**0.776**		
Sociomathematical Norm	0.730	**0.894**	
Mathematical Resilience	0.7761	0.760	**0.783**

Based on the CFA in Table 4, it can be concluded that the instruments of mathematical representation ability, sociomathematical norms and mathematical resilience that were developed can be used to test the hypothesis of the proposed model.After the mathematical representation ability, sociomathematical norms and mathematical resilience instruments were declared valid.The next step is to conduct a reliability test. The results of the reliability test on the instrument are as shown in Table 5.

Table 5. The Reliability Test Results

Variables	Cronbach's Alpha	Composite Reliability	Criteria	Conclusion
Mathematical Representation Ability	0.834	0.837	>0.700	Reliable
Sociomathematical Norm	0.969	0.969	>0.700	Reliable
Mathematical Resilience	0.952	0.965	>0.700	Reliable

Table 5 shows the CA and CR values > 0.7. So it can be concluded that the instrument meets the reliability requirements. Thus, the instrument has the consistency to be used as a research measuring instrument. There are three hypotheses proposed in this study as previously mentioned in Figure 1. To test the hypothesis of the proposed structural model, the R^2 values, t-values and traditional beta (β) can be used through the bootstrap procedure with 5000 repeated samples.(Hermanda et al., 2019). Furthermore, the results of the structural model test show the results of the hypothesis test using the t-value as shown in Table 6.

Table 6. Hypothesis Test Results

Hypothesis	Variables	Original Sample	Standard Deviation	T-Value	P-Value	Conclusion
H1	SN -> Rep	0.730	0.047	8,622	0.000	Accepted
H2	R -> Rep	0.542	0.034	4.716	0.000	Accepted
H3	SN -> R -> Rep	0.485	0.085	2.122	0.000	Accepted

Description: SN: sociomathematical norm; R: mathematical resilience; Rep: mathematical representation ability. The significance criteria of the hypothesis are obtained from the significance of the T-statistic in the bootstrapping algorithm report. By looking at the T-table at alpha 0.05 (5%) = 1.96 and comparing it with the t-test, we can conclude whether the proposed hypothesis is significant or not. If the t-test value is > t-critical, then the proposed hypothesis is accepted.(Wong, 2013). Table 6 shows H1, H2,and H3have each t-value > 1.96, so it can be concluded that H1, H2, and H3 are accepted. Thus, based on the results of data analysis, it can be concluded that there is a positive influence of sociomathematical norms on mathematical representation abilities, there is a positive influence of mathematical resilience on mathematical representation abilities; and there is a positive influence of sociomathematical norms on mathematical representation with the mediation of mathematical resilience.

Discussion

The results of the data analysis show that in the process of learning mathematics, sociomathematical norms have a positive impact on mathematical representation skills. The process of learning mathematics cannot be separated from the process of social interaction to develop students' ideas and thinking processes, including forming mathematical representation skills. Sociomathematical norms are an attitude of considering mathematical explanations of differences in mathematical understanding received by someone (Kang & Kim, 2016). Results Mathematical representation skills can be developed through a learning process that emphasizes active student interaction (Minarni et al., 2016; Ningsih & Maarif, 2021). This shows that sociomathematical norms that emphasize student interaction in determining ideas contribute to mathematical representation skills. Social interaction experiences influence the development of mathematical thinking processes in solving problems (Sánchez & Garcia, 2014). Therefore, sociomathematical norms that develop the thinking process through social interaction become an important part in developing mathematical and problem-solving abilities. In solving problems, mathematical representation abilities are needed, there is a positive relationship between mathematical representation abilities and problem-solving abilities (Syafira et al., 2023).

Sociomathematical norms contribute to mathematical representation skills with social interaction activities by strengthening the expression of ideas. Mathematical representation skills require a learning treatment that emphasizes interaction between students, student interaction with mathematical materials so that ideas can be expressed in the form of images, symbols, or tables in the form of mathematical representations (Jitendra et al., 2016). In another part, students with good socimathematical norms will be able to explain the solution to the problem clearly. The ability to explain clearly can be easily done if students are aware of the steps/strategies used in solving the problem. Students who are aware of problem-solving strategies will master the solution and easily explain the solution (Ignacio et al., 2021;(Maarif & Fitriani, 2023). Mathematical explanations need to be represented in the form of images, symbols, or mathematical models. Thus, someone with good sociomathematical norms can contribute to mathematical representation skills. Explanations of problem solutions can help students understand concepts, procedures and be flexible in choosing information in solving mathematical problems (Murtafiah et al., 2018). Thus, a person with good sociomathematical norms can contribute to the learning process.

The second finding, there is a positive impact of mathematical resilience on mathematical representation ability as shown by T-value = 4.716> 1.96 with P-value = 0.000. This shows that someone who has good mathematical resilience will have an effect on mathematical representation ability. This finding shows that each indicator of mathematical resilience supports the development of mathematical representation ability. Mathematical resilience is supported by how a student has the willingness to discuss expressing ideas in the form of mathematical representation. The experience of interacting with the surrounding environment or social interaction influences the development of mathematical thinking processes in solving problems including mathematical representation ability (Sánchez & Garcia, 2014). Good resilience will try to optimally find various alternative solutions in solving problems for. Alternative solutions can be represented by various mathematical models, making it easier to determine the solution to a mathematical problem. Mathematical representation is intended to determine ideas by writing down the results of the analysis with a mathematical model so that ideas are obtained for the desired solution (Hwang et al., 2007; Lai & Hwang, 2016). Mathematical resilience has a positive effect on positive responses in mathematics learning which is indicated by students' thinking habits (Hutauruk & Priatna, 2017). Thinking habits will lead students to formulate mathematical representation processes.

Mathematical resilience plays an important role in developing mathematical representation skills. In addition, mathematical representation skills that require students to express their ideas in the form of symbols, images, tables and mathematical models require an attitude that is not easy in exploring problems. For this reason, the ability to not give up easily in trying to express ideas is needed, which is often called mathematical resilience. This is in accordance with other studies that also reveal mathematical resilience has a positive effect on the thinking process to solve problems (Fitriani et al., 2023). Students with good resilience skills will provide significant opportunities to interact with fellow friends with optimism, participation and have academic achievements in mathematics learning. Furthermore, someone with good resilience skills is seen as having a positive perspective on problems, responding positively to the difficulties faced easily, the ability to adapt to the challenges faced for the sustainability of future work (Chirkina et al., 2020; Gürefe & Akçakın, 2018; Kooken et al., 2013). Thus, every challenge in mathematical representation ability can be overcome well with good mathematical resilience ability.

The third finding, there is a positive impact of sociomathematical norms on mathematical representation ability with mathematical resilience mediation. This finding means that in addition to sociomathematical norms directly influencing mathematical representation ability, it also has an influence based on mediation by the mathematical resilience aspect. This shows that in the process of learning mathematics, someone who has good sociomathematical norms and good resilience will support mathematical representation ability, either directly or indirectly. Mathematical resilience can directly influence mathematical representation ability or can also be a mediation for students who have poor mathematical resilience. The research that has been conducted has contributed to the development of mathematics learning, especially in the development of mathematical representation ability by estimating what soft skill factors support mathematical representation ability.

From the research results, sociomathematical norms and mathematical resilience are proven to be supporting factors in developing mathematical representation skills in mathematics learning. Therefore, in the process of learning mathematics, it is necessary to pay attention to the soft skill aspects, especially sociomathematical norms and mathematical resilience in order to strengthen mathematical representation skills. The limitation of this study is that the sample used is limited to using100 high school students consisting of 67 male students and 33 female students in DKI Jakarta. It is necessary for further research to add research samples, so that the research will be more representative to describe the research results. Furthermore, the research was conducted only in the DKI Jakarta area, so that the research only applies to high school students in the DKI Jakarta province. For this reason, it is necessary to develop it at other levels of education in various regions in Indonesia to strengthen the research results.

4. CONCLUSION

The results of the study indicate that the affective aspect in mathematics learning can support the hard skill aspect of mathematics. Thus, this study provides recommendations for developing soft skills or affective abilities in the mathematics learning process, especially sociomathematical norms and mathematical resilience in forming mathematical representation abilities. Both affective aspects can be used as considerations in developing a learning treatment to improve mathematical representation abilities. In addition, both aspects can also be used as a reference in determining the success of learning in addition to cognitive aspects. Furthermore, this study was conducted on studentshigh schools in DKI Jakarta, so it is necessary to develop it at other levels of education in various regions in Indonesia to strengthen the research results.

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