

# Mathematical resilience analysis of senior high school students

L S Zanthyl<sup>12\*</sup>, Y S Kusuma<sup>1</sup>, and U Soemarmo<sup>2</sup>

<sup>1</sup>Pendidikan Matematika, Institut Keguruan dan Ilmu Pendidikan Siliwangi, Jl. Terusan Jenderal Sudirman, Cimahi 40526, Indonesia

<sup>2</sup>Program Pascasarjana, Universitas Pendidikan Indonesia, Jl. Dr. Setia Budhi No 229, Bandung, Indonesia

\*Email: zanthyluvy@gmail.com

**Abstract.** The aim of this study is to analyze the mathematical resilience of high school students. The instrument used The Norm Reference Value (NRV), which consisted of 42 items. This Resilience Test consist of 6 indicators, that is: 1) Diligent, confident, working hard and not easily giving up on problems, failures and uncertainties; 2) Desire to socialize, easily provide assistance, discuss with peers, and adapt to their environment; 3) Bring up new ideas/ ways and find creative solutions to challenges; 4) Using experience of failure to build self motivation and self control; 5) Showing curiosity, reflecting, researching, utilizing various sources; 6) Having language skills, controlling themselves and being aware of their feelings. The resilience analysis based on a comparison of the average value of each indicator with a reference value that has been determined in NRV. The results showed that all indicators were in medium category.

## 1. Introduction

In the learning process, when students have difficulties in solving mathematical problems, they feel anxious and not confident [1]. If students have high math anxiety, students will avoid mathematics which will result in decreased learning achievement [2]. While students who have lower math anxiety, he will be more eager to learn mathematics, more persistent and work hard in facing obstacles, and set higher goals [3]. Durability to strive, never give up in facing difficult situations is known as resilience.

Resilience according to various experts is the ability to compose oneself in problematic situations [4], the ability to deal with disasters and overcome difficulties [5], the process develops the capacity to endure physical, social and emotional challenges [6], the ability to solving problems in daily life [7], and the ability to respond positively in the face of difficulties [8]. Resilience is one of the affective aspects that students must have. The importance of this affective aspect can be seen by the rapidly increasing research on affective abilities in the field of education [9] [10].

Someone who has good resilience is someone who has a strong personality[11], have high self esteem and realize their potential [12]. A resilient is not only able to survive but also develop. They will develop ways to transform stressful situations into an opportunity to develop themselves so that they will eventually be better than before [13] and allow them to be winners in facing difficult situations [14].

In relation to mathematics, Johnston-Wilder, S. & Lee, C. [15] argues that mathematical resilience is an important concept in education, because there are still many students experiencing difficulties and failures in learning mathematics. Students who have mathematical resilience have the ability to grow their confidence. They assume that mathematics is not an obstacle, even when the student himself has difficulty, he will maintain his confidence until it ends in success. He will not hesitate to



help his friends or groups based on his knowledge and can use his help and support if needed. Meanwhile, Kookan, J. Welsh, ME, Mccoach, DB, Johnson-Wilder, S and Lee [16] conceptualized mathematical resilience as a positive attitude towards mathematics that gave students the opportunity to continue learning mathematics even though facing difficulties.

In the preliminary study found that students mathematical resilience was generally low, most students still could not control themselves in facing difficulties encountered when learning mathematics [17]. When faced with mathematical problems, some students feel embarrassed to ask friends and are not confident to answer questions from the teacher. The role of teachers in schools is very necessary in building student resilience [18]. Teachers are expected to be able to do: 1) provide caring and support, 2) set and communicate high expectations, and 3) provide opportunities for meaningful participation. A teacher must have effective communication skills, so students can explore and develop their potential. Based on the explanation above, this study aims to obtain an overview of the mathematical resilience of high school students through The Norm Reference Value (NRV).

## 2. Method

This research is a descriptive study that involving one variable, namely resilience. The sample subjects in this study were 40 students in one of Senior High Schools in Cimahi City, West Java, Indonesia, which were selected by purposive sampling. Analysis of resilience is calculated based on the comparison of the average value of each indicator of resilience with the reference value specified in NRV [19].

Resilience instruments consist of 6 indicators that have been modified [20]. The following is the presentation of the six indicators of resilience:

- a) Diligence, confidence, hard work and not giving up easily face problems, failures and uncertainties.  
A person who has good resilience has positive thoughts in him. They are sure that all problems can be addressed properly. The attitude of not giving up easily and working hard in facing problems makes them become winners in all situations.
- b) Desire to socialize, easily provide assistance, discuss with friends of the same age, and adapt to their environment  
Friends and the environment are influential things in socializing. Socialization is a learning process experienced by someone to gain knowledge about values and norms so that he can participate in his environment. The process is a natural process carried out by everyone as a social creature.
- c) Bring up new ideas / ways and find creative solutions to challenges.  
The idea is how one can come up with new ideas / ways for certain purposes that are obtained from the process of searching for, analyzing or getting away from an event that creates a desire to "process and shape" different images and produce a new thought. The creative idea is how to think of something new that is believed to be unthinkable by others.
- d) Using experience of failure to build self motivation and self control.  
No matter how well the plan has been prepared, there are only problems that will be faced, even some people will experience failure in dealing with it. A resilient, he will reconstruct the experience of failure and make it a valuable experience as self-motivation to achieve success.
- e) Showing curiosity, reflecting, researching, utilizing various sources.  
Someone who has great curiosity, he will continue to find out what he doesn't know until he gets a lot of new information or knowledge.
- f) Having language skills, controlling themselves and being aware of their feelings.  
A person who can control himself well, he can still be calm even in a stressful situation. This attitude is very important in establishing relationships with friends and the environment.

**Table 1.** The Distribution of Item based on Each Indicators

Indicator	Favorable	Unfavorable
Diligent attitude, sure, work hard and not easily give up facing problems, failures and uncertainties	1,3,4,5,8,10	2,6,7,9
Desire to socialize, easily to help, discuss with peers, and adapt to their environment.	11,13,15	12,14
Bring up new ideas / ways and find creative solutions to challenges	17,18,21	16,19,20,22
Using experience a failure to establish self-motivation and self-control	23,25,26,28	24,27,29
Show curiosity, reflect, research, utilize various sources	30,32,33,36	31,34,35,37
Have the ability to speak, self-control and aware of the feelings	39,41	38,40,42

### 3. Result and Discussion

#### 3.1. Result

The results of data analysis using descriptive analysis techniques assisted by SPSS Version 24. Which can be seen in Table 2.

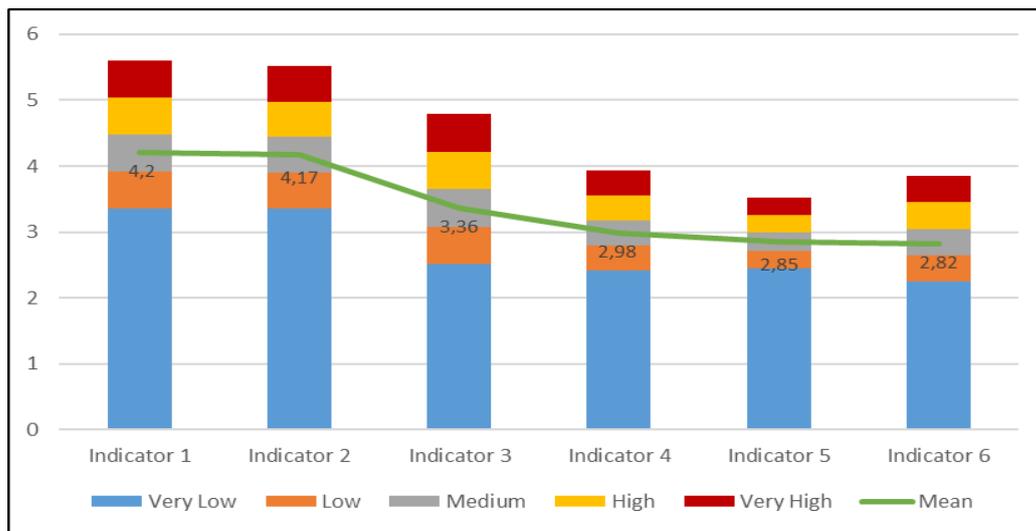
**Table 2.** Descriptive Statistic of Mathematical Resilience

	Indicators					
	1	2	3	4	5	6
Valid N	40	40	40	40	40	40
Missing	0	0	0	0	0	0
Mean	4,20	4,17	3,36	2,98	2,85	2,82
Std. Dev	0,56	0,54	0,57	0,38	0,27	0,40
Minimum	2,40	3	2	2,14	2	2
Maximum	5	5	4,50	3,71	3,25	3,40

The mean value of each resilience indicator above will be interpreted based on the NRV. The score categories each indicator and the percentage of resilience of each indicator can be seen in Table 3 and Table 4, while the results of the resilience diagram based on the indicators and the percentage of mathematical resilience can be seen in Figure 1 and Figure 2.

**Table 3.** Categories of Item Resilience Scores per indicator

Category	The Norm Reference Values					
	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indikator 5	Indikator 6
Very High	$X > 5,04$	$X > 4,98$	$X > 4,21$	$X > 3,55$	$X > 3,25$	$X > 3,42$
High	$4,48 < X \leq 5,04$	$4,44 < X \leq 4,98$	$3,64 < X \leq 4,21$	$3,17 < X \leq 3,55$	$2,98 < X \leq 3,25$	$3,02 < X \leq 3,42$
Medium	$3,92 < X \leq 4,48$	$3,90 < X \leq 4,44$	$3,08 < X \leq 3,64$	$2,79 < X \leq 3,17$	$2,72 < X \leq 2,98$	$2,62 < X \leq 3,02$
Low	$3,36 < X \leq 3,92$	$3,36 < X \leq 3,90$	$2,51 < X \leq 3,08$	$2,41 < X \leq 2,79$	$2,45 < X \leq 2,72$	$2,25 < X \leq 2,62$
Very Low	$X \leq 3,36$	$X \leq 3,36$	$X \leq 2,51$	$X \leq 2,41$	$X \leq 2,45$	$X \leq 2,25$

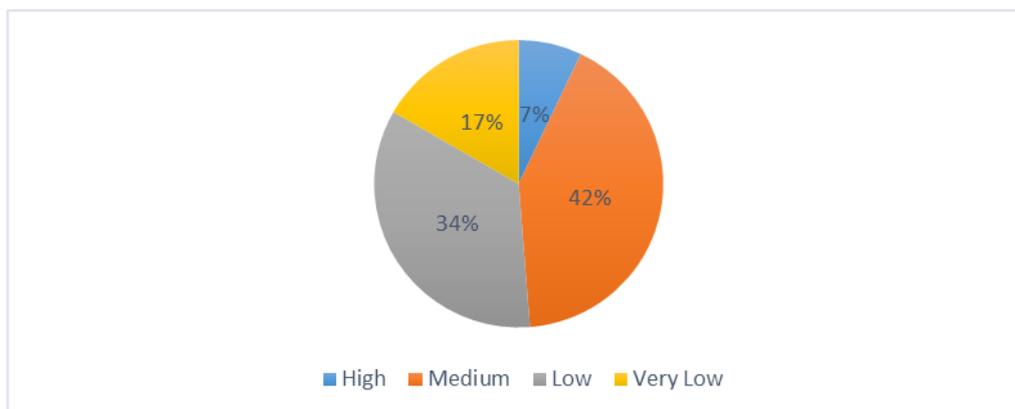


**Figure 1.** Chart of Mathematical Resilience based on NRV of Each Indicator

Figure 1 shows that comparison of the results of the average value obtained with the norm reference value resilience of all indicators of resilience is included in the MEDIUM category. This shows that students are quite capable of controlling themselves in overcoming difficulties when solving mathematical problems. Similarly, self-confidence students towards their abilities and potential to achieve success have begun to develop.

**Table 4.** Percentage of Student based on Categories

Category	Percentage of Student (%)					
	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5	Indicator 6
Very high	-	-	-	-	-	-
High	5	12.5	12.5	7.5	2.5	2.5
Medium	80	20	32.5	35	40	42.5
Low	2.5	45	45	40	37.5	37.5
Very low	12.5	22.5	10	17.5	20	17.5



**Figure 2.** Presentage of Student Mathematical Resilience by Category

Based on the results of the calculations listed in Table 3 show that in indicator 1 the percentage of students is 80%, indicator 5 is 40 & and indicator 6 is 42.5%, including in the MEDIUM category. There are 2 indicators of 45%, indicator 3 by 45% and indicator 4 by 40%, including in the LOW

category. Figure 2 shows that most (42%) students have moderate resilience. As many as 34% have relatively LOW resilience category, 17% belong to the VERY LOW category and 7% belong to the category with HIGH resilience.

### 3.2. Discussion

Diligent, confident, hard working and not easily giving up on problems, failure and uncertainty (indicator 1) are basically closely related to the ability to use experience of failure to build self motivation and self control (indicator 4). Students who have an attitude according to indicator 1 tend to use their experience of failure to work hard and not easily give up to achieve success. However, the findings indicate the ability to use experience failure to build self-motivation and self-control included in indicators that are difficult for students to develop.

There are various techniques for developing the ability to use experience of failure to build self motivation and self control, but the most effective strategy is to change the way of thinking or belief when someone experiences a bad event that creates strong negative feelings. Students who know their potential are able to solve a problem without feeling burdened even in difficult and stressful situations. Students who have the ability to know their strength and not depend on others, he is able to solve problems and control the stress that occurs on him so as not to cause excessive reactions [21]. The ability of students to develop resilience is one form of internal coping that students do to overcome feelings of pressure or stress when facing difficult situations [22].

A student who follows an organization in a school has a higher ability of resilience than students who do not participate in organizational activities. One of the benefits of the organization is improving language skills, independence, socializing and adapting to the environment. A person's resilience can be influenced by the interaction of individuals with their environment. Students who have high resilience will feel comfortable, confident and respect their abilities without being dependent on others in solving a problem [5].

### 4. Conclusion

The results of the analysis obtained in this study indicate that overall all indicators of mathematical resilience using The Norm Reference Value (NRV) are included in the MEDIUM category. Other findings reveal that diligence, confidence and not giving up easily are the indicators most students have, while curiosity and using various sources are indicators that are difficult for students to develop.

### Acknowledgments

We thank Yaya S Kusuma and Utari Soemarmo for their research assistance and gratefully acknowledge funding provided by Kemenristek DIKTI Republic of Indonesia.

### References

- [1] Chamberlin S A 2010 A review of instruments created to assess affect in mathematics *J Math Educ* **3** 1
- [2] Hembree R 1990 The nature, effects, and relief of mathematics anxiety *J Res Math Educ* **21** 1 33-46
- [3] Pajares F and Kranzler J 1995 Self-efficacy beliefs and general mental ability in mathematical problem-solving *Contemp Educ Psychol* **20** 426-443
- [4] Garnezy N 1991 Resiliency and Vulnerability to Adverse Developmental Outcomes Associated with Poverty *Am Behav Sci* **34** 416-430
- [5] Wagnild G M and Young H M 1993 Development and psychometric evaluation of the Resilience Scale *J Nurs Meas* **1** 2 165-178
- [6] Kumpfer K L 1999 *Factors and processes contributing to resilience: The resilience framework Resil Dev Posit life Adapt* (Netherlands: Kluwer Academic Publishers)
- [7] Hurtes K P and Allen L R 2001 Measuring resiliency in youth: The resiliency attitudes and skills profile *Ther Recreation J* **35** 4 333-347
- [8] Luthar SS, Cicchetti D, and Becker B 2000 The construct of resilience: A critical evaluation and

- guidelines for future work *Child Dev* **71** 3 543-562
- [9] Duckworth A L, Peterson C, Matthews M D, and Kelly D R 2007 Grit: perseverance and passion for long-term goals *J Pers Soc Psychol* **92** 6 1087-101
- [10] Yeager D S and Dweck C S 2012 Mindsets That Promote Resilience: When Students Believe That Personal Characteristics Can Be Developed *Educ Psychol* **47** 302-314
- [11] Howard S and Johnson B 2004 Resilient Teachers: Resisting Stress and Burnout *Social Psychology of Education* **7** 399-420
- [12] Margalit M and Idan O 2004 Resilience and Hope Theory: An Expanded Paradigm for Learning Disabilities Research *Thalamus* **22** 1 58-64
- [13] Maddi S R 2005 On hardiness and other pathways to resilience *Am Psychol* **60** 261-262
- [14] Gurgan U 2006 Resiliency Scale (RS): Scale Development, Reliability *J Ankara Univ Fac of Educ Sci* **39** 2 45-74
- [15] Zanthly L S 2018 Kontribusi resiliensi matematis terhadap kemampuan akademik mahasiswa pada mata kuliah statistika matematika *Mosharafa J Pendidik Mat* **7** 1 85-94
- [16] Hendriana H and Soemarmo U 2014 *Penilaian Pembelajaran Matematik* (Bandung: Refika Aditama)
- [17] Ariyanto L, Herman T, Sumarmo U, and Suryadi D 2017 Developing Mathematical Resilience of Prospective Math Teachers *J Phys Conf Ser* **895** 012062
- [18] Benard B 1991 *Fostering Resiliency in Kids: Protective Factors in Family, School, and Community* (Washington: ERIC)
- [19] Azwar S 2015 *Penyusunan Skala Psikologi* (Yogyakarta: Pustaka Belajar)
- [20] Hendriana H, Rohaeti E E, and Sumarmo U 2017 *Hard Skill Soft Skill Matematik Siswa* (Bandung: Refika Aditama)
- [21] Wagnild G M 2010 *Discovering Your Resilience Core*
- [22] Taylor E S and Tyler J H 2012 The Effect of Evaluation on Teacher Performance *Am Econ Rev* **102** 7 3628-3651