

# Construction of Student Mathematics Resilience Through the Development of Sainsmatika-Based Teaching Materials

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## ABSTRACT

Mathematical resilience is an internal factor in students that is important to have in dealing with learning mathematics. This study aims to design efforts to construct mathematical resilience and develop sainsmatika-based teaching materials in constructing students' mathematical resilience. The research method used is the design method (*design research*) with a qualitative approach. The design of this study uses the model proposed by Plomp and Nieveen (2007) which includes *preliminary research*, namely analyzing the level of students' mathematical resilience, conducting a literature review, and developing a conceptual or theoretical framework for research. *Prototyping stage*, the process of designing teaching materials that is developed repeatedly is the design of the Pythagorean module based on sainsmatika. The last is the *assessment phase*, by evaluating the extent to which the modules designed provide solutions in constructing students' mathematical resilience. The validation results show that the module category is at a very feasible level for use with a percentage of 89.84%, covering aspects of content feasibility assessment of 92.43%, presentation feasibility of 91.66%, language feasibility of 84.25%, and assessment of sainsmatika elements. by 91.68%. So that the module that has been designed is very feasible to use as a form of constructing students' mathematical resilience.

**Keywords:** mathematical resilience, mathematical resilience construction, development of sainsmatika-based teaching materials

## INTRODUCTION

Education is an effort that can accelerate the development of human potential (Sa'ud & Makmun, 2006). In the *Dictionary of Education*, Sa'ud and Makmun (2006) state that education is a process by which a person develops the ability, attitudes, and other forms of behavior in the society in which he lives, a social process in which people are exposed to selected and controlled environmental influences, so that they can acquire and experience the development of optimal social and individual abilities. One of the potential developments in this educational process is contained in learning mathematics.

In dealing with learning mathematics, it is necessary to have mathematical resilience. Mathematical resilience is an important internal factor for students to have in dealing with mathematics learning. Komala (2017) states that students who have strong resilience will have the necessary mathematical skills and are willing to apply them in everyday life. Students who have mathematical resilience skills not only master the theory, but also have the ability to adapt to any problems they face and communicate with other individuals while maintaining their identity. So that the effort to construct mathematical resilience becomes a series of attitudes that can provide a positive response to learning mathematics (Rafiana & Adirakasiwi, 2019). Based on these things, so that mathematics learning can be delivered effectively and can construct students' mathematical resilience, a new innovation is needed, one of which is the use of innovative teaching materials media. Module development efforts can be made to help improve students' mathematical resilience (Ahmad, 2017). In line with Asih's (2020) research, which states that there is an increase in mathematical resilience in classes that are given module-assisted learning/teaching materials.

In learning mathematics integration is very necessary in facilitating student understanding. As well as integration with science, based on research by Wangid et al. (2016) which states that science and mathematics are two subjects that can be integrated because both can be linked to contextual daily life. This is in line with Dewi and Hasanah (2017) which states that one way to interpret mathematics lessons is to apply integrated values to the material being studied. According to the *Webster's New Collegiate Dictionary* in Safira and Ifadah (2020), science is an observational activity and a series of experiments in finding answers related to the reality that exists in the surrounding environment, while mathematics is a mindset, logical organization and proof, which becomes a series of problem solving. Based on the above potential, this research seeks to construct students' mathematical resilience by developing sainsmatika-based teaching materials.

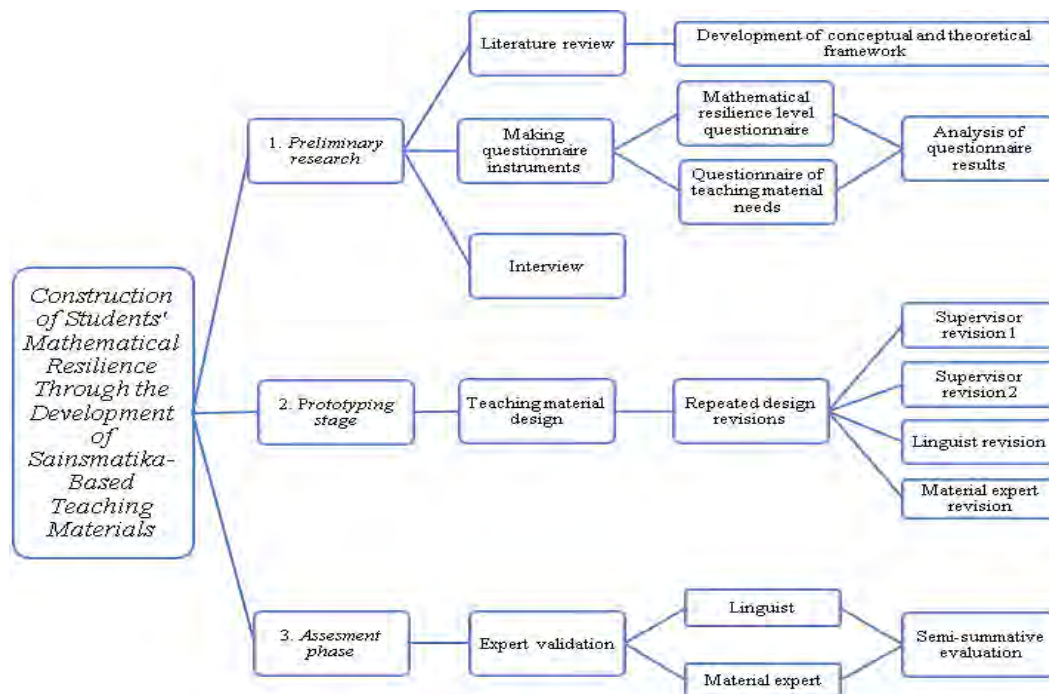


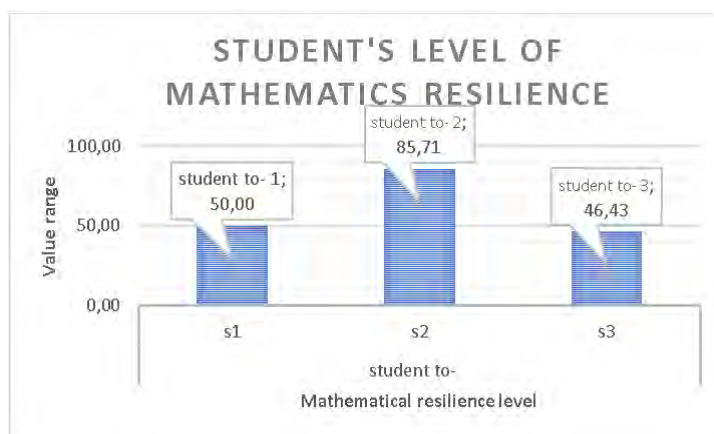
Figure 1. Research framework

## METHOD

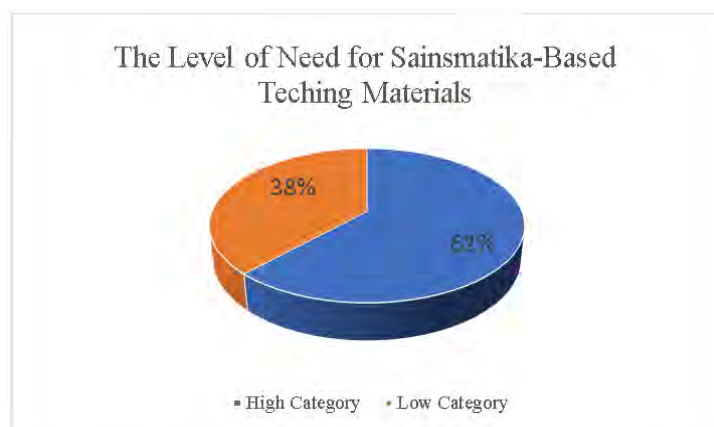
This study uses design research methods by conducting systematic assessments related to designing, developing and evaluating learning materials as solutions to problem solving in education (Plomp & Nieveen, 2007). Barab and Squire (2004) state that design-based research is not an approach but a series of approaches with the aim of generating new theories, products and practices that explain and have the potential to impact learning and teaching in naturalistic settings. According to Edelson (2006), the design method is a method that captures and makes explicit decisions regarding the design process and turns them into guidelines for addressing educational problems. This study aims to develop research-based solutions to complex problems in educational practice. This study uses research methods of design (*design research*) by assessing systematically related to design, develop, and evaluator of learning materials as solutions to problems in education (Plomp & Nieveen, 2007). Based on the design research model proposed by Plomp and Nieveen (2007), the development procedure in this study follows the following steps:

1. *Preliminary research*: At this stage, the researcher conducts the needs and context analysis process, literature review, and the development of a conceptual or theoretical framework for research. Data analysis was carried out through the provision of a questionnaire instrument in the form of a mathematical resilience level questionnaire and a questionnaire on the need for sainsmatika-based teaching materials. Aspects/characteristics, indicators, and statements of the two questionnaires used, as well as the form of the questionnaire are contained in attachments 1, 2, 3, 4, 5, and 6. Then from the results of the questionnaire, the interview process was carried out by reconfirming the statements in the questionnaire to three students as samples. The sample selection was done by *random sampling* and the questionnaire was distributed online through the help of *Google form*. In addition to providing questionnaires and interviews, a literature review was carried out by multiplying references from the results of previous studies that discussed the development of teaching materials and the construction of mathematical resilience. The collected data is then analyzed using descriptive quantitative analysis techniques, and a research development framework is made.
2. *Prototyping stage*: Based on the results of the analysis in the previous stage, at this stage the design process will be carried out. The design begins by creating a flow of module content, then wrapping the Pythagorean material in a sainsmatika-based module. This design stage is carried out repeatedly by revising the module based on suggestions for improvement from supervisors, linguists, and material experts. It aims to improve and refine the research module.
3. *Assessment phase*: This stage is carried out by evaluating the extent to which the designed modules provide solutions in building students' mathematical resilience. Efforts are made by conducting a validation process. Previously, each student's mathematical resilience questionnaire statement was validated with valid and invalid assessment criteria. This is done to determine the level of validity of the mathematical resilience questionnaire instrument used and so that the conclusion of the analysis of the mathematical resilience level of students obtains the correct data to be constructed in the designed module. Then the module design is validated with the validation questionnaire attached in attachments 7 and 8; and evaluated through the four assessment criteria, as follows: 1: not feasible, 2: less worthy, 3: worthy, and 4: very worthy. This validation was carried out by 1 linguist and 2 material expert lecturers. This stage produces recommendations for improvement of the intervention and is referred to as the semi-summative phase.

The research design is systematically represented in the research framework in **Figure 1**.



**Figure 2.** Student's mathematical resilience level



**Figure 3.** Level of need for sainsmatika-based teaching materials

## RESULTS

### Student's Mathematical Resilience Level

The assessment of the level of mathematical resilience was carried out by filling in the *Google form* and interviewing 28 statements. The data on the level of mathematical resilience of students from 3 research samples are presented in **Figure 2**. Based on the range of mathematical resilience criteria, it is known that two of them have a low level of resilience, and one student has a high level of resilience. Therefore, it is necessary to construct the level of students' mathematical resilience.

### The Level of Student Need for Innovation in Sainsmatika-Based Teaching Materials

Analysis of the level of need for teaching materials was carried out through a questionnaire instrument of 27 written statements which were used to obtain information related to the level of student need for innovation in sainsmatika-based teaching materials. From the results of the overall analysis related to the level of need for sainsmatika-based teaching materials, it is presented in **Figure 3**.

Analysis of the results of the questionnaire on the level of needs for sainsmatika teaching materials showed 62%, which in the range of criteria values for the level of needs for teaching materials were in high criteria. Researchers also conducted interviews as a form of strengthening the results of the questionnaire. The following is a snippet of the interview results:

Researcher: Do you really need teaching materials other than textbooks?

Student 1: Really need it.

Researcher: With the teaching materials that are currently used, do you understand mathematics?

Student 1: Sometimes I like to understand, the rest I don't.

Researcher: Is it difficult to learn mathematics from the Pythagorean material independently through the textbook you use?



Figure 4. Design of a sainsmatika-based Pythagorean module

Student 2: Yes.

Researcher: If there is an innovative textbook that combines Pythagorean science and mathematics, would you want to use it?

Student 2: Want.

Researcher: Have you ever tried as an example a teacher giving innovative textbooks for certain materials?

Student 2: No, never.

Researcher: Do you think there is a need for textbooks other than the textbooks that are currently being used?

Student 3: Need.

Researcher: Are the teaching materials that you are currently using make you excited or not in learning?

Student 3: No.

Researcher: In your opinion, do the teaching materials used now provide an opportunity for you to do the practice questions independently?

Student 3: No.

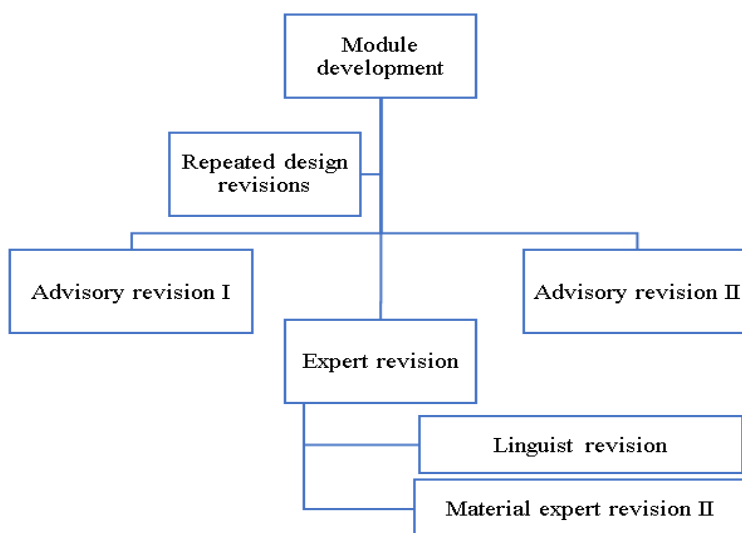
Researcher: If there is an innovative Pythagorean material textbook that adapts to the development of science, for example mathematics combined with science, do you want to use it?

Student 3: Yes.

From the results of the analysis above, it can be concluded that students have a high level of need related to the innovation of sainsmatika-based teaching materials. This encourages an effort to design a sainsmatika-based Pythagorean module design in constructing the level of mathematical resilience.

### Sainsmatika-Based Teaching Material Design

The design in this study is a concept of developing teaching materials which is expected to be an alternative innovation of teaching materials for mathematics teachers of SMP class VIII. The development of the design of this teaching material is made in the form of a learning module. The module that addresses the Pythagorean material is arranged based on its implications as an effort to construct mathematical resilience abilities accompanied by the development of sainsmatika values. Some design drafts for the development of the sainsmatika-based Pythagorean module are presented in Figure 4.



**Figure 5.** Pythagorean module design improvement flow based on sainsmatika

**Table 1.** Validation test results for content feasibility aspects

Validator	Score	Maximum score	Percentage	Category
Linguist	41	44	93.18	Very worthy
Material expert I	41	44	93.18	Very worthy
Material expert II	40	44	90.90	Very worthy
<b>Average</b>	<b>40.67</b>	<b>44</b>	<b>92.43</b>	<b>Very worthy</b>

**Table 2.** Results of the validation of the feasibility aspects of presentation

Validator	Score	Maximum score	Percentage	Category
Linguist	30	32	93.75	Very worthy
Material expert I	29	32	90.63	Very worthy
Material expert II	29	32	90.63	Very worthy
<b>Average</b>	<b>29.33</b>	<b>32</b>	<b>91.66</b>	<b>Very worthy</b>

**Table 3.** Results of the validation of the language feasibility aspects

Validator	Score	Maximum score	Percentage	Category
Linguist	32	36	88.89	Very worthy
Material expert I	32	36	88.89	Very worthy
Material expert II	27	36	75.00	Worthy
<b>Average</b>	<b>30.33</b>	<b>36</b>	<b>84.25</b>	<b>Very worthy</b>

In the module development stage before the assessment process is carried out, the module is revised repeatedly. The process of repairing this module includes the stages of improvement which are presented in **Figure 5**.

The draft module that has been designed then goes through an assessment or validation stage from a competent expert in the field of language and materials. The purpose of this assessment is to determine the feasibility of the module that has been designed. The module validity/validity test involved two material experts and one linguist. This validation test was conducted to determine the level of validity of the developed module. Aspects assessed include aspects of content feasibility, presentation feasibility, language feasibility, and assessment of sainsmatika elements, as follows:

1. The calculation of the validity test for the presentation aspect consists of four assessment criteria can be seen in **Table 1**. From **Table 1**, it is known that the calculation of the validity test for the content feasibility aspect is in the very feasible category with a percentage of 92.43%.
2. The calculation of the validity test for the presentation feasibility aspect consists of three assessment criteria can be seen in **Table 2**. From **Table 2**, it is known that the calculation of the validity test for the presentation feasibility aspect is in the very feasible category with a percentage of 91.66%.
3. The calculation of the validity test for the language feasibility aspect consists of five assessment criteria can be seen in **Table 3**. From **Table 3**, it is known that the calculation of the validity test for the language feasibility aspect is in the very feasible category with a percentage of 84.25%.
4. The calculation of the validity test for the sainsmatika assessment aspect consists of two assessment criteria can be seen in **Table 4**. From **Table 4**, it is known that the calculation of the validity test for aspects of the assessment of sainsmatika elements is in the very feasible category with a percentage of 91.68%.



**Table 4.** Validation test results for sainsmatika assessment aspects

Validator	Score	Maximum score	Percentage	Category
Linguist	15	16	93.75	Very worthy
Material expert I	14	16	87.50	Very worthy
Material expert II	15	16	93.75	Very Worthy
<b>Average</b>	<b>14.67</b>	<b>16</b>	<b>91.68</b>	<b>Very worthy</b>

**Table 5.** Results of the Pythagorean module validation test based on sainsmatika

Validator	Score	Maximum score	Percentage	Category
Linguist	118	128	92.19	Very worthy
Material expert I	116	128	90.63	Very worthy
Material expert II	111	128	86.72	Very Worthy
<b>Average</b>	<b>115</b>	<b>128</b>	<b>89.84</b>	<b>Very worthy</b>

From the four aspects of the assessment above, it can be stated the feasibility of the overall module development design. The following is a calculation of the validity of the Pythagorean module based on science from the four aspects of the assessment presented in **Table 5**.

The results of the module validation test carried out by two material experts and one linguist illustrate sainsmatika-based Pythagorean module is in the very suitable category for use.

#### Description

- a. Linguist: Mrs. Hesti Muliawati, SS, M.Pd
- b. Material expert I: Mrs. Ika Wahyuni, S.Pd., M.Si
- c. Material expert II: Mrs. Laelasari, M.Pd

## DISCUSSION

### Student's Mathematical Resilience Level

From the results of the analysis of the level of mathematical resilience carried out, it shows the need for construction efforts. Based on the range of mathematical resilience criteria, it is known that two of them have a low level of resilience, and one student has a high level of resilience. Therefore, it is necessary to construct the level of students' mathematical resilience.

### Students' Mathematical Resilience Construction Efforts

From the results of research related to the level of students' mathematical resilience, it refers to the need for efforts to construct mathematical resilience. This is also supported by the results of the questionnaire on the level of need for science teaching materials as an effort to construct students' mathematical resilience. The results of the questionnaire are in the high category range, which is 62%.

Efforts to construct mathematical resilience are also supported by the results of previous studies regarding the importance of mathematical resilience. Among them, mathematical resilience is needed to encourage effective mathematics learning (Lugalia et al., 2013). Students who have high mathematical resilience will support the success of the mathematics learning process even in situations and conditions that they do not like. Resilience can help students overcome difficulties in solving mathematical problems (Maharani & Bernard, 2018).

The research of Asih et al. (2019) also shows that mathematical resilience has a fairly high contribution to students' mathematical understanding abilities. This indicates that resilience is an important ability to be possessed by students. So that the development of the module in an effort to construct students' mathematical resilience is a series of important things that will be carried out in line with Asih's (2020) research, which states that the module is not only used to familiarize students with independent learning as well as an effort to improve students' resilience abilities.

### Development of Sainsmatika-Based Modules in Constructing Students' Mathematical Resilience

The preparation of a sainsmatika-based Pythagorean module to improve students' mathematical resilience begins with a needs analysis that has been described previously. After knowing the need for efforts to construct mathematical resilience, then a module design is prepared according to these implications. The design of this module is structured to address the problems experienced by students. The design of the module is carried out repeatedly in accordance with the suggestions for improvement of two supervisors, one linguist, and two material expert lecturers. The module prototype design process includes content criteria that contain aspects of mathematical resilience to support the improvement and construction of students' mathematical resilience levels which include four aspects quoted from (Johnston-Wilder et al., 2014), as follows:

1. Understanding of math grades: An understanding of the value of mathematics in the module is presented in the module flow as well as an introduction to the Pythagorean Theorem material which is carried out through observation activities and the inclusion of truth-checking steps in the material presented.

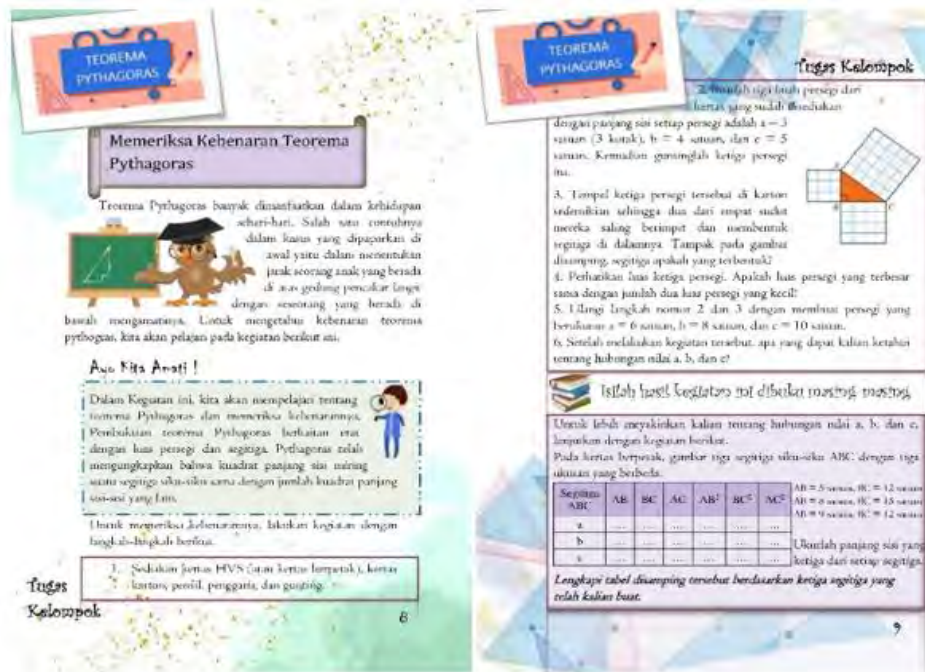


Figure 6. Introduction to the value of mathematics through the examination of the Pythagorean Theorem

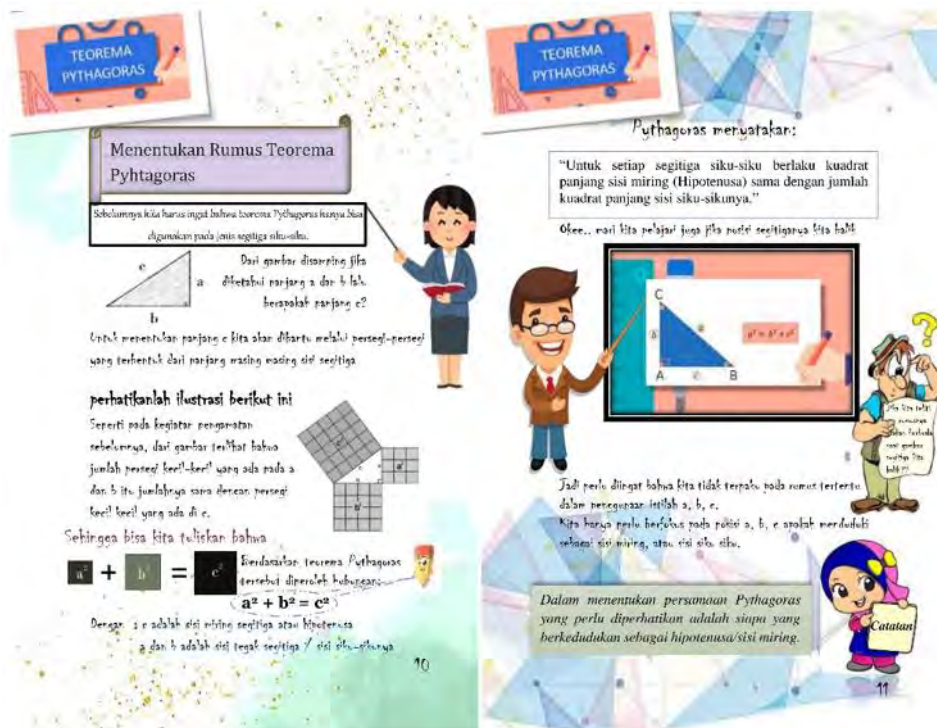


Figure 7. The introduction of mathematical values through the introduction of the Pythagorean Theorem formula

Figure 6 represents the value of mathematics through Pythagorean value checking activities. Figure 6 describes the activities of examining the Pythagorean Theorem. Students are invited to understand the Pythagorean values through the experience gained from these activities. This is in line with the research of Mawaddah and Maryanti (2016), which states that knowledge will stick longer if students are directly involved in the process of understanding and constructing the concepts and knowledge themselves.

In addition, the introduction of values is also found in the activity of determining the Pythagorean Theorem formula which is presented in Figure 7. It is important to pay attention to the values contained in mathematics (Dewi & Hasanah, 2017). Therefore, the activity of determining the formula for the Pythagorean Theorem contributes to helping students understand the Pythagorean concept in the module as presented in Figure 7.

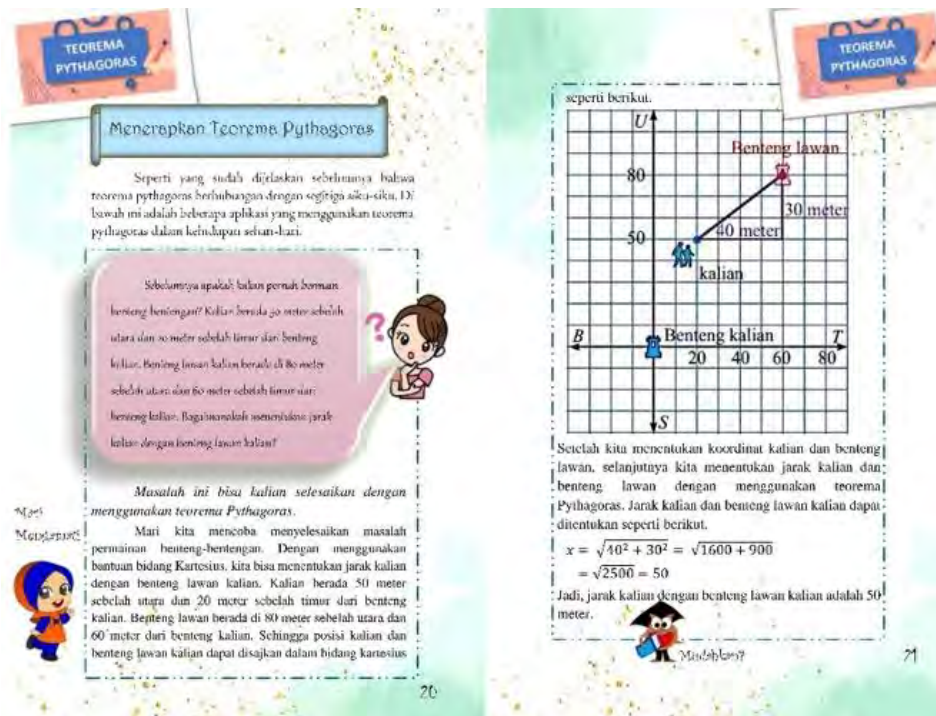


Figure 8. Building a growth mindset through the presentation of implementable materials

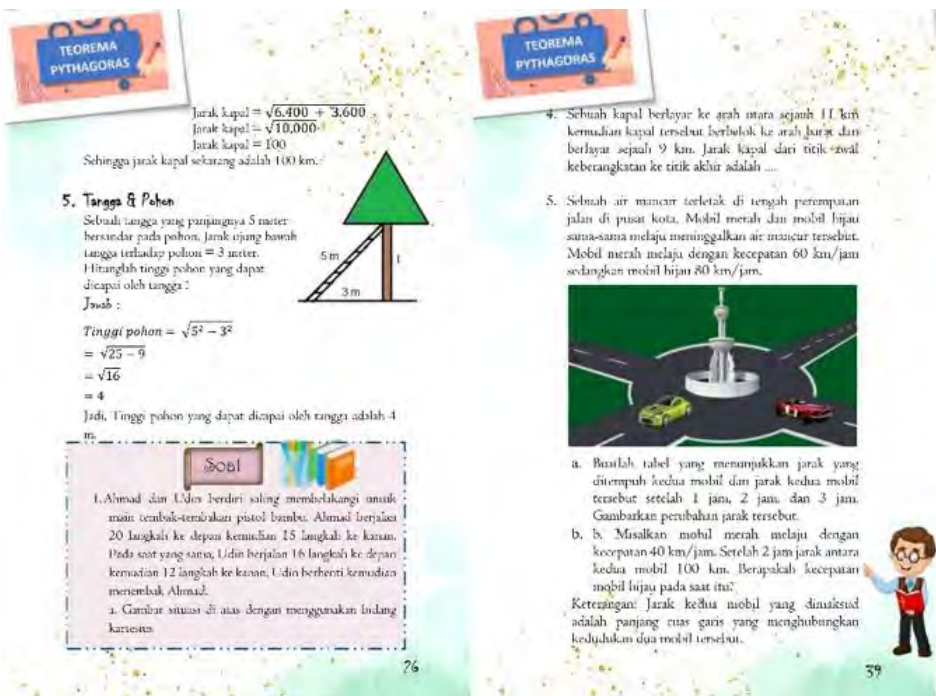


Figure 9. Building a growth mindset through the inclusion of varied questions

2. Growth mindset: In building the aspect of students' growth mindset, it is presented in modules with the inclusion of varied questions and the presentation of implementable material to support the process of increasing students' cognitive abilities and help develop their thinking processes. The cultivation of a growth mindset presented in Figure 8. Figure 8 is a form of material presentation that is implemented as an effort to adapt strategies in constructing students' mathematical resilience. The research by Irawan and Kencanawaty (2017) stated that exploring the line of life that is related to mathematics becomes very enjoyable for students.

As for building a growth mindset in the inclusion of varied questions, it is presented in Figure 9. Figure 9 is a presentation of the solution from the research results stating that the growth mindset aspect in students' mathematical resilience abilities is only 50.00, which means that it is in the low criteria range. Putranti and Prahmana (2018) revealed that the decline in the achievement of the ability aspect in solving problem-based mathematics problems occurred because of learning resources. Through the presentation of varied questions in this module, it helps students in developing their thinking skills so that they can construct a student's growth mindset.



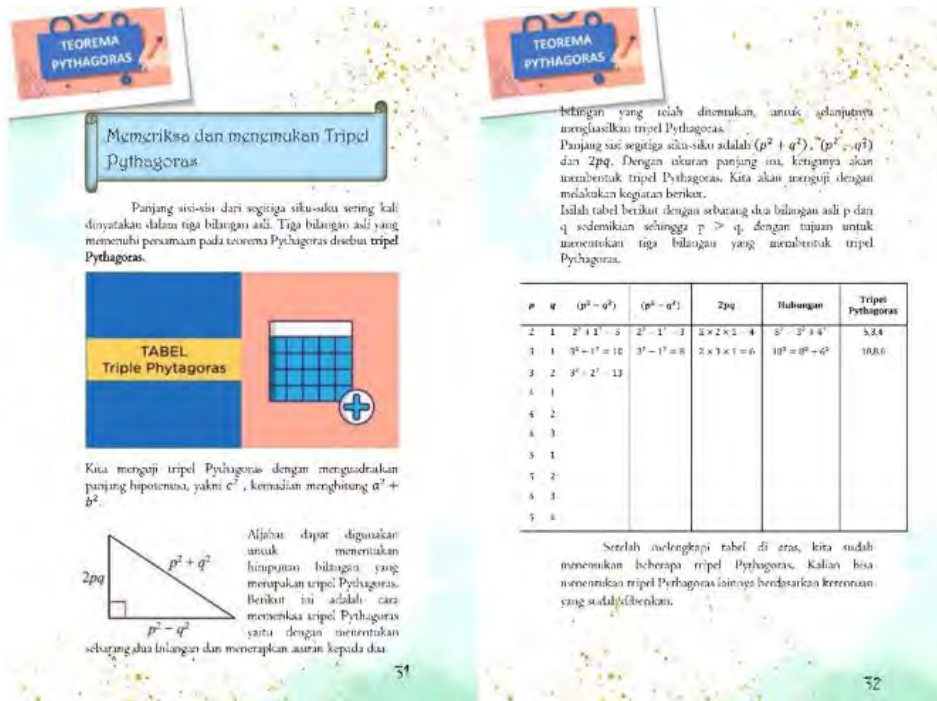


Figure 10. Understanding of how to work in mathematics

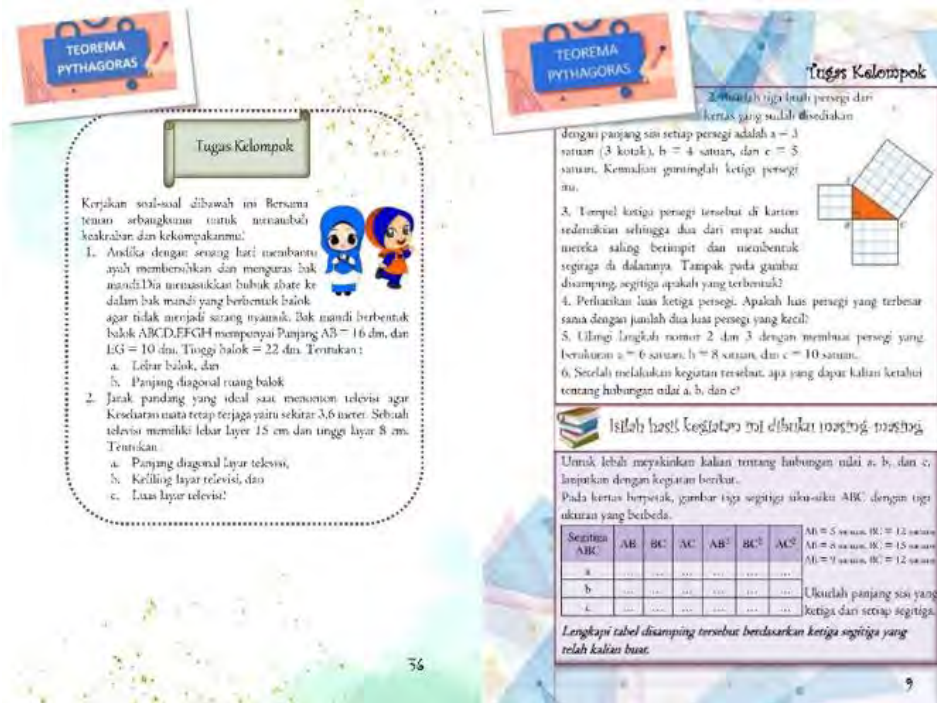


Figure 11. Understanding of how to work in mathematics through group-based activities

3. Understanding of how to work in math: The construction of the third aspect is carried out by giving students the opportunity to experiment through various observation activities and group task-based activities. An inculcation of understanding to students about how to work in mathematics is presented in Figure 10. Figure 10 is a form of solution from the results of the study stating 50.00 scores for aspects of students' understanding of how to work in mathematics, which means that they are in the low criteria range. Through the activity of completing the Pythagorean triple, students are taught how to do mathematics through pre-existing patterns.

In addition, an introduction to how to do mathematics is also found in group-based activities presented in Figure 11. In the context of learning, resilience in this aspect is a concept about students' abilities in dealing with problems and obstacles that seem impossible to overcome (Goodall & Johnston-Wilder, 2015). Figure 11 describes aspects that describe the struggle in facing and overcoming obstacles, one of which is through group-based activities and student experimentation activities.

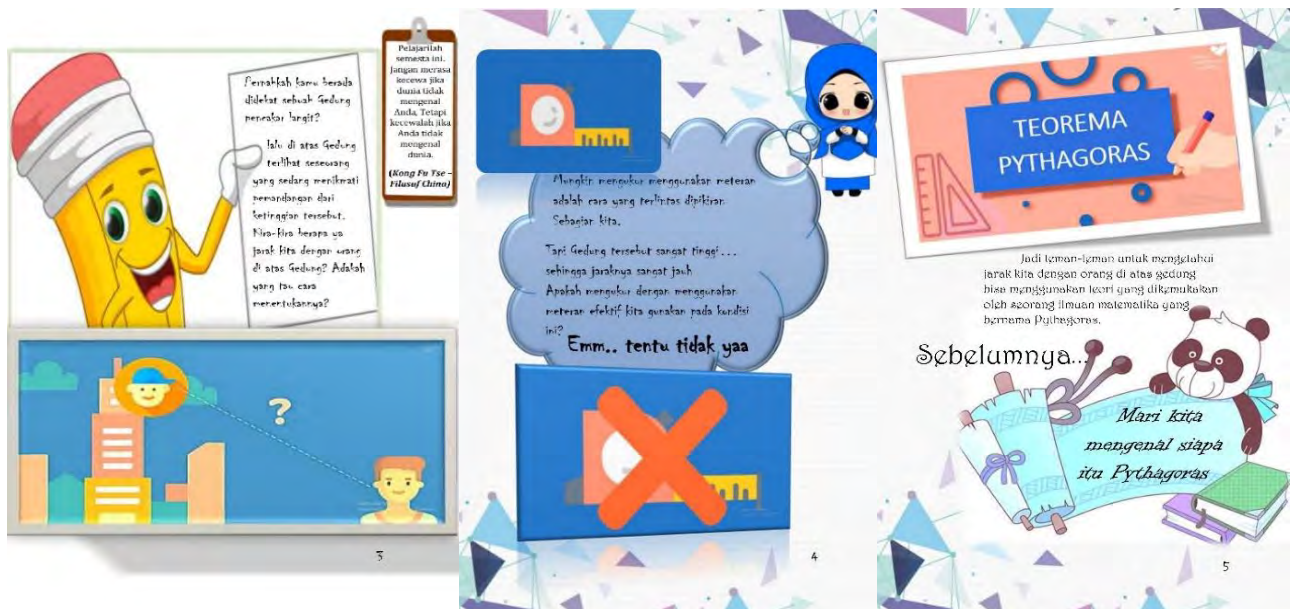


Figure 12. Awareness of support

4. Awareness of support: Around 90.48% of students are aware of the support. Therefore, in this effort to build mathematical resilience, module development innovations are made by providing interesting illustrations that can support the delivery of the material presented by the module. The construction of the awareness aspect of support is presented in **Figure 12**. **Figure 12** illustrates the awareness aspect of reinforced support in the flow of material delivery that is made coherent and interesting so that students are easier to understand the material presented.

The content of the module is designed by elevating elements of science and mathematics that are integrated. In line with research (Nurhidayah & Wangid, 2020), which states that the results of research on developing teaching material products in the form of *sainsmatika*-based fairy tale books prove that fun teaching materials can have a positive effect on the learning process. The *sainsmatika* element in this module lies in the introduction, how to present the material and the selection of questions presented in the module. The completeness of the elements in the design of this module then goes through the assessment stage or expert validation to determine the feasibility of the module that has been designed.

The validation stage is carried out by evaluating the extent to which the designed module provides solutions in building students' mathematical resilience. The validation results show that the module category is at a very feasible level for use with a percentage of 89.84%. The validation of this module includes aspects of content feasibility assessment of 92.43%, presentation feasibility of 91.66%, language feasibility of 84.25%, and assessment of *sainsmatika* elements of 91.68%.

The inputs given by the validator include improvements in the use of sentences, improvements in setting the writing distance, adding flat libraries, and improving the use of numbers in sample questions. The conclusion from the results of the module that has been designed is feasible to be used as a means of constructing students' mathematical resilience.

## CONCLUSIONS

From the results of the analysis of the level of mathematical resilience of SMP class VIII students in Kuningan regency, it shows the need for construction efforts. Analysis of the results of the questionnaire on the level of need for *sainsmatika* teaching materials showed 62% and was in the high criteria range. This encourages an effort to design a *sainsmatika*-based pythagorean module design in an effort to construct the level of students' mathematical resilience. This research produces teaching materials in the form of a *sainsmatika*-based pythagorean module which is designed to contain elements of mathematical resilience as a form of efforts to construct students' mathematical resilience. The module was validated by two material experts from the mathematics education lecturer at the Teacher Training and Education Faculty, Swadaya Gunung Jati University and one language expert lecturer from the Indonesian Language Education study program, the Teacher Training and Education Faculty, Swadaya Gunung Jati University. In assessing aspects of content feasibility, presentation feasibility, language feasibility, and assessment of *sainsmatika* elements, the *sainsmatika*-based Pythagorean module is stated to be very suitable for use in learning mathematics in schools. Because this research was conducted as a form of lecture final project with a limited time span, so the drawback of this research is the imperfection of the results because there is no module implementation process for students at school. So it is hoped that there will be further studies that will continue this research.

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**Declaration of interest:** No conflict of interest is declared by authors.

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## APPENDIX A - Mathematical Resilience Level Questionnaire Grid

No	Aspects of mathematical resilience	Mathematical resilience indicator	Statement
1	Understanding of math grades	Engage in mathematical thinking	Thinking mathematically helps me with important things.
			Math often gets me stuck in confusion.
			I believe that mathematics can develop my thinking skills.
		Starting to experience personal value in math	Mathematics has a high contribution to my learning goals so far.
			Learning math does not bring any significant changes to my learning progress.
			I have consciously implemented mathematics in my daily life.
2	(Mindset of growth) Belief that brain abilities can be developed	Strategy adaptation	I never knew the benefits and uses of learning math.
			I like to work on different questions from questions that have been given previously.
			I do not like doing math problems.
			I re-learn about my wrong answers in doing math problems.
			I'm not good at math, so I can't learn much math.
			I always believe I can come up with different ideas from other friends in the group.
		Study skills	I always fixate and leave everything to friends who are smarter in math.
			I am confident when presenting my math answers in front of the class.
			I avoid solving math problems that have multiple solutions.
		Develop resilience in the face of problems	I am able to do math problems without giving up.
			I like solving problems presented in math problems.
			I think wrong in doing math it's important to better understand math.
3	Understanding of how to work in math	Develop options & opportunities to experiment	I get confused easily when I'm wrong in doing math problems.
			I can work on difficult math problems without giving up.
			I always take failure in math exams as an experience to get better.
		Access help & support	I am embarrassed to seek help in solving problems that are different from the example questions that have been given previously.
			I am comfortable discussing concepts that have not been understood with friends.
			I feel disturbed when asked for help by friends who have difficulty learning math.
4	Awareness of available support from friends, teachers, ICT, the Internet, etc.	Access media support & learning resources	I will ask the teacher if I do not understand a concept in math.
			I can easily access media and adequate mathematics learning resources.
			I'm desperate when I can not find the source to complete the task.
			In my opinion, learning mathematics only requires the provided textbook.



## APPENDIX B - Mathematical Resilience Level Questionnaire

### STUDENT MATHEMATIC RESILIENCE LEVEL QUESTIONNAIRE

#### PERSONAL IDENTITY

Full name :  
 School name :  
 Class :

Fill in the following statements with a (✓) on one of the Yes/No answers. Answer the statements below honestly!

*(This questionnaire does not affect the value of any subject)*

No	Statement	Yes	No
1	Thinking mathematically helps me with important things.		
2	Math often gets me stuck in confusion.		
3	I believe that mathematics can develop my thinking skills.		
4	Mathematics has a high contribution to my learning goals so far.		
5	Learning math does not bring any significant changes to my learning progress.		
6	I have consciously implemented mathematics in my daily life.		
7	I never knew the benefits and uses of learning math.		
8	I like to work on different questions from the questions that have been given previously.		
9	I do not like doing math problems.		
10	I re-learn about my wrong answers in doing math problems.		
11	I'm not good at math, so I can't learn much math.		
12	I always believe I can come up with different ideas from other friends in the group.		
13	I always fixate and leave everything to friends who are smarter in math.		
14	I am confident when presenting my math answers in front of the class.		
15	I avoid solving math problems that have multiple solutions.		
16	I am able to do math problems without giving up.		
17	I like solving problems presented in math problems.		
18	I think wrong in doing math is important to better understand math.		
19	I get confused easily when I'm wrong in doing math problems.		
20	I can work on difficult math problems without giving up.		
21	I always take failure in math exams as an experience to get better.		
22	I am embarrassed to seek help in solving problems that are different from example questions that have been given previously.		
23	I am comfortable discussing concepts that have not been understood with friends.		
24	I feel disturbed when asked for help by friends who have difficulty learning math.		
25	I will ask the teacher if I don't understand a concept in math.		
26	I can easily access media and adequate mathematics learning resources.		
27	I'm desperate when I can't find the source to complete the task.		
28	In my opinion, learning mathematics only requires the provided textbook.		

***Thank you for your honesty and participation.***

### APPENDIX C - Questionnaire of Mathematical Resilience Levels Through Google Form

<p>ANGKET TINGKAT RESILIENSI MATEMATIS SISWA &amp; ANGKET KEBUTUHAN BAHAN AJAR</p> <p>Isilah pernyataan berikut. Jawablah pernyataan-pernyataan dibawah ini dengan sejujur-jujurnya! (Jawaban angket ini tidak mempengaruhi nilai mata pelajaran apapun, jadi jawablah dengan jujur apa adanya) Angket ini ditujukan untuk siswa kelas VIII SMP/MTS</p> <p><b>* Wajib</b></p>	<p>Berfikir secara matematis membantu saya dalam berbagai hal penting *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya tidak pernah tau manfaat dan kegunaan belajar matematika *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>Nama *</p> <p>Jawaban Anda</p>	<p>Matematika sering membuat saya terjebak dalam kebingungan *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya suka mengerjakan soal matematika yang berbeda dari soal yang telah diberikan sebelumnya *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>Kelas *</p> <p>Jawaban Anda</p>	<p>Saya yakin bahwa matematika dapat mengembangkan keterampilan berfikir saya *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya tidak suka mengerjakan soal-soal matematika *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>Asal Sekolah *</p> <p>Jawaban Anda</p>	<p>Matematika memiliki kontribusi yang tinggi terhadap tujuan belajar saya selama ini *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya mempelajari kembali mengenai jawaban saya yang salah di dalam mengerjakan soal-soal matematika *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>ANGKET TINGKAT RESILIENSI MATEMATIS SISWA</p> <p>Isilah pernyataan berikut. Jawablah pernyataan-pernyataan dibawah ini dengan sejujur-jujurnya! (Jawaban angket ini tidak mempengaruhi nilai mata pelajaran apapun, jadi jawablah dengan jujur apa adanya)</p>	<p>Belajar matematika tidak membawa perubahan signifikan terhadap kemajuan belajar saya *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya tidak ahli dalam matematika, karenanya saya tidak dapat belajar banyak matematika *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
	<p>Saya secara sadar telah mengimplementasikan matematika dalam kehidupan sehari-hari *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya selalu yakin dapat memberikan ide yang berbeda dengan teman lain di dalam kelompok *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>

Saya selalu terpaku dan menyerahkan semuanya pada teman yang lebih pintar dalam matematika \*

- Ya  
 Tidak

Saya percaya diri ketika mempresentasikan jawaban matematika saya di depan kelas \*

- Ya  
 Tidak

Saya menghindari menyelesaikan soal matematika yang memiliki banyak cara penyelesaian \*

- Ya  
 Tidak

Saya mampu mengerjakan soal-soal matematika dengan pantang menyerah \*

- Ya  
 Tidak

Saya suka menyelesaikan permasalahan yang disajikan dalam soal-soal matematika \*

- Ya  
 Tidak

Menurut saya salah dalam mengerjakan matematika itu penting untuk lebih memahami matematika \*

- Ya  
 Tidak

Saya mudah bingung ketika salah dalam mengerjakan soal matematika \*

- Ya  
 Tidak

Saya dapat mengerjakan soal matematika yang sukar dengan pantang menyerah \*

- Ya  
 Tidak

Saya selalu menjadikan kegagalan dalam ujian matematika sebagai pengalaman untuk menjadi lebih baik \*

- Ya  
 Tidak

Saya malu mencari bantuan dalam menyelesaikan soal yang berbeda dari contoh soal yang telah diberikan sebelumnya \*

- Ya  
 Tidak

Saya nyaman berdiskusi mengenai konsep yang belum dipahami dengan teman \*

- Ya  
 Tidak

Saya merasa terganggu diminta bantuan oleh teman yang mengalami kesulitan belajar matematika \*

- Ya  
 Tidak

Saya akan bertanya kepada guru jika saya tidak memahami suatu konsep dalam matematika \*

- Ya  
 Tidak

Saya dapat dengan mudah mengakses media dan sumber belajar matematika yang memadai \*

- Ya  
 Tidak

Saya putus asa ketika tidak dapat mencari sumber untuk menyelesaikan tugas \*

- Ya  
 Tidak

Menurut saya, belajar matematika hanya membutuhkan buku paket yang disediakan \*

- Ya  
 Tidak

## APPENDIX D - Questionnaire Grid of Teaching Material Needs

No	Aspects/characteristics	Indicator	Statement
1	Self-instructional	The ability to teach students independently	The mathematics teaching materials that I use make me excited to learn independently.
			I find it difficult to learn mathematics from the Pythagorean material independently through the textbook I use.
	Ability to train students independently	The mathematics teaching materials that I use make it easier for me to understand the Pythagorean material independently.	
		The mathematics teaching materials that I use provide space for me to be able to do the practice questions independently.	
2	Self-contained	Full material loading	I can't do the Pythagorean exercises in my math textbook.
			I find it difficult to understand the Pythagorean material math exercises in the textbook independently.
			The mathematics teaching materials that I use contain Pythagorean material with complete and complete examples and practice questions.
			The mathematics teaching materials that I use contain a unified whole that makes it easier for me to learn.
3	Stand alone	Does not depend on other teaching materials	The Pythagorean material contained in my math textbook is incomplete.
			The teaching materials that I use are very complete so that I no longer need to look for other references in understanding the Pythagorean material.
			I need other references from the internet and other books to understand the material and Pythagorean math problems.
			I need mathematics teaching materials for Pythagorean material that contain complete material, so that I can focus on studying only that one teaching material.
4	Adaptive	In accordance with the development of science & technology	The Pythagorean material mathematics textbook that I use has not had a touch of current scientific and technological developments.
			My math textbook has been integrated with the current innovations in the development of science and technology.
			I have never used an innovative textbook that adapts to the current development of science and technology.
		Flexible to use within a certain time	If there is an innovative Pythagorean material textbook that adapts to the development of science, for example math material combined with science, I want to use it.
			The Pythagorean mathematics textbook that I use is very old and irrelevant to current scientific developments.
			My Pythagorean material math textbook is flexible to use for a long time.
5	User friendly	Use simple language	The Pythagorean mathematics textbook that I use has not adapted to the current development of science.
			I am sure that the innovative Pythagorean textbook that combines mathematics and science with an interesting storyline will really help me in learning mathematics.
			The language used in math textbooks is difficult for me to understand.
		Use of commonly used terms	I can easily understand the Pythagorean material with the language used in the textbook I use.
			I can't understand the Pythagorean material with the language in my textbook.
			I need a Pythagorean textbook that contains science and mathematics with a simple language presentation that makes it easier for me to understand the material.
			The math terms in my Pythagorean math textbook are easy to understand.
			The terms used in my math textbook for Pythagoras are very complicated.
			I need teaching materials using easy-to-understand mathematical terms to help understand the Pythagorean material.



## APPENDIX E - Questionnaire on the Level of Teaching Material Needs

### PYTHAGORAS MATHEMATICS TEACHING MATERIAL REQUIREMENTS QUESTIONNAIRE BASED ON SCIENCE FOR

**PERSONAL IDENTITY**

Full name : \_\_\_\_\_

School name : \_\_\_\_\_

Class : \_\_\_\_\_

Fill in the following statements with a (✓) on one of the Yes/No answers. Answer the statements below honestly!

*(This questionnaire does not affect the value of any subject)*

No	Statement	Yes	No
1	The mathematics teaching materials that I use make me excited to learn independently.		
2	I find it difficult to learn Pythagorean mathematics independently through the textbook I use.		
3	The mathematics teaching materials that I use make it easier for me to understand the Pythagorean material independently.		
4	The mathematics teaching materials that I use provide space for me to be able to do the practice questions independently.		
5	I can't do the Pythagorean exercises in my math textbook.		
6	I find it difficult to understand the practice of Pythagorean math problems in the textbook independently.		
7	The mathematics teaching materials that I use contain Pythagorean material with complete and complete examples and practice questions.		
8	The mathematics teaching materials that I use contain a unified whole that makes it easier for me to learn.		
9	The Pythagorean material contained in my math textbook is incomplete.		
10	The teaching materials that I use are so complete that I no longer need to look for other references in understanding Pythagorean material.		
11	I need other references from the internet and other books to understand the material and Pythagorean math problems.		
12	I need Pythagorean mathematics teaching materials that contain complete material, so that I can focus on studying only that one teaching material.		
13	The Pythagorean material mathematics textbook that I use has not had a touch of the current development of science and technology.		
14	My math textbook has been integrated with the current innovations in the development of science and technology.		
15	I have never used an innovative textbook that adapts to the current development of science and technology.		
16	If there is an innovative Pythagorean material textbook that adapts to the development of science, for example mathematics combined with science, I want to use it.		
17	The Pythagorean math textbook that I use is very old and irrelevant to the current development of science.		
18	My Pythagorean math textbook is flexible to use for a long time.		
19	The Pythagorean mathematics textbook that I use has not adapted to the current development of science.		
20	I'm sure the innovative Pythagorean textbook that combines math and science with an interesting storyline will really help me in learning math.		
21	The language used in math textbooks is difficult for me to understand.		
22	I can easily understand the Pythagorean material with the language used in the textbook I use.		
23	I can not understand the Pythagorean material with the language in my textbook.		
24	I need a Pythagorean textbook that contains science and mathematics with a simple language presentation that makes it easier for me to understand the material.		
25	The math terms in my Pythagorean math textbook are easy to understand.		
26	The terms used in my math textbook Pythagoras are very complicated.		
27	I need teaching materials with the use of easy-to-understand mathematical terms to help understand the Pythagorean material.		

***Thank you for your honesty and participation.***

## APPENDIX F - Questionnaire on the Level of Teaching Material Needs Through Google Form

<p>ANGKET KEBUTUHAN BAHAN AJAR PYTHAGORAS MATEMATIKA BERBASIS SAINSMATIKA</p> <p>Isilah pernyataan berikut. Jawablah pernyataan-pernyataan dibawah ini dengan sejujur-jujurnya! (Jawaban angket ini tidak mempengaruhi nilai mata pelajaran apapun, jadi jawablah dengan jujur apa adanya)</p>	<p>Bahan ajar matematika yang saya gunakan memudahkan saya dalam memahami materi pythagoras secara mandiri *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya sulit memahami latihan soal matematika materi pythagoras yang ada pada buku ajar secara mandiri *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>Bahan ajar matematika yang saya gunakan membuat saya semangat belajar secara mandiri *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Bahan ajar matematika yang saya gunakan memberikan ruang kepada saya untuk bisa mengerjakan latihan soal secara mandiri *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Bahan ajar matematika yang saya gunakan memuat materi pythagoras dengan contoh dan latihan soal secara utuh dan lengkap *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>Saya sulit belajar matematika materi pythagoras secara mandiri melalui buku ajar yang saya gunakan *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya tidak bisa mengerjakan latihan pythagoras dalam buku ajar matematika saya *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Bahan ajar matematika yang saya gunakan memuat satu kesatuan utuh yang memudahkan saya dalam belajar *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>Materi pythagoras yang termuat dalam buku ajar matematika saya tidak lengkap *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya memerlukan bahan ajar matematika materi pythagoras yang memuat materi lengkap, sehingga saya bisa fokus belajar pada satu bahan ajar itu saja *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Saya belum pernah menggunakan buku ajar inovatif yang menyesuaikan dengan perkembangan ilmu pengetahuan dan teknologi saat ini *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>Bahan ajar yang saya gunakan sangat lengkap sehingga saya tidak perlu lagi mencari referensi lain dalam memahami materi pythagoras *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Buku ajar matematika materi pythagoras yang saya gunakan belum ada sentuhan perkembangan ilmu pengetahuan maupun teknologi saat ini *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Jika ada buku ajar inovatif materi pythagoras yang menyesuaikan dengan perkembangan ilmu pengetahuan misalkan materi matematika yang dipadukan dengan sains, saya ingin menggunakannya *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>
<p>Saya memerlukan referensi lain dari internet dan buku lainnya untuk memahami materi dan soal-soal matematika pythagoras *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Buku ajar matematika saya sudah terpadu dengan inovasi perkembangan ilmu dan teknologi saat ini *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>	<p>Buku ajar matematika materi pythagoras yang saya gunakan sudah sangat lama dan tidak relevan dengan perkembangan ilmu pengetahuan saat ini *</p> <p><input type="radio"/> Ya</p> <p><input type="radio"/> Tidak</p>

Buku ajar matematika materi pythagoras yang saya gunakan sudah sangat lama dan tidak relevan dengan perkembangan ilmu pengetahuan saat ini \*

- Ya  
 Tidak

Buku ajar matematika materi pythagoras saya fleksibel untuk digunakan dalam kurun waktu yang panjang \*

- Ya  
 Tidak

Buku ajar matematika materi pythagoras yang saya gunakan belum menyesuaikan dengan perkembangan ilmu saat ini \*

- Ya  
 Tidak

Saya yakin buku ajar inovatif materi pythagoras yang memadukan matematika dan sains dengan alur cerita yang menarik akan sangat membantu saya dalam belajar matematika \*

- Ya  
 Tidak

Bahasa yang digunakan dalam buku ajar matematika sulit saya pahami \*

- Ya  
 Tidak

Saya tidak bisa memahami materi pythagoras dengan bahasa yang ada pada buku ajar saya \*

- Ya  
 Tidak

Saya memerlukan buku ajar pythagoras yang memuat sains dan matematika dengan penyajian bahasa yang sederhana sehingga memudahkan saya dalam memahami materi \*

- Ya  
 Tidak

Saya mudah memahami materi pythagoras dengan bahasa yang digunakan dalam buku ajar yang saya gunakan \*

- Ya  
 Tidak

Istilah matematika yang ada dalam buku ajar matematika materi pythagoras saya mudah di pahami \*

- Ya  
 Tidak

Istilah yang digunakan dalam buku ajar matematika saya materi pythagoras sangatlah rumit \*

- Ya  
 Tidak

Saya memerlukan bahan ajar dengan penggunaan istilah matematika yang mudah dipahami untuk membantu memahami materi pythagoras \*

- Ya  
 Tidak

Kirim

Jangan pernah mengirimkan sandi melalui Google Formulir.

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## APPENDIX G - Mathematical Resilience Level Questionnaire Validation Sheet

### VALIDATION SHEET MATHEMATIC RESILIENCE LEVEL QUESTIONNAIRE

Validator name:  
NIP/NIDN:  
Areas of expertise:

#### A. Introduction

This validation sheet is used to obtain your assessment of students' mathematical resilience questionnaires. I thank you for your willingness to be a validator and fill out this validation sheet.

#### B. Instruction

- You are requested to give a score for each item of the statement by ticking (✓) in the column with the rating scale, as follows:  
V=Valid; TV=Invalid
- If necessary, you can provide criticism and suggestions for improvement in the lines provided.

#### C. Evaluation

Indicator	Statement	Evaluation		Comment
		V	TV	
Engage in mathematical thinking	Thinking mathematically helps me with important things.			
	Math often gets me stuck in confusion.			
	I believe that mathematics can develop my thinking skills.			
Starting to experience personal value in math	Mathematics has a high contribution to my learning goals so far.			
	Learning math does not bring any significant changes to my learning progress.			
	I have consciously implemented mathematics in my daily life.			
Strategy adaptation	I never knew the benefits and uses of learning math.			
	I like to work on different questions from the questions that have been given previously.			
	I do not like doing math problems.			
Study skills	I re-learn about my wrong answers in doing math problems.			
	I'm not good at math, so I can't learn much math.			
	I always believe I can come up with different ideas from other friends in the group.			
Develop resilience in the face of problems	I always fixate and leave everything to friends who are smarter in math.			
	I am confident when presenting my math answers in front of the class.			
	I avoid solving math problems that have multiple solutions.			
Develop options & opportunities to experiment	I am able to do math problems without giving up.			
	I like solving problems presented in math problems.			
	I think wrong in doing math is important to better understand math.			
Access help & support	I get confused easily when I'm wrong in doing math problems.			
	I can work on difficult math problems without giving up.			
	I always take failure in math exams as an experience to get better.			
Access media support & learning resources	I am embarrassed to seek help in solving problems that are different from the example questions that have been given previously.			
	I am comfortable discussing concepts that have not been understood with friends.			
	I feel disturbed when asked for help by friends who have difficulty learning math.			
	I will ask the teacher if I don't understand a concept in math.			
	I can easily access media and adequate mathematics learning resources.			
	I'm desperate when I can't find the source to complete the task.			
	In my opinion, learning mathematics only requires the provided textbook.			

#### D. Comments and Suggestions

.....  
.....

#### E. Conclusion

Based on the assessment that has been carried out, the student's mathematical resilience level questionnaire sheet is stated:

- Worth using without revision
- Worth using with revision
- Not worth using

Please put a circle mark on the number that corresponds to your conclusion.

Cirebon, .....2021  
validators,  
(.....)



## APPENDIX H - Pythagorean Module Validation Sheet Based on Science

### VALIDATION SHEET PYTHAGORAS MODULE BASED ON SCIENCE

Validator name:  
NIP/NIDN:  
Areas of expertise:

#### A. Introduction

This validation sheet is used to obtain your assessment of the science-based Pythagorean module in constructing students' mathematical resilience. I thank you for your willingness to be a validator and fill out this validation sheet.

#### B. Instruction

- You are requested to give a score for each item of the statement by ticking (✓) in the column with the rating scale, as follows:  
4=Very eligible; 3=Eligible; 2=Less eligible; 1=Not eligible
- If necessary, you can provide criticism and suggestions for improvement in the lines provided.

#### C. Evaluation

Rating indicator	Rating points	Evaluation			
		1	2	3	4
<b>Content feasibility aspect</b>					
A. Suitability of material with KD	1. Material equipment				
	2. Material breadth				
	3. Material depth				
B. Material accuracy	4. Concept and definition accuracy				
	5. Example and case accuracy				
	6. Image and illustration accuracy				
	7. Accuracy of terms				
C. Material update	8. Suitability of the material, examples, & questions that are relevant to current scientific developments				
	9. Using examples and cases found in everyday life				
D. Encourage curiosity	10. Encourage curiosity				
	11. Creating the ability to ask questions				
<b>Aspects of feasibility of presentation</b>					
A. Presentation technique	1. Concept collapse				
	2. Examples of questions in each sub-material presented				
	3. Practice questions at the end of each sub material				
B. Presentation support	4. Introduction				
	5. Bibliography				
	6. Explanation and description of the contents of the module				
C. Coherence & coherence of flow of teaching materials	7. Regularity between activities in teaching materials				
	8. Integrity of meaning in teaching materials				
<b>Language eligibility aspect</b>					
A. straightforward	1. The accuracy of sentence structure				
	2. Sentence effectiveness				
	3. Term standard				
B. Communicative	4. Understanding of messages or information				
C. Dialogic & interactive	5. Ability to motivate students				
D. Suitability with the development of students	6. Conformity with the intellectual development of students				
	7. Conformity with the level of emotional development of students				
E. Conformity with language rules	8. Grammatical accuracy				
	9. Spelling accuracy				
<b>Aspects of scientific assessment</b>					
A. The nature of science	1. The relationship between the material presented and scientific situations in everyday life				
	2. The ability to encourage students to make connections between their knowledge of science and mathematics and their application in everyday life				
B. Scientific component	3. Relation of science and mathematics to Pythagorean material				
	4. The attachment of scientific elements in the presentation of material and questions				

#### D. Comments and Suggestions

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**E. Conclusion**

Based on the assessment that has been carried out, the student's mathematical resilience level questionnaire sheet is stated:

- a. Worth using without revision
- b. Worth using with revision
- c. Not worth using

Please put a circle mark on the number that corresponds to your conclusion.

Cirebon, .....2021  
validators,  
(.....)