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Development of Student Self-Efficacy for Mathematics Learning in Indonesia

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Abstract: The purpose of this development research is to create a self-efficacy instrument to assist students learning mathematics that is valid, practical, and reliable. A self-efficacy questionnaire is the format of the instrument that was created. The main driving force behind this research is the scarcity of empirically validated self-efficacy surveys for studying mathematics in different parts of Indonesia. Students' self-efficacy is important since it affects how well they learn. This research used the ADDIE development technique as its methodology, comprising five stages: Analysis, Design, Development, Implementation, and Evaluation. Readability, validity, and reliability tests were used to test the data empirically and theoretically through expert evaluation. Both qualitative and quantitative analyses were done on the data; expert validation results and readability test results were subjected to a qualitative analysis, while validity and reliability test results were subjected to a quantitative analysis. Students from different schools in Indonesia took the quantitative test. At least ten times as many statements were included in the sample size that was used. 36 statement items were originally developed throughout the development phase; however, item 33 was split into two distinct statements, resulting in 37 questionnaire items that represent students' self-efficacy in learning mathematics. This designed questionnaire can be used to evaluate Indonesian students' self-efficacy in learning mathematics at the junior and senior high school levels.

Keywords: questionnaire, self-efficacy, learning mathematics

INTRODUCTION

Mathematics is a topic that many pupils dislike (Kamarullah, 2017). When most students hear the word of mathematics, they appear to want to avoid it. This dread is exacerbated by parents who struggled with

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mathematics during their school years and frequently relay the message that mathematics is a tough subject, adding psychological stress to their children learning mathematics. This condition persists, almost becoming a fiction that mathematics is terrifying.

One of the reasons mathematics is difficult is because it is abstract and loaded with symbols (Kurniawan, 2017). Many figures and educators in mathematics education have observed and experienced that if these symbols are not understood, it becomes difficult to connect with the subject. Furthermore, solving mathematical problems or equations needs following accurate and logical procedures, which needs conceptual competence. As a result, understanding and mastering mathematics frequently necessitates the assistance of experts.

The affective part of mathematics learning is very important and plays a key impact in learning success. Beliefs, attitudes, and emotions are three affective elements that might influence students' learning processes. When students engage in an investigation process, their behaviors, efforts, tenacity, flexibility in differences, and goal realization are influenced by belief elements. Student beliefs include their mathematical self-confidence or self-efficacy, which is the student's assessment of their capacity to achieve a desired or defined performance level, impacting subsequent behaviors (Bandura, 1997). As a result, considerable self-efficacy in mathematics is required for students to succeed in the mathematics learning process.

Albert Bandura, a psychologist, pioneered the concept of self-efficacy in 1982. The concept was suggested by Bandura (1982) as a personal assessment of "how well one can execute actions required to deal with prospective situations." Bandura (1997) defined self-efficacy as a person's belief in their ability to succeed in a certain scenario or complete a task. Every aspect of human endeavor is influenced by self-efficacy. Beliefs regarding one's power to control situations have a substantial impact on a person's ability to handle challenges properly and the choices they are most likely to make. The consequences of self-efficacy are most noticeable and persuasive in human activities such as health (Luszczynska and Schwarzer, 2005; Buckley, 2014), education (Krishnan and Krutikova, 2013; Schunk, 1991; Chemers et al., 2001; Morton et al., 2014), and industry and organization (Akhtar et al., 2012), and agriculture (Wuepper and Lybbert, 2017).

Self-efficacy is frequently misunderstood as a sense of personal efficacy. This sense is critical in how a person handles objectives, tasks, and obstacles. An individual's self-efficacy, according to Bandura (1997), will: (1) influence their decision-making and actions; (2) determine the extent of their effort in an activity, how long they persevere when faced with difficulties, and their flexibility in unfavorable situations; and (3) affect their thought patterns and emotional reactions.

Mathematical self-efficacy positively adds to and plays a vital part in the achievement of mathematics learning that students can achieve (Sunaryo, 2017). It is also important in solving mathematical difficulties (Ayotola and Adedeji, 2009). For example, Ramlan (2013) noticed that when asked to comment or solve problems verbally, students frequently look left and right as if seeking assistance from their peers, showing a lack of confidence or fear in responding and expressing their ideas.

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Most teachers concentrate solely on imparting knowledge to pupils, whereas many students struggle with non-cognitive aspects such as self-efficacy or a negative attitude toward mathematics. These characteristics can impede mathematics learning, as the application of emotive aspect assessments has been shown to improve learning (Qadar et al., 2015: 9). Gurefe and Bakalim (2018: 157) discovered that self-efficacy in mathematics favorably improves performance in their research with Faculty of Education students.

In terms of the function of self-efficacy in mathematics, knowing how to do mathematical operations is not enough; one must also have self-efficacy in the credibility of their conceptions and procedures (Garfield and Ben-Zvi, 2009: 1). For example, while using a formula, students must be confident in their application. Students' mathematical self-efficacy is not fixed, but it can be enhanced. Yuliarti et al. (2016), for example, investigated the growth of student self-efficacy through generative learning methodologies, discovering that students' self-efficacy can be increased even from a low starting position.

According to Finney and Schraw (2003), students' self-efficacy develops as a result of their own circumstances and environment. Teachers, textbooks, learning methodologies, and, in particular, the usage of everyday problems in the students' environment all influence the change in students' self-efficacy. Thus, all of these aspects must be examined in order to boost self-efficacy (Ulpah, 2019).

An instrument that reliably evaluates students' self-efficacy is required to understand their self-efficacy and lead them successfully in the learning process for optimal outcomes. Novrianto et al. (2019) used a sample of 585 students from UIN Sultan Syarif Kasim Riau to examine the construct validity of the General Self Efficacy Scale (GSES) converted to Indonesian. The confirmatory factor analysis (CFA) approach was employed with Lisrel 8.80 software to indicate that the GSES's ten items are unidimensional and measure a single factor, supporting the GSES's one-factor model. This instrument is of a generic character.

Betz and Hackett (1983) established the Mathematics Self-Efficacy Survey (MSES) for mathematics in 1983. This instrument has been widely used to study the effects of mathematical self-efficacy in a variety of contexts, including high school students (O'Brien et al., 1999), older students (Gatobu et al., 2014), science and technology students (Lent et al., 1991), first-year college students (Hall and Ponton, 2005), and pre-service teachers (Bates et al., 2011). However, using it by other researchers without adapting and validating it diminishes the validity of study conclusions, especially when translated into multiple languages and applied to diverse cultures (Chávez and Canino, 2005; Walther, 2014).

Usher and Pajares (2009) have created a mathematical self-efficacy questionnaire for Northern American middle school students. They developed a 24-item questionnaire measuring self-efficacy across four dimensions: mastery experiences, social persuasion, physiological states, and vicarious experiences after three stages including students from varied ethnic backgrounds (White, Black, Asian-American, and Mixed). The findings revealed that it was appropriate for students in various situations. However, because self-efficacy is strongly influenced by the learning environment, validation for multiple ethnic groups and places is required.

Meanwhile, Chan and Abdullah (2018) sought to construct a self-efficacy questionnaire for primary school pupils, testing it on 100 fifth-grade students from Penang Island, Malaysia's government schools. The research

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yielded 14 valid and dependable items for a mathematical self-efficacy questionnaire. However, this study was limited to public elementary schools and was not examined in private or international elementary schools. To investigate if different types of schools' learning environment rules influence students' self-efficacy, the study subjects should be enlarged to include both public and private schools.

Furthermore, Riboroso (2020) created a questionnaire in the Philippines to assess first-year college students' mathematics self-efficacy, resulting in 46 valid and useful items from an initial 76. The questionnaire assesses self-efficacy in four areas: mathematical modeling, representation, communication, and learning technology use. However, given the importance of technology in current education, the item distribution warrants more examination.

Muhtarom et al. (2017) designed a mathematics learning belief questionnaire rather than a self-efficacy questionnaire in the setting of Indonesia. Yoga et al. (2020) created a math self-efficacy questionnaire for elementary school students. Continuous research demonstrates a scarcity of Indonesian researchers' self-efficacy questionnaires. Most studies in Indonesia use existing questionnaires established outside Indonesia, either directly or with adjustments, like in Somakim and Risnanosanti's doctoral research, which adjusted mathematics learning self-efficacy surveys. Modified self-efficacy surveys were also utilized by Ramlan (2013), Yuliarti et al. (2016), Sunaryo (2017), Ulpah (2019), and others.

As a result, there is a substantial limitation in the availability of self-efficacy questionnaires for assessing student self-efficacy in mathematics learning within the environment and culture of Indonesia, particularly for students in junior high and senior high school. This scarcity presents difficulties for mathematics educators in assessing students' self-efficacy. To promote the quality of mathematics education in Indonesia, the creation of a self-efficacy instrument in mathematics learning is regarded required. Both theoretical and empirical testing are required to confirm the instrument's validity and reliability. Theoretical testing should include highly qualified experts, while empirical testing should include a diverse spectrum of responders from across Indonesia. The created instrument is expected to help teachers improve and enhance the mathematics learning process in the classroom. The designed self-efficacy instrument is based on Bandura's Theory.

METHODOLOGY

This is a development study to create a valid, practical, and reliable student self-efficacy measure. The ADDIE development approach is used in the study, which stands for Analysis, Design, Development or Production, Implementation or Delivery, and Evaluation. Dick and Carey created the ADDIE model in 1996 to help them construct learning systems. The ADDIE model's research and development steps are divided into five parts. The following are descriptions of each step in the ADDIE development paradigm (Mulyatiningsih, 2019; Aldoobie, 2015):

a) *Analysis*

At this stage, the emphasis is on examining student needs, curriculum, and characteristics. The needs analysis is carried out to identify existing problems in the field so that the construction of the self-efficacy questionnaire is in line with the students' circumstances. The curriculum analysis is used to understand mathematics learning in schools and the suitability

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of the utilized questionnaire. The results of the student characteristics study are then used to personalize the questionnaire that is being prepared.

b) *Design*

A theoretical study is undertaken at this stage, which includes researching self-efficacy theory, learning about questionnaire design theory, making an initial draft of the questionnaire, and creating the questionnaire sheets to be developed. At this point, the instruments for the questionnaire's validation are also being produced.

c) *Development*

A questionnaire is constructed at this step based on the previously investigated theories (Prototype 1). Following the development of the product, it is subjected to theoretical testing by validating Prototype 1 with specialists in psychology and learning. The prototype evaluation format is consistent with construct, content, and language elements. Prototype 2 of the questionnaire is obtained after adjustments depending on the validation procedure.

The procedure is then followed by empirical testing, specifically a practicability test. A limited readability test with four students is used to evaluate the questionnaire's practicality in this case. The purpose is to see if the statements in the questionnaire, as written, are intelligible and comprehensible to students. After detecting Prototype 2's weaknesses it is updated, resulting in Prototype 3.

d) *Implementation*

At this stage, additional empirical testing is carried out with a larger subject group. Prototype 2 is being tested in junior high schools (SMP) and senior high schools (SMA) in many Indonesian provinces. Students in grades VII, VIII, and IX of junior high schools (SMP/MTs) and students in grades X, XI, and XII of senior high schools take the self-efficacy questionnaire.

e) *Evaluation*

Following the empirical trial, an evaluation is carried out to determine the quality of the created self-efficacy questionnaire (Prototype 3). There are quantitative and qualitative analyses carried out. This stage tries to make adjustments if the produced self-efficacy questionnaire still has limitations.

This research was conducted over two years, from September 2020 to September 2022. Data collection took place in several junior high schools (SMP) and senior high schools (SMA) across various provinces in Indonesia. The research areas included both urban and rural regions, to ensure that the developed instrument was not solely targeted at urban students who generally have access to better educational facilities. The goal was for the instrument resulting from this research to be suitable for use by all students.

Although this is a qualitative study, considering that the produced instrument is intended for use by all junior high school and equivalent senior high school students, the selection of trial subjects had to adhere to the sampling rules of quantitative research. Therefore, purposive sampling was

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used. This technique was chosen because the samples were selected based on certain considerations and characteristics of the known population (Malik and Chusni, 2018). In line with the type of questionnaire developed, namely a self-efficacy questionnaire for students in mathematics learning, the sample selection was filtered through the following criteria: (1) Students who have studied mathematics, as those who have not will not have experienced the difficulties of learning mathematics; (2) Students who understand the questionnaire statements, given the relatively high level of comprehension required, thus making it more suitable for students of at least seventh grade in junior high school; (3) Students from various locations/regions, to ensure representation from every area. Therefore, the respondents were junior high school equivalent students (grades VII, VIII, and IX) and senior high school equivalent students (grades X, XI, and XII) from various areas within Indonesia.

Regarding sample size, it is statistically stated that a larger sample size is expected to yield better results. According to Krejcie and Morgan (Schreiber and Asner-Self, 2011: 92), for a population below 100, all should be sampled; for a population of 500, 50% should be sampled; for a population of 5000, 357 respondents should be sampled; and for a population of 100,000, only 384 respondents need to be sampled. In this study, samples were taken based on how many respondents filled out the questionnaire, as long as they met the respondent criteria, by asking for help in distributing the questionnaire through teacher colleagues in various places. Once enough data met the minimum requirements, the distribution of the trial questionnaire was stopped. The minimum requirement was adjusted according to Nunnaly's suggestion (Alwi, 2012), stating that the size of respondents in a trial should be ten times the number of items in the measuring instrument. Since there were 36 statement items, the minimum number of respondents was 360 students for each grade level.

The variable in this study is a valid, practical, and reliable student self-efficacy questionnaire. The questionnaires in this study included: (1) a questionnaire for expert validation, (2) a questionnaire for readability testing, and (3) a self-efficacy questionnaire to test validity and reliability quantitatively. The dimensions measured to observe student self-efficacy are based on Bandura's (1997) concept, namely Magnitude (How an individual can overcome their learning difficulties), Strength (How strongly students believe in their ability to overcome learning difficulties), and Generality (Indicating whether efficacy beliefs will persist in a specific domain or apply across a variety of activities and situations).

Data analysis techniques were employed to produce a high-quality self-efficacy questionnaire that meets the criteria of being valid, practical, and reliable. The steps in analyzing the quality criteria of the developed self-efficacy questionnaire are as follows:

(1) Validity Analysis

a) Based on the validation data from the questionnaire assessment by learning and psychology experts, the validity of the questionnaire can be determined by examining the qualitative evaluation results (theoretical validity). These experts were asked to

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review and theoretically evaluate the questionnaire, providing comments on incorrect statements and suggestions for their replacement.

b) Subsequently, by conducting a trial of the self-efficacy questionnaire with a large number of students, its validity is also examined quantitatively (empirical validity). The calculation of the trial results uses the product moment formula. An instrument is considered valid if the calculated correlation coefficient (r_calculated) is greater than the table correlation coefficient (r_table) at a 5% significance level (Sugiyono, 2017).

(2) Practicality Analysis

The content of the questionnaire statements was also tested for readability with 4 students, specifically 3 junior high school students and 1 sixth-grade elementary school student. This readability test was conducted to determine if the statements created were understandable and comprehensible to students. A questionnaire was also designed to assess students' readability of the statements. From the scores obtained in the readability test questionnaire, the practicality value of the self-efficacy questionnaire was calculated. The questionnaire is considered good if the students' responses meet the minimum practicality criteria, referring to the following Table 1:

Interval score	Category
$x > 3,4$	Highly practical
$2,8 < x \leq 3,4$	Practical
$2,2 < x \leq 2,8$	Moderately practical
$1,6 < x \leq 2,2$	Slightly practical
$x \leq 1,6$	Not practical

Table 1. Criteria for the practicality of the questionnaire

(Riduwan, 2018)

(3) Reliability Analysis

The questionnaire was trialed with many students to quantitatively assess its reliability. The testing of the instrument's reliability utilized Cronbach's Alpha formula, appropriate for research instruments in the form of questionnaires and scales (Ananda and Fadhli, 2018). A Cronbach's Alpha value greater than 0.7 indicates sufficient reliability. Meanwhile, an Alpha value above 0.80 suggests that all items are reliable and that the entire test consistently exhibits strong reliability (Wahyuni, 2014). Mehrens and Lehmann (Retnawati, 2017) stated that although there is no general consensus, it is widely accepted that for tests used to make decisions about individual students, a minimum reliability coefficient of 0.85 should be achieved.

RESULTS

The results of the development research on the student self-efficacy instrument in mathematics learning are outlined according to the ADDIE stages, as follows:

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1) *Analysis*

Needs Analysis: Understanding students' self-efficacy is as important as teaching the material because students' readiness and confidence in learning will affect their learning outcomes. To effectively teach students and produce good learning outcomes, it is necessary to consider their self-efficacy in learning mathematics. It was found that there are few self-efficacy questionnaires in mathematics learning developed by Indonesian researchers, necessitating the creation of a new self-efficacy questionnaire that is field-tested directly with many respondents and tailored to the Indonesian context.

Curriculum Analysis: The curriculum mostly applied in schools where students were asked to fill out the questionnaire is the revised 2013 curriculum. This curriculum integrates four elements: character education reinforcement (PPK), Literacy, the 4Cs (Creative, Critical Thinking, Communicative, and Collaborative), and HOTS (Higher Order Thinking Skills). Therefore, it is indeed necessary to look at students' self-efficacy to identify where students' weaknesses in learning mathematics may lie due to the implementation of this curriculum.

Student Analysis: Based on the ability to understand sentences and recognize feelings, it was deemed best to measure the self-efficacy of junior high school equivalent and senior high school equivalent students.

2) *Design*

a) Collection of References

Credible reference sources were sought to create an accurate and effective self-efficacy questionnaire. Materials on self-efficacy and examples of questionnaires were collected. Researchers studied the theory of self-efficacy. This activity took place from November to December 2020.

b) Creation of Questionnaire and Validation Sheet

Researchers discussed and created a self-efficacy questionnaire for students in mathematics learning. The content of the questionnaire was aligned with the self-efficacy framework. The dimensions of self-efficacy referred to were magnitude, strength, and generality (Bandura, 1997). A total of 36 questionnaire statements were created. Validation sheets for lecturers and readability test sheets for students were also developed. Creating statements that truly reflect self-efficacy was challenging, leading researchers to spend a considerable amount of time studying the theory of self-efficacy and designing the questionnaire, and consulting with experienced colleagues about self-efficacy. This activity took place from January to February 2021. The initial draft of the questionnaire statements based on dimensions and derived indicators is as follows:

Dimension	Operational definition	Indicators and their statements

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Magnitude	How an individual can overcome their learning difficulties	1. Optimistic Outlook in Working on Lessons and Assignments. – I feel that I can always solve mathematical problems or complete math assignments on my own (+) – I cannot succeed in learning mathematics without help from others (-) 2. Level of Interest in Lessons and Assignments – For me, learning mathematics is enjoyable (+) – I am not at all interested in mathematics (-) 3. Developing Skills and Achievements – Learning mathematics is important for training the mind (+) – For me, there is no benefit in learning mathematics (-) 4. Planning in Task Completion – Correct step-by-step solutions are necessary to solve mathematical problems (+) – When I have a mathematics problem, I just work on the core issue immediately without first writing down the preliminary steps (-) 5. Confidence in Performing and Completing Tasks – I can solve mathematical problems accurately (+) – Mathematical problems are always difficult to solve (-) 6. Viewing Difficult Tasks as a Challenge – I feel challenged when completing more difficult math problems (+) – When the math problems become harder, I start to feel overwhelmed (-) 7. Studying According to a Set Schedule – I can study mathematics independently when the time is calm, such as at night (+) – In any situation, I find it hard to learn and understand mathematics (-)) 8. Selective Action in Achieving Goals (Statement not provided)

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Strength	How High is a Student's Confidence in Overcoming Their Learning Difficulties	1. Effort Can Lead to Improved Performance – If we diligently work, we can solve even the difficult math tasks (+) – No matter how much effort I put into solving math problems, the results are always unsatisfactory (-) 2. Commitment to Completing Assigned Tasks – I will try to complete every math task or problem that is given(+) – I am unwilling to work on any math tasks or problems (-) 3. Belief in and Awareness of One's Strengths – I know that I am capable of learning mathematics (+) – I believe that I have many weaknesses in mathematics (-) 4. Persistence in Completing Tasks – I will continuously try my best to complete the math tasks given by my teacher (+) – If the task given by the teacher turns out to be difficult, I start to avoid it (-) 5. Having a positive purpose in doing various things – I aim to become smarter by studying mathematics (+) – Studying mathematics is not beneficial (-) 6. Having good self-motivation for personal development – I always push myself to keep liking and learning mathematics because I think it's important – I always try to follow mathematics lessons because they can train my thinking ability – I feel that learning mathematics is useless 1. Responding well to different situations and thinking positively – If I study different mathematical materials than before, I remain happy to increase my thinking skills (+) – The more varied the mathematics materials I study, the more confused I become (-)

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Generality	Indicates whether efficacy beliefs will persist in a specific domain or apply across various activities and situations	2. Using life experiences as a path to success – I always try to correct my previous mistakes in solving mathematical problems – From past experiences, I have never been able to learn mathematics 3. Enjoy seeking new situations – Once I finish studying one mathematics topic, I move on to another – Every mathematics topic is always difficult for me to learn 4. Able to effectively handle all situations – I prefer to solve each mathematical problem in a simple way without needing to use formulas – I often encounter obstacles when solving (+) mathematical problems and sometimes go in circles without reaching a solution (-) 5. Trying new challenges – I feel happy when there are more challenging mathematical problems (+) – Studying even easy mathematics topics feels difficult, let alone the harder ones (-)

Table 2. Initial design framework for the Self-Efficacy questionnaire

3) *Development*

a) Validity Test through Expert Validation

The researcher created and designed the self-efficacy questionnaire, which passed the expert validation test. Several experts then validated the questionnaire. Attempts were made to find specialists who are very knowledgeable about self-efficacy. The following criteria were used in selecting experts: (1) comprehension and mastery of learning theory, (2) comprehension and mastery of psychological theories, (3) involvement in the field of psychology, (4) comprehension and mastery of questionnaire theory, and (5) comprehension of sentence purpose.

The validation by experts employed a panel technique, where validators reviewed each item of the questionnaire based on the rules of writing questionnaire items. This review considered aspects of material, construction, language/culture, and the accuracy of answer keys/scoring guides. The process involved several reviewers who were given the questionnaire items to assess, a format for the review, and guidelines for evaluation. The

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reviewers worked independently in different locations. They were allowed to make direct corrections to the questionnaire text, provide comments, and assign a rating to each item based on criteria such as: good, needs improvement, or needs replacement (Alwi, 2012).

Experts who were asked to theoretically test the content of the self-efficacy questionnaire included three lecturers from the Guidance and Counseling Program at Universitas PGRI Palembang and one lecturer from the Islamic Psychology Study Program at the Faculty of Psychology, UIN Raden Fatah Palembang. Three out of these four lecturers also worked as psychological consultants. The validation testing period was from March 8, 2021, to July 16, 2021. The following is a summary of all comments and suggestions from the validation of the self-efficacy questionnaire content by experts:

No.	Comments and suggestions from the experts
1.	Overall, the construction, content, and language are good and accurate. However, it's essential to consider the meaning of self-efficacy in its context.
2.	Self-efficacy refers to the ability to produce outcomes (the belief that students can create, not just solve problems).
3.	It also encompasses self-trust, which is the confidence in one's ability to perform tasks according to their competence.
4.	The word 'feel' is not suitable for self-efficacy, as it is emotional and abstract, while self-efficacy should be a tangible product.
5.	There are still some words that need to be replaced to be appropriately reflective of self-efficacy.
6.	The statements made do not sufficiently reflect the students' attitudes.
7.	The statements are not formulated clearly and definitively.
8.	Some statements have ambiguous meanings.
9.	It seems there are sentences that are not yet robust.
10.	Every expert judgment or academic work should be scientific, so please improve the language, such as changing 'not' to 'less.' This is because if 'not' is used, it implies complete ignorance, whereas every student should at least understand basic addition and subtraction for future use.
11.	Overall, this questionnaire is suitable, but it needs only minor improvements.
12.	There are a few statement items that still need refinement.
13.	There appears to be one overlapping item.
14.	On the header of the second sheet, alternative answer options should be placed again.
15.	Some words still need to be improved.
16.	Is this research qualitative or quantitative? It seems to be a combination of both.
17.	The word ' I ' is unnecessary because the subject fills it out themselves.
18.	There must be a distinction between attitude questionnaires and survey questionnaires

Table 3. Comments and suggestions from the experts

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After validation and identification of deficiencies and weaknesses in the questionnaire, the researchers proceeded to improve the content of the self-efficacy questionnaire. The revised version was reconfirmed with the validators to ensure that the improvements met the correct criteria. Once accepted and deemed appropriate by the validators, the next step was taken.

b) Practicality Test through Readability Test

The purpose of the readability test was to ensure that the text of the statements created could be understood and were appropriate for the comprehension of the targeted students. The selection of students as subjects for the readability test met the following criteria: (1) a minimum of seventh-grade junior high school students, as the questionnaire was aimed at junior high school students, but there was one sixth-grade elementary school student included as a subject because this student was considered capable of understanding and comprehending the text statements; (2) able to feel what the text states, (3) at the time of testing, still an active student, not a dropout or unemployed. The results of the readability test were as follows:

1) Subject 1, initials AMP, a ninth-grade student at SMP Negeri 1 Inderalaya, South-Sumatera. Tested on Tuesday, September 7, 2021, from 14:00 - 15:00, by the third researcher as the examiner. Tested by giving a questionnaire sheet and the subject filled it out independently. No obstacles encountered. Conclusion: The statement sentences were understandable.
2) Subject 2, initials NFI, a sixth-grade student at SD Negeri 68 Palembang, South-Sumatera. Tested on Sunday, September 12, 2021, from 17:00 - 18:00, by the second researcher as the examiner. Tested through face-to-face questioning. No obstacles encountered. Conclusion: The long sentences were still quite understandable, did not fully understand the word “material,” some words should be replaced with easier equivalents, and some words should be simplified as they were too verbose.
3) Subject 3, initials PR, a ninth-grade student at SMP Negeri 6 Palembang, South-Sumatera. Tested on Wednesday, September 22, 2021, from 18:50 - 19:25, by the third researcher as the examiner. Tested through direct face-to-face questioning. No obstacles encountered. Conclusion: Many sentences caused doubt in subject 3's understanding, and several sentences required more clarity.
4) Subject 4, initials DAV, a seventh-grade student at SMP IT Iqro’ Bengkulu. Tested on Thursday, October 7, 2021, from 14:15 - 15:05, by the second researcher as the examiner. Tested through online questioning via Google Meet. No obstacles encountered. Conclusion: There were words that subject 4 did not understand, and the long statements were understandable as long as the words were easy to understand.

The results of the readability test were totaled and recapitulated for calculation and conclusion, and the results are presented in the following Table 4:

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No.	Subject	Score				Total	Mean
		1	2	3	4		
1.	Subject 1	-	-	4	32	4×3+32×4=12+128 = 140	140/36 = 3,89
2.	Subject 2	-	2	6	28	2×2+6×3+28×4 = 4+18+112 = 134	134/36 = 3,72
3.	Subject 3	-	12	13	11	12×2+13×3+11×4 = 24+39+44= 107	107/36 = 2,97
4.	Subject 4	-	4	9	23	4×2+9×3+23×4 = 8+27+92= 127	127/36 = 3,53
	Mean					504/4 = 127	14,11/4 = 3,53

Table 4. Recapitulation of readability test results

The recapitulation results from the readability test conducted on four students yielded an average score of 3.53. This score indicates that the questionnaire tested on these four students falls into the category of being very practical.

Furthermore, from the results of this readability test, the evaluators' assessment of the students' responses to the created self-efficacy questionnaire is as follows:

No.	Evaluators' assessment from the readability test results
1.	All students understood the meaning of the content in 18 statements.
2.	The phrase 'achieving success' was somewhat confusing for the students.
3.	Two students were quite confused by the words 'build and train.'
4.	The word 'challenged' was confusing for the students.
5.	The sentence 'When there's a math problem, I just work on the crux of the issue without first stating the introduction' was confusing for the students.
6.	The phrase 'in any situation' was confusing for the students.
7.	The sentence 'Every effort I make in solving math problems always ends up being unsatisfactory' was not effective.
8.	The phrase 'withdraw' was confusing for the students.
9.	The sentence 'Studying mathematics is less beneficial for my life' was confusing for the students.
10.	There were several other words that confused the students, so their wording was simplified

Table 5. Evaluators' assessment from the readability test results

From the results of the readability test, it was found that certain statement sentences needed to be revised. After making these revisions, the final version of the questionnaire was established, which was a result of revising the questionnaire based on the readability test outcomes.

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4) *Implementation*

At this stage, the questionnaire was distributed online in a Google Form format. The Google Form included the connecting teacher's name, the student's school name and address, the student's name and grade, the date the questionnaire was filled out, and the questionnaire statements.

For the distribution of the questionnaire, assistance was requested from teachers spread across several provinces in Indonesia. These teachers had participated in the Teacher Professional Education (PPG) Program for Mathematics Education at Universitas PGRI Palembang, including the cohorts of 2018 (in-person), 2019 (in-person), 2020 (online), and 2021 (online). Assistance was also provided by teachers who are alumni of the Mathematics Education Study Program at Universitas PGRI Palembang. Specifically, for teachers outside the Southern Sumatra region, they had participated in the PPG program online, so there were teachers from areas such as Toraja and Bulukumba (South Sulawesi), East Java, Bali, East Nusa Tenggara, and West Papua.

5) *Evaluation*

The questionnaire was distributed in a partisan manner by asking teachers voluntarily to disseminate it to their students for empirical testing in a quantitative manner (validity and reliability testing). A total of 113 teachers from various areas across 17 provinces agreed to help, including 16 from Riau, 2 from the Riau Islands, 5 from West Sumatra, 7 from Jambi, 18 from South Sumatra, 6 from Bangka Belitung, 4 from Bengkulu, 8 from Lampung, 20 from West Java, 3 from Central Java, 1 from East Java, 1 from Bali, 5 from West Kalimantan, 3 from East Kalimantan, 11 from South Sulawesi, 1 from East Nusa Tenggara, and 2 from West Papua.

Students were asked by their teachers to fill out the questionnaire online. The selection of students as samples was left to the teachers distributing the questionnaire. The only requirement was to ask for their willingness to fill out the questionnaire, without coercion. The overall timeframe for completing the questionnaire ranged from January 19, 2022, to March 16, 2022. The schools whose students completed the questionnaire included 29 junior high schools, 1 Islamic junior high school, 31 senior high schools, and 7 vocational high schools from 17 provinces.

No.	SMP/MTs	School accreditation	Grade			Number of students
			VII	VIII	IX	
1	SMPN 30 Batam City of Riau Islands	A	2	74	0	76
2	SMPN 2 Bukit Batu Bengkalis Riau	A	13	13	30	56
3	SMPN 7 Muaro Jambi	A	40	17	48	105
4	SMPN 12 Muaro Jambi	A	46	0	1	47
5	SMPN 6 Mesuji OKI South Sumatera	B	6	2	38	46
6	SMPN 59 Palembang	C	22	17	15	54
7	SMPN 39 Palembang	A	64	50	3	117

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8	SMP Islam Al Azhar Sriwijaya Palembang	B	18	15	7	40
9	SMPN 31 Palembang	A	0	14	1	15
10	SMPN 7 Palembang	A	0	22	21	43
11	SMPN 5 Keluang Musi Banyuasin South Sumatera	C	0	7	26	33
12	SMPN 7 Satu Atap Sungai Selan Bangka	B	34	21	35	90
13	SMPN 3 Bakam Bangka Belitung	B	0	20	20	40
14	SMPN 4 Kaur Bengkulu	B	25	0	18	43
15	SMPN 22 Kota Bengkulu	A	15	13	21	49
16	MTs Qaryatul Jihad Center Bengkulu, Bengkulu	B	8	3	14	25
17	SMPN 3 Bandar Lampung	A	8	18	21	47
18	SMP Datarajan Tanggamus Lampung	B	4	7	6	17
19	SMPN 2 Kalianda Lampung	B	43	0	0	43
20	SMPIT Al-Ukhuwah Subang West Java	A	13	16	15	44
21	SMP Pesantren Ciwaringin Cirebon West Java	A	14	0	2	16
22	SMP Muhammadiyah Cilongok Banyumas Center Java	A	9	23	21	53
23	SMPIT Insan Cendekia Banyuwangi East Java	C	8	10	1	19
24	SMPN 4 Matan Hilir Selatan Ketapang West Kalimantan	A	11	7	8	26
25	SMP Muhammadiyah 2 Samarinda East Kalimantan	B	0	26	32	58
26	SMP Kristen Gandangbatu Tana Toraja South Sulawesi	B	0	10	24	34
27	SMPN 47 Bulukumba South Sulawesi	C	0	8	5	13
28	SMP Jembatan Budaya Badung Bali	A	48	0	0	48
29	SMPN 1 Poco Ranaka Manggarai Timur NTT	C	7	4	19	30
30	SMPN 5 Kota Sorong West Papua	B	0	0	23	23
	Total		458	417	475	1.350

Table 6. Some junior high schools/islamic junior high schools (SMP/MTs) where students filled out the questionnaire

No.	SMA/SMK	School accreditation	Grade			Number of students
			X	XI	XII	
1	SMAN 1 Bunguran Timur Natuna of Riau Islands	A	14	17	3	34
2	SMKN 1 Tapung Kampar Riau	A	18	36	15	69
3	SMAN 4 Bangko Pusako Rokan Hilir Riau	A	21	16	2	39
4	SMAN 1 Rengat Indragiri Hulu Riau	A	36	29	31	96
5	SMAN 10 Pekanbaru Riau	A	29	12	7	48
6	SMAN 1 Pangkalan Kuras Pelalawan Riau	A	2	8	0	10
7	SMAN 1 Ranah Pesisir West Sumatera	A	60	25	0	85
8	SMAN 4 Solok Selatan West Sumatera	A	0	15	2	17
9	SMAN 11 Padang West Sumatera	A	0	0	27	27
10	SMAN 2 Jambi	A	31	35	0	66
11	SMA Xaverius 1 Jambi	A	0	33	23	56
12	SMK PP Negeri, Batanghari Jambi	A	21	0	10	31

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13	SMAN 3 Bungo, Jambi	A	0	0	50	50
14	SMAN 1 Tiga Dihaji OKU South Sumatera	C	26	27	24	77
15	SMAN 8 Palembang	A	20	0	0	20
16	SMAN South Sumatera	A	0	0	31	31
17	SMAN 3 Banyuasin III South Sumatera	B	0	0	5	5
18	SMAN 1 Sanga Desa Musi Banyuasin South Sumatera	A	19	26	1	46
19	SMAN 1 Namang Bangka Tengah	A	34	18	25	77
20	SMAN 1 Pangkalan Baru Bangka Tengah	A	23	9	0	32
21	SMKN 1 Sragi Lampung	A	25	2	0	27
22	SMAN 1 Gedong Tataan Pesawaran Lampung	A	16	35	11	62
23	SMAN 1 Gunung Pelindung East Lampung	B	0	0	8	8
24	SMKN 2 Lebong Bengkulu	B	6	0	3	9
25	SMAN 3 Lebong Bengkulu	A	0	10	0	10
26	SMA Swasta Pasundan 1 Bandung West Java	A	8	7	7	22
27	SMAN 1 Palimanan Cirebon East Java	A	36	12	8	56
28	SMAN 1 Ciwaru Kuningan East Java	A	22	41	8	71
29	SMK Muhammadiyah 1 Ajibarang, Banyumas Center Java	A	0	22	0	22
30	SMA Muhammadiyah 2 Samarinda East Kalimantan	B	13	10	8	31
31	SMAN 1 Suhaid Kapuas Hulu West Kalimantan	C	23	18	20	61
32	SMA Swasta Advent Singkawang West Kalimantan	C	6	2	7	15
33	SMAN 1 Belitang Hulu Kabupaten Sekadau West Kalimantan	B	24	25	25	74
34	SMAN 13 Makassar South Sulawesi	A	35	51	24	110
35	SMK Muhammadiyah Bungoro District Pangkajene and Kepulauan South Sulawesi	B	10	0	0	10
36	SMAN 5 Kabupaten Enrekang South Sulawesi	A	0	11	14	25
37	SMAN 5 Barru Kabupaten Barru South Sulawesi	A	0	97	2	99
38	SMKN 1 Kota Sorong West Papua	A	0	30	0	30
	Total		578	679	401	1.658

Table 7. Some senior high schools/vocational high schools (SMA/SMK) where students filled out the questionnaire.

After the questionnaire was distributed and filled out by students online, the results were obtained in an Excel format. A total of 3,020 students filled out the questionnaire voluntarily, but only 3,008 were selected, comprising 1,350 junior high school students and 1,658 senior high school students. The data of 12 students were not included due to unclear responses. After the students completed the questionnaire, the results in the Excel format were sorted into six groups based on grade criteria, namely Grade VII, VIII, and IX for junior high school, and Grade X, XI, and XII for senior high school.

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No.	Item	Field test result											
		Junior high school						Senior high school					
		Grade VII		Grade VIII		Grade IX		Grade X		Grade XI		Grade XII	
		rcal	CA	rcal	CA	rcal	CA	rcal	CA	rcal	CA	rcal	CA
1.	Item 1	0,575	0,915	0,510	0,914	0,520	0,905	0,582	0,920	0,576	0,908	0,593	0,925
2.	Item 2	0,367		0,379		0,333		0,356		0,413		0,415	
3.	Item 3	0,598		0,562		0,590		0,645		0,563		0,611	
4.	Item 4	0,547		0,498		0,555		0,583		0,550		0,520	
5.	Item 5	0,468		0,425		0,511		0,492		0,488		0,468	
6.	Item 6	0,515		0,448		0,431		0,455		0,430		0,463	
7.	Item 7	0,359		0,392		0,374		0,406		0,386		0,378	
8.	Item 8	0,383		0,392		0,377		0,380		0,302		0,392	
9.	Item 9	0,506		0,493		0,528		0,584		0,499		0,596	
10.	Item 10	0,550		0,585		0,501		0,616		0,552		0,609	
11.	Item 11	0,386		0,465		0,464		0,502		0,475		0,514	
12.	Item 12	0,437		0,461		0,348		0,378		0,395		0,448	
13.	Item 13	0,410		0,372		0,392		0,399		0,451		0,472	
14.	Item 14	0,617		0,647		0,541		0,645		0,563		0,642	
15.	Item 15	0,515		0,490		0,530		0,557		0,471		0,465	
16.	Item 16	0,521		0,562		0,555		0,552		0,550		0,594	
17.	Item 17	0,532		0,560		0,601		0,590		0,556		0,573	
18.	Item 18	0,524		0,558		0,451		0,525		0,486		0,492	
19.	Item 19	0,574		0,607		0,594		0,627		0,583		0,583	
20.	Item 20	0,458		0,523		0,397		0,432		0,458		0,556	
21.	Item 21	0,511		0,544		0,525		0,539		0,503		0,529	
22.	Item 22	0,604		0,568		0,526		0,604		0,545		0,594	
23.	Item 23	0,500		0,522		0,475		0,522		0,459		0,478	
24.	Item 24	0,524		0,513		0,449		0,444		0,473		0,416	
25.	Item 25	0,583		0,529		0,530		0,594		0,575		0,573	
26.	Item 26	0,522		0,521		0,458		0,418		0,439		0,406	
27.	Item 27	0,570		0,628		0,567		0,590		0,580		0,620	

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28.	Item 28	0,549		0,609		0,530		0,505		0,520		0,576	
29.	Item 29	0,506		0,514		0,457		0,510		0,476		0,543	
30.	Item 30	0,624		0,570		0,567		0,614		0,584		0,609	
31.	Item 31	0,563		0,505		0,567		0,550		0,487		0,546	
32.	Item 32	0,570		0,600		0,591		0,616		0,628		0,628	
33.	Item 33	0,065		0,017		0,069		0,049		0,001		0,194	
34.	Item 34	0,606		0,604		0,513		0,589		0,588		0,660	
35.	Item 35	0,534		0,521		0,571		0,632		0,558		0,617	
36.	Item 36	0,588		0,529		0,524		0,521		0,541		0,617	
		r table = 0,093	0,85	r table = 0,098	0,85	r table = 0,088	0,85	r table = 0,081	0,85	r table = 0,074	0,85	r table = 0,098	0,85

Table 8. Validity and reliability test results for junior high school and senior high school students

Notes:
rcal: calculated r
CA: Cronbach's Alpha value

From the data in Table 8, it is concluded that:

(1) For Grades VII, VIII, IX, X, and XI, there are 35 statements with a calculated r (rhit) greater than the table r (r tabel), making these 35 statements valid. Additionally, for Grades VII, VIII, IX, X, and XI, there is 1 statement with a calculated r (rhit) less than the table r (r tabel), making this statement invalid. This invalid statement is item 33.

(2) For Grade XII, there are 36 statements with a calculated r (rhit) greater than the table r (r tabel), so all statements are declared valid

(3) Meanwhile, the Cronbach's Alpha value for all statements is greater than 0.85, making all statements reliable.

Statement item 33, declared invalid, reads: 'I prefer to solve mathematical problems in a simple way without using formulas'

DISCUSSION

For a broader empirical test, namely a field test, the questionnaire was distributed to junior high school (SMP sederajat) and senior high school (SMA sederajat) students. The selection of students to fill out the questionnaire was not based on their ability level; the main criterion was their

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willingness to participate. By having a large number of students participate, all ability levels were naturally included. The schools whose students filled out the questionnaire had accreditation levels of A, B, and C. These schools were located in both large cities and districts, as well as in rural areas.

By examining the data from the schools where students who filled out the questionnaire were enrolled, it was evident that the questionnaire was completed by students from various ethnic groups, reflecting the diversity of Indonesia. These included the Malay, Batak, Minang, Rejang, Komering, Lampung, Sundanese, Javanese, Bugis, Duri, Enrekang, Maiwa, To Balo, Toraja, Dayak, Balinese, Manggarai, and Papuan ethnic groups.

The questionnaire designed to assess self-efficacy, prepared for deployment in field testing, consists of 36 statements. After distributing the questionnaire to students in various regions of Indonesia, it was concluded that for students in Grades VII, VIII, IX, X, and XI, 35 statements were deemed valid and 1 statement was invalid, which was item 33, stating, 'I prefer to solve mathematical problems in a simple way without using formulas'. All statements were found to be reliable, with a reliability coefficient greater than 0.85. However, for Grade XII, all 36 statements were valid, and no statements were found to be invalid. All statements were reliable, with a reliability coefficient greater than 0.85.

These results indicate that statement item 33 was disliked by most respondents. The wording of the statement implies that 'the respondent prefers to solve mathematical problems in a simple way without using formulas'. This can be interpreted in two ways: (1) students prefer solving math problems in a simple way, and (2) students prefer solving math problems without using formulas. In actual classroom learning, students indeed prefer simpler methods if there are easier alternatives available. However, students may face difficulties in solving mathematical problems without using formulas, as they may not know the direction to take for solving the problem without formulas.

Therefore, statement item 33 should be split into two separate statements, as its content indeed represents two different conditions as mentioned in the previous paragraph. The revised wording for statement item 33 should be 'I prefer to solve mathematical problems in a simple way' and 'I prefer to solve mathematical problems using formulas'.

Although for Grade XII senior high school students, statement item 33 can still be used to assess self-efficacy, as it was also found valid when tested on these students. However, for consistency, for Grade XII as well, statement item 33 should be split into two statements as mentioned above.

Finally, the self-efficacy questionnaire produced herein completed a comprehensive development process using the ADDIE model, going systematically through each phase of the ADDIE framework, and its validity and reliability were rigorously validated. The questionnaire was originally comprised of 36 items, but after intensive field testing and content analysis, the item count was refined and expanded to 37. As a result, the findings confirm that the self-efficacy

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questionnaire is valid, practical, and reliabel, culminating in a finalized instrument of 37 items, as shown below:

No.	Statement
1.	I can solve mathematical problems or assignments
2.	I find it difficult to succeed in learning mathematics without someone else's help
3.	Learning mathematics is enjoyable
4.	I am not at all interested in learning mathematics
5.	Learning mathematics is important for training the mind
6.	I have not yet found the benefit of learning mathematics
7.	Correct steps are needed to solve mathematical problems or tasks
8.	If there's a math problem, I just write the answer without stating 'given' and 'asked'
9.	I can solve mathematical problems accurately
10.	I always face difficulties in solving mathematical problems
11.	I want to finish quickly when there is a more difficult math problem
12.	If the math problems become harder, I start to feel overwhelmed
13.	I can study mathematics on my own when it's quiet, like at night
14.	I always find it hard to learn and understand mathematics
15.	If I work hard, I can complete even the difficult math tasks
16.	Every time I try to solve a math problem, the result is always unsatisfying
17.	I will try to complete every math task or problem given
18.	I am not willing to work on any math tasks or problems
19.	I realize that I am capable of learning mathematics
20.	I am aware that I have many weaknesses in learning mathematics
21.	I keep trying to complete the math tasks given by the teacher as best as I can
22.	If the math task given by the teacher turns out to be difficult, I start to avoid it
23.	I want to be smart by learning mathematics
24.	Learning mathematics is not very beneficial
25.	I always try to follow the math lessons because they can train my abilities
26.	I don't like learning mathematics because it's not important
27.	Even if I learn different math materials than before, I am still happy, as it enhances my thinking ability
28.	The more varied the math materials I study, the more confused I become
29.	I try to correct my previous mistakes in learning mathematics
30.	I have never been able to learn mathematics
31.	If I finish studying one math topic, I will study another
32.	I always find it difficult to learn every math topic
33.	I prefer to solve math problems in a simple way
34.	I prefer to solve math problems by using formulas
35.	I always struggle when solving math problems, sometimes even unable to finish them
36.	I am happy when there are new, more challenging materials
37.	Even learning easy math topics feels difficult, let alone the hard ones

Table 9. Self-Efficacy questionnaire valid, practical, and reliable

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During this research, several challenges were encountered that may have affected the validity of the study, as follows:

1. Creating questionnaire statements that truly reflect self-efficacy. In this process, the researcher spent a considerable time designing the questionnaire, frequently consulting with experienced colleagues about self-efficacy, and also sought validators who were highly competent in this area.
2. Testing readability for junior high school students, as they sometimes did not understand the meaning of the sentences they read.
3. When administering the questionnaire to students, especially junior high school students, it was estimated that some did not fully understand its purpose, particularly those with lower IQs.
4. The self-efficacy questionnaire was created and distributed using Google Forms, and for the Likert scale, only the far left and far right statement options were written, potentially confusing students about the middle options. Therefore, the researcher asked teachers distributing the questionnaire to explain this.
5. Many teachers helping to distribute the questionnaire faced signal issues, especially those in remote areas like Bulukumba and Tanah Toraja.
6. Many students were not allowed to bring mobile phones to school, forcing them to fill out the questionnaire at home. If completed at school, teachers could provide explanations, but at home, if students were confused, they might just click options randomly without further thought.
7. Some students in urban areas, and especially in district and rural areas, did not have mobile phones and thus could not fill out the questionnaire, resulting in fewer data from those regions.
8. Some teachers asked their students to fill out the questionnaire on Google Forms, but only a few responded, with some classes having only one student participating.

Despite these challenges, considering that 3,008 students filled out the questionnaire, with each grade level having a minimum of 400 respondents, this meets the recommendations of Crocker and Algina (Alwi, 2012), who stated that a minimum of 200 respondents is needed for stability. It also aligns with Nunnaly's (Alwi, 2012) suggestion that the sample size in a trial should be ten times the number of items in the measuring instrument. In this study, with 36 questionnaire items, $10 \times 36 = 360$ respondents were needed, while the actual number of respondents was at least 400. Thus, the challenges mentioned above were overcome with the number of respondents meeting these criteria.

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CONCLUSIONS

This development research has produced a valid, practical, and reliable self-efficacy questionnaire for students in mathematics learning. This questionnaire has undergone a development process using the ADDIE model. In this development process, the questionnaire was subjected to both theoretical and empirical testing. The questionnaire statements were reviewed and commented on by 4 expert validators, tested for readability on 4 students (1 elementary and 3 junior high school students), and quantitatively tested on 1,350 junior high school students and 1,658 senior high school students across Indonesia.

Initially, there were 36 statements. Of these, 35 statements were declared valid after empirical validity testing, and 1 statement was declared invalid (item 33), leading to the modification of this statement into 2 separate statements (items 33 and 34). All statements were declared reliable based on field test results. Ultimately, the self-efficacy questionnaire produced consists of 37 statements.

The self-efficacy questionnaire developed through this process can be used to assess students' self-efficacy in mathematics learning in Indonesia. According to the research subjects, the questionnaire is suitable for junior high school students and senior high school students. However, it can potentially also be used by university students.

This developed questionnaire can be further researched to make it more perfect, and it can also be retested on students outside Indonesia to broaden its applicability. Of course, this would involve adapting the developed self-efficacy questionnaire to suit the conditions of other countries

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