



## The instruments for measuring students' self-efficacy in biology learning: Validity and reliability

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Article Information	ABSTRACT
Submitted: 2021-08-05 Accepted: 2021-12-17 Published: 2022-02-01	<p>Creating a valid and reliable instrument is very necessary to produce a quality and accountable research. A research instrument must also be able to meet the requirements so that what you want to measure can produce accurate data. This study aims to develop a standard and quality instrument for measuring students' self-efficacy in Biology learning. The method used in this research is descriptive quantitative with the aim of knowing the quality of the items on the three dimensions of self-efficacy, namely the dimensions of level, strength, and generality, that it can be used to measure the self-efficacy of students in learning biology. The instrument used is a self-efficacy questionnaire consisting of 40 statements. Sample in this research is 20 students in grade XI MIPA SMAN 2 Hiliran Gumanti. The items in instrument analysis test, was conducted by a validator, namely through professional judgment or expert review. The data analysis technique used is the validity test using Pearson's Product Moment analysis and the reliability test using the Chronbach Alpha technique. The results of the study and data analysis showed that the instrument for measuring students' self-efficacy was valid and reliable. So, it can be concluded that the research instrument meets the criteria for use in the next analysis, because it can measure students' self-efficacy even though there are several items that must be revised first.</p> <p><b>Keywords:</b> Reliability; self-efficacy; validity</p>
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### INTRODUCTION

Self-efficacy was introduced by Albert Bandura in the view of social cognitive theory. According to Hayati et al. (2021) and Sari et al. (2021) self-efficacy is the belief of each individual in his potential, including the ability to complete various jobs, as well as oneself in dealing with various obstacles encountered during the process to achieve the desired goals. According to Rahman (2013) self-efficacy is believed to be the key to successful work, and self-efficacy can also influence thinking patterns and

behavior in making decisions. Self-efficacy based on idea of [Adicondro & Purnamasari \(2011\)](#) can be obtained, changed, increased or decreased, through one or a combination of four sources, namely achievements that have been obtained, experiences from others, confidence in providing change, and emotional control. Self-efficacy is needed in various aspects, including education. Self-efficacy of students in undergoing the educational process can have an influence on learning motivation, learning achievement, confidence in completing tasks, and learning outcomes obtained. Based on the research, it was found that self-efficacy had a contribution of 272.54% in influencing the learning competence of students ([Suwardi, 2012](#)).

Many researchers have concluded that self-efficacy greatly affects the process and student learning outcomes. The meaningful of self-efficacy is to improve learning competence is evidenced by research conducted by [Hardianto et al. \(2016\)](#) which concluded that students with high self-efficacy will get good learning competencies, and vice versa. In the other research [Farah et al. \(2018\)](#) said that self-efficacy can affect students' learning competencies, where students with high scores have high self-efficacy in general. Students with high self-efficacy will believe that the task is a challenge not a threat, so they will minimize distractions, apply effective strategies, find learning partners, not easily give up and even overcome the failures they face [Rosyida et al. \(2016\)](#). In contrast to students with low self-efficacy, they believe that they will not be able to carry out the task even before the task is given so that it will affect the learning competencies they get ([Novena & Kriswandani, 2018](#)).

The results of the research above indicate that self-efficacy is needed in the learning process, including learning Biology. As a state by [Taufik \(2019\)](#) that in Biology learning emphasizes more on providing direct experience and seeks to be able to equip students with various abilities that provide a direct role in developing the ability to behave and think scientifically. Self-efficacy has differentiation and variations in each people. This is can be influenced by various factors such as gender, education level, parental encouragement and living environment ([Beghetto & Karwowski, 2017](#)). This difference in self-efficacy can also be found in students, thus it is necessary to have a measurement of the level of self-efficacy of students to be able get maximize the achievement of learning objectives. One of the measuring tools that can be used to determine the level of self-efficacy of students is a self-efficacy questionnaire.

The instrument used in measuring the level of self-efficacy must include 3 dimensions, namely the dimensions of level, dimension of strength, and dimension of generality. The level dimension contains a discussion that refers to the level of difficulty that the individual believes to be able for overcome. Individuals who have high self-efficacy will have high confidence in their ability to perform a task, namely the effort they will do will be successful. On the other hand, individuals who have low self-efficacy will have low beliefs about every effort that they have made. The strength dimension contains of studies that related to the strength of a person's self-efficacy when facing a challenge or a problem. Individuals have a strong belief and persistence in the effort to be achieved despite many obstacles. The stronger the self-efficacy and the greater the persistence, the higher the probability of activities which will be selected and worked on. The generality dimension includes a discussion of variety situations in which individuals feel confident about their abilities. A person can judge himself to have high self-efficacy in many activities or only in certain activities. The more self-efficacy applied to various conditions, the higher one's self-efficacy.

As far as literacy studies have been carried out, the authors have not found a self-efficacy instrument that discusses students' self-efficacy in learning biology for high school. The authors found that there is a self-efficacy instrument in writing skills by ([Schmidt, 2012](#)), a self-efficacy instrument in managing oneself in the face of fatigue and the instrument of the effect of self-efficacy on the ability to manage the class. For this reason, the author is interested in writing an instrument for student self-efficacy

in learning biology which will be different from other subjects. This instrument will also be very useful because at the research site there is no instrument to determine the self-efficacy of students. This instrument will also increase self-efficacy instruments in the world of education.

Because of there has never been a self-efficacy measurement at SMAN 1 Hiliran Gumanti, many students have low self-confidence in their own abilities. Many students rely on the abilities of others in doing school assignments. Teachers also find it difficult to deal with students because they do not know the self-efficacy of various students in the classroom. So that many students do not get the desired learning outcomes. It will be necessary to measure the self-efficacy of students so that teachers can easily understand the emotions of each student. And for that we need a self-efficacy instrument that can measure the self-efficacy of students at SMAN 1 Hiliran Gumanti.

The research questionnaire instrument before being used should be tested first to find out how valid the instrument is, because the truth of the data obtained in a study is influenced by the quality of the instrument (Arifin, 2017). It is supported by the opinion Suharsono & Istiqomah (2014) which state that it is not enough to test a research instrument once for the realization of a standard and quality instrument in a research. The analysis that can be used in determining the extent to which the instrument can be used in research are the validity test and the reliability test of instrument. The higher the value of the validity and reliability test of the instrument, the higher the accuracy of the data that will be obtained in the study (Yusup, 2018). Based on the study literature, problem of students and teacher for interview and observation, this study aims to prepare a standard and quality instrument so that it is suitable for use in measuring the students's self-efficiency in learning Biology. With the existence of valid and reliable self-efficacy instruments, it is hoped that teachers can use them in an effort to determine the self-efficacy of their students, so that they can assist teachers in maximizing learning to improve satisfying learning competencies.

## RESEARCH METHODS

This research questionnaire trial using quantitative descriptive method. This analysis aims to determine the quality of the items in the three dimensions of self-efficacy, namely the dimensions of level, dimension of strength, and dimension of generality in Biology learning. The stages specified in this study were conducting a literacy study, making a grid of self-efficacy instruments, validating self-efficacy instruments, experimenting with self-efficacy instruments. In the literacy study stage, various processes of reading and understanding source books are carried out to create a self-efficacy instrument. In the stage of making a statement grid, it is done by making a concept from the results of the literacy study. In instrument validation, there are 2 ways of logistical validation and validation per item, logistical validation is carried out by 2 biology lecturers who discuss the contents and constructs of the instrument in measuring students' self-efficacy and item validation used technique validation and reliable instrument from SPSS version 16. In the trial phase, it was carried out on Class XI students of SMAN 2 Hiliran Gumanti on May 26, 2021 with a total of 20 students who were determined based on the sampling technique (purposive sample).

There are 3 indicators used in this self-efficacy instrument, namely, the level dimension, the strength dimension, and the generality dimension. The instrument used is a self-efficacy questionnaire consisting of 40 statements that include the three dimensions of self-efficacy. Each of these dimensions is then broken down into several sub-indicators which can be seen in Table 1.

**Table 1. Indicators of Self-Efficacy Instrument**

Variable	Sub-Variable	Indicators
Self-Efficacy	Magnitude /Level	Confidence in the ability to overcome the difficulties of the subject matter
		Confidence in the ability to complete school assignments
	Strength	Confidence in self-ability in learning
		Confidence in self-restraint in learning
	Generality	Strength in solving learning problems
		confidence in obtaining good learning outcomes
	Managing learning conditions	
	Strategies to master the subject matter	
		Manage study time

Guidelines for filling out the questionnaire are stated on a Likert scale. Each question has four alternative answers, namely Always, Often, Sometimes, and Never. The researcher used a score for each question item which consisted of two kinds, namely positive and negative questions. Positive question scores start from 4, 3, 2, 1 and negative questions start from 1, 2, 3, 4, as in [Table 2](#).

**Table 2. Score Alternative Answer**

Alternative Answer	Description	
	Positive	Negative
Strongly agree (SS)	4	1
Agree (S)	3	2
Do not agree (TS)	2	3
Strongly Disagree (STS)	1	4

[Sugiyono \(2013\)](#)

The data analysis technique used is validity test and reliability test. The instrument validity test was conducted to determine whether each statement in the questionnaire had a valid value or not. The research instrument can be valid if the value of  $r\text{-count} > r\text{-table}$ . Test the validity of the instrument in this study using Pearson's Product Moment analysis. According to [Sugiyono \(2013\)](#) If the validity value of each statement item is stated to be greater than 0.30, then the statement item is valid.

The reliability test on the self-efficacy questionnaire instrument was used to determine whether the instrument to be used in collecting research data was said to be reliable or not. The reliable test in this study used Cronbach's Alpha analysis. [Sugiyono \(2013\)](#) said that an instrument is state to be reliable if it has a value of  $r > 0.60$ . If a research instrument meets the requirements, it can be state that the instrument is reliable and consistent to be used as a measuring tool, and if it does not meet the requirements, it is better to revise each item in order to get quality research results.

## FINDING AND DISCUSSION

This research was conducted by preparing a self-efficacy questionnaire by compiling a list of statements according to the questionnaire grid to be used. The self-efficacy questionnaire used in the study consisted of 40 statements that included 12 statements about the level dimension, 14 statements about the strength dimension, and 14 statements about the generality dimension. First, the validity test.. Validity test is a test carried out with the aim of testing the accuracy of a measuring instrument that will be used in measuring something that should be measured ([Sugiyono, 2013](#)). Firsth validity was conducted by 2 od biology's lecturer for content validity,and to be measured the validity test per item which is carried out quantitatively. The validity test on each statement item is carried out with the help of the SPSS program, namely by using the Product Moment correlation technique. [Gunawan et al. \(2019\)](#)

said that in correlation testing, which was carried out by correlating the score of each statement item with the total score obtained.

Based on the results of validation with biology lecturers, it was concluded that the questionnaire had met the requirements to be tested, in language the self-efficacy instrument was easily understood by students using communicative language, in terms of instrument content it had fulfilled all the indicators in the research instrument grid. want to do. After that testing the validity using SPSS 16, it can be seen that the statements that are said to be valid in the level dimensions of self-efficacy can be seen in [Table 3](#).

**Table 3. Validity Test in Dimension of Level**

Dimension of Self-Efficacy	No	r-count	r-table	Singnification
Level	1.	0.550	0.30	0.012
	2.	0.354	0.30	0.126
	3.	0.391	0.30	0.088
	4.	0.666	0.30	0.001
	5.	0.366	0.30	0.012
	6.	0.424	0.30	0.063
	7.	0.440	0.30	0.052
	8.	0.182	0.30	0.442
	9.	0.821	0.30	0.000
	10.	0.160	0.30	0.501
	11.	0.546	0.30	0.013
	12.	0.559	0.30	0.010

Based on the results of the validity test on the dimensions of the self-efficacy questionnaire level in [Table 1](#) above, it shows that there are 2 statements that do not meet the criteria and are declared invalid because the correlation value is below 0.30. The statement is on items numbered 8 and 10. The statement with item number 8 has an r value of 0.182 and item number 10 has an r value of 0.160, so the r value is smaller than 0.30. So that there are only 10 statements out of 12 statements on the level dimension that are declared valid and can be used in the next analytical test. Statements in number 8 and number 10 can be used in research if revisions and improvements are made first.

Revision in preparing a research instrument is needed. Because with the revisions made by researchers, they know more about the quality of their research instruments. With several revisions will make an instrument better. As stated by [Suharsono & Istiqomah \(2014\)](#) that the revision in making research instruments cannot be done just once, it takes several revisions to get a research instrument with good quality and valid, so that it can measure what you want to know when conducting research, for this reason, it is necessary to experiment with the instrument first before the instrument is used in research.

In the level dimension there are indicators regarding students' beliefs in facing difficulties in doing assignments, self-efficacy in dealing with learning difficulties, and self-confidence in their own abilities in learning. This indicator will measure students' self-efficacy on how capable they are in learning, points are needed by a student, because with the belief in themselves it will make them more enthusiastic in learning regardless of the abilities of others. In line with the opinion of [Widyaninggar \(2015\)](#) which states that students with high self-efficacy will have great confidence in their abilities, this belief can be seen from the activeness of students in learning and is not easily influenced by the abilities of others. The second dimension in instrument self-efficacy is strength dimension, that conducted from 14 item. The validity for each item shown in [Table 4](#).

**Table 4. Validity Test In Dimension of Strength**

Dimension of Self-Efficacy	No	r-count	r-table	Singnification
<i>Strength</i>	1.	0.406	0.30	0.076
	2.	0.499	0.30	0.025
	3.	0.423	0.30	0.063
	4.	0.395	0.30	0.085
	5.	0.458	0.30	0.042
	6.	0.309	0.30	0.185
	7.	0.191	0.30	0.420
	8.	-0.010	0.30	0.966
	9.	0.427	0.30	0.061
	10.	0.544	0.30	0.011
	11.	-0.022	0.30	0.927
	12.	0.487	0.30	0.029
	13.	0.544	0.30	0.011
	14.	0.638	0.30	0.002

Based on the results of the validity test on the strength dimension of the self-efficacy questionnaire in table 2 above, it shows that there are 3 statements that do not meet the requirements for the correlation value below 0.30, namely the statements contained in items 7, 8, and 11. While the other 11 statements meet the requirements. and declared valid. Testing the validity of the self-efficacy questionnaire on the strength dimension, it was found that statement number 7 has an r value of 0.191, statement number 8 has an r value of -0.010, and statement number 11 has an r value of -0.022. The test results state that the three statements above are considered invalid because they do not meet the requirements for an r value greater than 0.30. Statements numbered 8 and 11 have negative values, so these statements should be replaced and tested before being used for further measurements. In the strength dimension there are 11 valid statements and can be directly used for further analysis.

The strength dimension has three indicators. The first indicator is the belief in self-restraint in learning, the second indicator on the strength dimension is the strength in solving learning problems, the third indicator is the belief in obtaining good learning outcomes. In this dimension, it is expected to be able to measure students' beliefs about their abilities, to measure this belief, a more in-depth study is needed about each statement, because students' beliefs about their abilities can be influenced by internal factors and external factors. As Mahmudi (2014) argues that self-efficacy and parental support can help students increase their confidence in solving the learning problems they face.

In some questions that have negative values, it is necessary to review the statements used by considering the internal and external factors above. It is very necessary to re-excavate the contents of the statement and the grammar in the statement so that it is easily understood by students in filling out the instrument. The third dimesnion of self-efficacy is generality dimension, that result of validity tes or each of item can see in Table 5.

**Table 5. Validity test in dimension of Generality**

Dimensi Self-Efficacy	No	r-count	r-table	Singnification
<i>Strength</i>	1.	0.122	0.30	0.608
	2.	-0.086	0.30	0.720
	3.	0.194	0.30	0.413
	4.	0.340	0.30	0.887
	5.	0.370	0.30	0.108
	6.	0.197	0.30	0.405
	7.	0.412	0.30	0.071
	8.	0.420	0.30	0.065
	9.	0.373	0.30	0.105

Dimensi <i>Self-Efficacy</i>	No	r-count	r-table	Singnification
	10.	0.312	0.30	0.181
	11.	0.385	0.30	0.094
	12.	0.245	0.30	0.298
	13.	0.312	0.30	0.120
	14.	0.383	0.30	0.095

Based on the results of the validity test on the strength dimension of the self-efficacy questionnaire in Table 3 above, it shows that there are statements that do not meet the requirements for a correlation value below 0.30, these statements are items with no. 1,2,3,6, and 12. Other statements are declared valid. namely as many as 9 statement items. Testing the validity of the self-efficacy questionnaire on the generality dimension, it was found that there were statements that did not meet the requirements for the correlation value below 0.30. the statements are items with numbers 1,2,3,6, and 12. Statement number 1 has an r value of 0.122, statement number 2 has an r value of -0.086, statement number 3 has an r value of 0.194, statement number 6 has a value of r is 0.197, and statement number 12 has an r value of 0.245. The results of this test indicate that statements numbered 1,3,6, and 12 can be used by making revisions first, while statements with number 2 have negative values so they must be replaced and tested before use. The other 11 statements in the generality dimension can be directly used for further analytical tests without having to go through the revision stage.

In the generality dimension, there are many questions with invalid values, and most of the dimensions have invalid statements. This incident can arise because the generality dimension discusses topics in general and broad, such as the ability to manage the learning atmosphere, the ability to manage learning strategies, and the ability to manage study time. In this dimension, students have different ways so that the statements made are not too specific. For example, there are students who have the ability to be able to learn in any learning conditions, but there are also those who are only able to learn under certain conditions, as stated by Slameto (2013), namely that some students are able to learn well with a conducive classroom atmosphere so that they can improve and encourage students to better understand the subject matter provided. In this part really need a more studies and discussion with the expert and another lecturer for make the valid instrument in every item. The next test in this research is reliability test.

Reliability test is a test conducted to determine the extent to which a measuring instrument can be trusted in measuring something desired. In the reliability test carried out for the self-efficacy questionnaire, the Cronbach's Alpha value was 0.813, meaning that the reliability value of the questionnaire was greater than 0.60. This means that the self-efficacy questionnaire has met the test requirements and is declared reliable. According to Dewi & Sudaryanto (2020) said that if a measuring instrument has a Cronbach's Alpha value > 0.60 then the measuring instrument is declared constant and fixed so that the measuring instrument can be used in future research.

The reliability test was also carried out using SPSS 16. This reliability test was carried out in order to see whether the questionnaire used in the study was reliable or not. The results of the reliability test can be seen in Table 6.

**Table 6. Reliability test of Self-Efficacy's Instrument**

No	Variable	Cronbach's Alpha	N of item
1.	Self-Efficacy	0.813	40

The reliability test of the self-efficacy questionnaire resulted in the Cronbach's Alpha value of 0.813, meaning that the reliability value of the questionnaire was greater than 0.60. The results of this reliability

test indicate that the questionnaire is reliable or consistent. The reliability value of 0.813 indicates that the questionnaire can be used in further analysis. Reliability test is a test conducted to determine the extent to which a measuring instrument can be trusted in measuring something desired. In the reliability test carried out for the self-efficacy questionnaire, the Cronbach's Alpha value was 0.813, meaning that the reliability value of the questionnaire was greater than 0.60. This means that the self-efficacy questionnaire has met the test requirements and is declared reliable. Based on the test, it was found that the Cronbach's Alpha value  $> 0.60$  then the measuring instrument was declared constant and fixed so that the measuring instrument could be used in future research. The constant instrument meant this instrument can be used in various condition and various place and situation of students, but the value will show the same characteristics and can measuring that self-efficacy of students.

## CONCLUSION

Based on the finding and discussion the validity and reliability tests were carried out, it was found that 30 statements were declared valid without revision and the other 10 statements should be revised again because they did not meet the requirements to be declared valid. The statement is divided into 2 statements on the level dimension, 3 statements on the strength dimension, and 5 statements on the generality dimension. The results of the validity test show that there are 10 valid statements on the level dimension, 11 valid statements on the strength dimension, and 9 valid statements on the generality dimension. The test results of the validity and reliability of the instrument have proven that the self-efficacy in 3 dimension have validity and reliability values that meet the criteria for use in the next analytical test, although with several items that should be revised first.

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