Covid-19 literacy test: Developing of instruments and measuring for high school students

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A R T I C L E   I N F O

A B S T R A C T

COVID-19 literacy is very important in dealing with the current pandemic, especially for students who will or are carrying out offline learning. So, it is necessary to develop an instrument that can measure the literacy ability of COVID-19. This study aims to develop an instrument that can assess the COVID-19 literacy level of high school students. The research method used is research and development with Borg & Gall model, which consists of eight stages namely (1) research and initial information collection, (2) designing, (3) developing initial products, (4) expert validation, (5) initial product revision based on input from expert validators; (6) Field trials, (7) revision, (8) implementation and dissemination. The results of the development obtained 28 items consisting of eight questionnaires and 20 multiple choice questions. The questionnaire aims to obtain descriptive data about students' attitudes towards the COVID-19 pandemic, while multiple choice questions are used to measure students' knowledge. The expert test results obtained a score of 3.56 so that the COVID-19 literacy instrument developed was in the very feasible category. In the next stage, the validity of multiple-choice questions was tested and 15 questions were included in the valid category, then the 15 questions obtained were tested for reliability, based on the calculation of the calculated r value greater than r table so that the developed instrument was reliable and could be used in subsequent research.

INTRODUCTION

COVID-19 literacy is health literacy related to respiratory disorders and diseases caused by infection with the SARS-CoV-2 virus (Fauzi et al., 2020). Another understanding of COVID-19 literacy is knowledge of general terms, how to obtain information, understanding, and curiosity about COVID-19 (Hardika et al., 2020). COVID-19 literacy is the ability to respond proactively to the COVID-19 pandemic situation which will reduce the spread of infectious diseases, prevent overreaction, reduce carelessness, by adopting healthy lifestyle behaviors (Shaukat et al., 2021). COVID-19 literacy is the ability to access, understand, assess, and apply health information (Okan et al., 2020). COVID-19 literacy is a person's ability to receive, understand, conclude, and apply information to make health decisions, including healthy behavior and self-care activities, decision-making about health that is influenced by the ability to think critically and evaluate information about COVID-19 (Ifroh & Asrianti, 2020). Based on the explanation above, it can be concluded that COVID-19 literacy is health literacy that focuses on the spread, transmission, symptoms, treatment, and death rates from diseases caused by SARS-CoV-2.

Literacy is a basic ability that everyone needs to have to face the challenges of the world today and in the future (Hardianty, 2015; Permana & Suwono, 2016; Suwono & Furaidah, 2016). The ability to understand, evaluate, and act on information related to health is called health literacy (Kesumawati et al., 2019; Sørensen et al., 2020; Zarcadoolas et al., 2015). A person with qualified health literacy will have good health status, can understand medical conditions, be able to access information about medical services and preventive treatment of diseases, in addition to reducing the risk of hospitalization and expensive health care costs (Okan et al., 2018; Zarcadoolas et al., 2015). In pandemic conditions like now, health literacy related to COVID-19 is needed or can be called COVID-19 literacy (Fauzi et al., 2020). COVID-19 literacy provides students with knowledge of attitudes that will affect practical attitudes in dealing with pandemics, for example in terms of their willingness to apply health protocols or stop the spread of hoaxes (Alahdal et al., 2020; Yanti et al., 2020).

The low literacy rate of COVID-19 is one of the causes of the increasing spread and transmission of COVID-19 (Okan et al., 2020). This also causes the spread of fake news (hoax) thereby increasing panic in the community. At the beginning of its appearance, people bought masks and hand sanitizers in large quantities. As well as buying chloroquine and evigan as drugs to relieve symptoms of COVID-19, which are actually hard drugs and require a doctor's prescription (Anastasopoulou & Mouzaki, 2020; Susilo et al., 2020; Zheng, 2020). On the other hand, there are those who are indifferent and do not pay attention to the call for prevention of COVID-19 (Sari & 'Atiqoh, 2020). Student health cultures such as washing hands, cutting nails, consuming healthy food and drinks, not smoking, and exercising are also still relatively low (Permana & Suwono, 2016). In dealing with a pandemic, well-literate individual behavior becomes the main point, in addition to easily accessible medical care and government policies (Okan et al., 2018).

COVID-19 literacy is health literacy that focuses on the spread, transmission, symptoms, treatment, and death rates of COVID-19 (Fauzi et al., 2020). There are four aspects that a person must understand to have adequate COVID-19 literacy, namely an understanding of (a) the spread and transmission of COVID-19; (b) causes and symptoms of disease, (c) prevention of the spread and transmission of disease; and (d) treatment and mortality rates. An understanding of these four aspects will be an important factor for someone to respond to the current COVID-19 outbreak (Fauzi et al., 2020; Okan et al., 2020).

Coronavirus disease 2019 (COVID-19) caused by SARS-CoV-2 was first reported in Wuhan, Hubei Province, China (Zheng, 2020). The disease was originally called the 2019 novel coronavirus (2019-nCov). However, in February 2020 WHO gave a new name for this disease, namely Coronavirus Disease (Covid-19) because based on the samples studied, it showed the etiology of the new corona virus, namely Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) (Susilo et al., 2020). Human-to-human transmission of SARS-CoV-2 is the main cause of the spread of COVID-19. Transmission of SARS-CoV-2 occurs through droplets that come out of the body of a person with COVID-19 when coughing or sneezing (Zu et al., 2020). However, the latest development of transmission of SARS-CoV-2 is possible through the air (airborne). Recent studies have shown that SARS-CoV-2 can survive >72 hours on plastic and stainless steel, cardboard for 24 hours, and on copper for 4 hours. Based on recent research, SARS-CoV-2 has been shown to infect the gastrointestinal tract, such as the epithelium of the stomach, duodenum, and rectum. Some cases even show that the virus is found in the feces, thus increasing the indication of faecal-oral spread (Susilo et al., 2020).

It is very important to develop COVID-19 literacy instruments so that they can be used as a measuring tool for students' COVID-19 literacy skills. The components assessed by this instrument consist of knowledge about the spread and transmission of COVID-19, the causes and symptoms of COVID-19, prevention of transmission and spread of COVID-19, as well as treatment and mortality rates (Fauzi et al., 2020). Then for supporting data, attitude instruments were added with closed questionnaires to find out students' attitudes towards the COVID-19 pandemic phenomenon. For example, related to the most accessed and trusted sources of information, changes in habits such as washing hands and receiving guests into the house, as well as relating to student responses at the beginning of the pandemic such as the panic buying phenomenon.

In the realm of knowledge, students' understanding of when the SARS-CoV-2 virus spreads and infects its host is measured. For example, the fact that COVID-19 droplets can last longer on stainless-stell and plastic media than other media (Susilo et al., 2020). Knowledge of this information will make students more aware of

transmission and increase the intensity of hand washing. In discussing the causes and symptoms of COVID-19, students will be tested on their understanding of the causes and symptoms of COVID-19, for example about the virus that causes COVID-19 or about the symptoms that occur and the potential for ARDS in patients with COVID-19. Likewise for the other three components of COVID-19 literacy. The instrument developed consists of the domains of knowledge and attitudes developed using google form media.

In a pandemic condition, someone who is well-literate will be able to adapt to the situation, including in the offline learning process in a pandemic condition. Given the importance of COVID-19 literacy skills, it is necessary to develop a test instrument regarding COVID-19 literacy to see the readiness of high school students to start face-to-face learning. Therefore, it is necessary to develop an instrument that can measure the literacy ability of COVID-19 so that the level of students' ability to understand and respond to the COVID-19 pandemic can be detected. Knowledge of COVID-19 literacy is important to know so that more up-to-date designs and teaching materials can be developed to support the demands of future times.

METHODS
Research Design
The research method used in this research is Research and Development. Research and Development is a research method used to develop products or improve products (Setyosari, 2016; Nurseha et al., 2021) . Products developed can be in the form of books, modules, evaluation instruments, software, or learning models (Salim & Haidir, 2019). This research will use the Borg and Gall model which consists of ten stages, but in this study only eight stages were carried out with a reduction in the field test stage which was only carried out once. Then the research stages consist of (1) research and initial information collection; (2) planning; (3) initial product format development; (4) product trials; (5) product revision; (6) field trials; (7) final product revision; and (8) dissemination and implementation (Setyosari, 2016).

Population and Samples
The population in this study were all high school students in Tangerang Regency, Indonesia (Table 1). High school students were chosen because they were equipped with the concept of a virus. The concept of viruses is studied in the tenth grade of the first semester. Thus, it is assumed to have basic knowledge to understand advanced information regarding COVID-19. In contrast to junior high or elementary students who have not been provided with basic knowledge about viruses. However, this does not mean that the instruments developed cannot be implemented for junior high or elementary students. The sampling technique used a multistage sampling technique with four levels. First, Balaraja District, Indonesia was selected as the research sample with a random sampling technique based on area (cluster random sampling). Followed by the selection of schools selected SMAN 1 Tangerang Regency, SMAN 19 Tangerang Regency, and MAN 2 Tangerang with purposive sampling technique, the selection was based on the school being a public school with the assumption that learning standards were in accordance with the demands of the 2013 curriculum. In the final stage, 30 students were selected consisting of 10 students from each school using a random sampling technique (Putrawan, 2019; Alwi, 2012).

Table 1.
Population and Research Sample

| No	School	Total population	Number of Samples
1	SMAN 1 Kabupaten Tangerang	3189 students	10 students
2	SMAN 19 Kabupaten Tangerang	3226 students	10 students
3	MAN 2 Tangerang	1524 students	10 students

Instrument
The research instrument is an instrument to validate the COVID-19 literacy instrument that was developed. The instrument used was an expert validation instrument on multiple choice questions. Consists of material, construction, and language components (Sofyan et al., 2006). The selection of multiple choice questions is based on the ability of multiple choice questions to include more concepts, easy to analyze, more efficient in assessing, and simpler problem solving (Kadir, 2015). In addition, the pandemic condition causes research to be done online and multiple-choice questions are easy to make in online questions. The material components with the assessment criteria consist of (1) the suitability of the questions with the required competencies; (2) homogeneous and logical answer choices; (3) there is only one correct answer key. The construction component with the assessment criteria consists of (1) the subject matter is formulated briefly, clearly, and firmly; (2) the formulation of the main questions and the answer choices must be a required statement; (3) the subject matter does not give clues to the answer key; (4) the subject matter does not use statements that are double negative; (5) pictures, graphs, tables, diagrams or the like are clear and functional (6) questions should not depend on the answers to previous questions. The language component with the assessment criteria consists of (1) using a language that is in accordance with the rules of the Indonesian language; (2) use communicative language; (3) do not use the local

language; (4) the answer choices do not repeat the same word or group of words. Then the assessment criteria were measured with a score of 1 to 4 (Sofyan et al., 2006). In addition, a note column is provided so that the validator can provide input regarding the developed test instrument.

Procedure

The research step used refers to the Borg and Gall (1983) model consisting of 10 steps (Silalahi, 2017). In this study, only eight research steps were carried out consisting of (1) research and initial information collection, at this stage a literature review was carried out through scientific articles and news media to determine the importance of COVID-19 literacy in handling the pandemic; (2) designing, compiling instrument designs for each competency and then developing questions that are in accordance with COVID-19 literacy competencies; (3) developing initial products in the form of COVID-19 literacy test instruments, item indicators, and answer keys for each item; (4) expert validation, conducted on expert lecturers in the field of literacy; (5) initial product revision based on input from expert validators; (6) Field trials with 10 students in each school up to 30 students as a sample, students are randomly selected; (7) revision of the final product by testing the validity and reliability with the SPSS 25 application; (8) the use of COVID-19 literacy instruments for further research and dissemination. model development research procedures can be seen Figure 1.
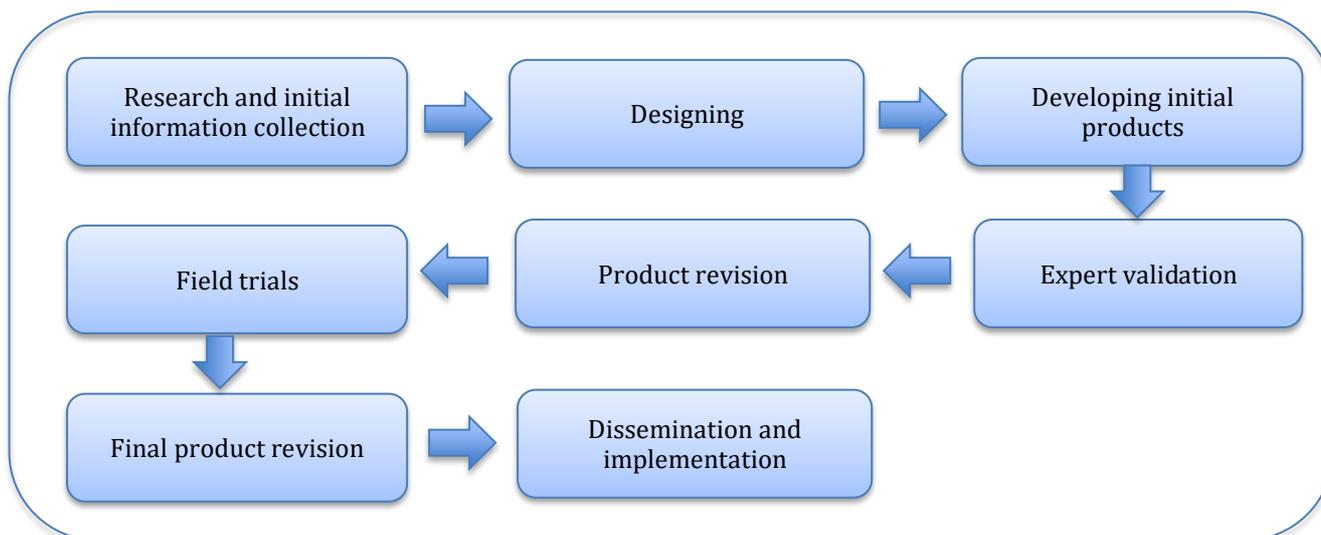
Figure 1. Borg and Gall (1983) model development research procedures

Data Analysis Techniques

Data analysis was carried out by describing the data from expert validation which included three assessment components, namely the material, construction, and language components. Then a descriptive analysis was carried out regarding the input from the validator in the note's column under the validation instrument. After the descriptive analysis was carried out, improvements were made and submitted back to the validator. After that, test the validity and reliability of the instrument using the SPSS 25 application. Validity test was conducted to determine the accuracy of an instrument. While the reliability test is carried out to determine the consistency of the measuring instrument, whether the measuring instrument used is consistent if the measurement is repeated (Dewi, 2019). Then the final product is produced which will be carried out in further research.

RESULTS AND DISCUSSION

In developing the COVID-19 literacy instrument, five assessment components were obtained, consisting of the ability to access information about COVID-19, the spread and transmission of COVID-19, the causes and symptoms, prevention of the spread and transmission, treatment, and mortality rate (Fauzi et al., 2020). The instrument developed by a combination of questionnaires and multiple-choice tests consists of 28 questions consists of 20 multiple choice questions, and 8 questionnaires with a grid as shown in Table 2. The instrument developed consisted of a questionnaire and multiple-choice questions. The questionnaire aims to obtain descriptive data regarding the ability to access COVID-19 information from students, while multiple choice questions are to determine students' knowledge about COVID-19. Each indicator is represented by one question. While indicators one and two are represented by two questions, the first question is a general question, and the second question is a follow-up question. Like, did you experience panic buying at the start of the pandemic? and what commodities do you buy when you experience panic buying?

Table 2
COVID-19 Literacy Instrument Grid

No	Assessment Component	Indicators	Question form	Question Number
1	the ability to access information about COVID-19	● Students have access to information about Covid-19	Questionnaire	1,2
		● There was no panic buying by students at the beginning of the pandemic	Questionnaire	3,4
		● Students gave the right response about a WA broadcast that contained information that wearing a mask would interfere with the exchange of oxygen (O2) and carbon dioxide (CO2) in the lungs.	Questionnaire	5
2	the spread and transmission of COVID-19	● Students know that Covid-19 droplets can last the longest on plastic and stainless-steel media.	Multiple choice	6
		● Students know that COVID-19 can be transmitted through the faecal-oral route, because ACE 2 can not only be expressed by lung cells, but also infects the gastrointestinal tract such as gastric, duodenal, and rectal epithelium.	Multiple choice	7
		● Students know the incubation period of SARS-CoV-2	Multiple choice	8
		● Students know that ACE-2 receptors are most abundant in the lungs.	Multiple choice	9
3	the causes and symptoms	● Students know COVID-19 stands for Coronavirus Disease 19	Multiple choice	10
		● Students know the virus that causes Covid-19 is Sars-CoV-2	Multiple choice	11
		● Students know about the symptoms in patients with COVID-19 from the most frequently experienced	Multiple choice	12
		● Students know that Covid-19 can trigger a cytokine storm that can trigger ARDS (acute respiratory distress syndrome), respiratory failure, and death.	Multiple choice	13
4	prevention of the spread and transmission	● Students know the ability to transmit COVID-19 through the faecal-oral route, causing funerals to require special protocols.	Multiple choice	14
		● Students know the mechanism of action of antibodies as a humoral response against antigens in the form of viruses, bacteria, toxins, or other microorganisms	Multiple choice	15
		● Students know the benefits of COVID-19 vaccination to stimulate antibody formation	Multiple choice	16
		● Students know that someone who has been vaccinated against COVID-19 must continue to comply with health	Multiple choice	17

			protocols because vaccination does not prevent transmission		
		●	Students know that 5M stands for the government proclaimed, namely wearing masks, washing hands, maintaining distance, staying away from crowds, reducing mobility	Multiple choice	18
		●	Students know The test method is carried out by collecting mucus samples from the nose or throat using a special swab, namely the PCR molecular test	Multiple choice	19, 20
		●	Students know Immunoglobulin (Ig) is a specific antibody component that plays a role against the SARS-Cov-2 virus which can be formed by increasing protein consumption	Multiple choice	21
		●	Students know the preventive behaviour that we need to do at home, namely consuming nutritious food, exercising, and getting enough rest	Multiple choice	22
		●	Knowing the average frequency of students washing their hands in one day	Questionnaire	23
		●	Know the habits that students do at home to increase the body's immune	Questionnaire	24
		●	Find out the average number of guests visiting the student's house per day	Questionnaire	25
		●	Students know the types of masks that are not good to use	Multiple choice	26
5	treatment and mortality rate	●	Students are aware of available epidemiological data showing the majority of patients are aged 30 to 79 years and the case fatality rate is increasing in patients over 70 years of age. Hypertension has been studied as a risk factor for exacerbating COVID-19 symptoms.	Multiple choice	27
		●	Students know that one of the treatment methods that can be used for COVID-19 patients with severe symptoms is transfusion of patients with plasma from recovered patients	Multiple choice	28

Expert Validation

The COVID-19 literacy instrument was validated using expert validation. The instrument validators were assessed by literacy experts and microbiologists namely Mr. Dr. Ericka Darmawan, S.Si., S.Pd., M.Pd from Tidar University, Magelang, Indonesia. The results of expert validity are translated into several categories, namely very feasible, feasible, less feasible and not feasible as in Table 3 (Amirumukminin & Aprianti, 2019).

Table 3
Expert validation test results

No	Assessment Component	Cycle 1	Cycle 2	Category
	Material			
1	Questions according to competence	3.0	4.0	

	Requested			
2	Homogeneous and logical answer choices	3.0	4.0	
3	There is only one answer key the most appropriate	4.0	4.0	
	Average	**3.3**	**3,67**	**Very feasible**
	Construction			
4	The subject matter is formulated briefly, clearly, and firmly	3.0	3.0	
5	The formulation of the subject matter and the answer choices must be a required statement.	3.0	3.0	
6	The subject matter does not give clues to the answer key	4.0	4.0	
7	The main question does not use statements that are double negative	4.0	4.0	
8	Pictures/graphs/tables and diagrams are clear and functional	4.0	4.0	
9	The item of the question does not depend on the answer to the previous question	4.0	4.0	
	Average	**3.5**	**3.5**	**Very feasible**
	Language			
10	Using language that is in accordance with the rules of the Indonesian language	4.0	4.0	
11	Use communicative language	3.0	3.0	
12	Do not use local language	4.0	4.0	
13	Answer choices do not repeat the same word/word group	3.0	3.0	
	Average	**3.5**	**3.5**	**Very feasible**
	Total Average	**3.43**	**3.56**	**Very feasible**

In the first expert test, according to the validator, the multiple choice overall is in accordance with the characteristics of the intended cognitive domain, it just needs improvement in the question instructions section. Question instructions must be clarified for each category of multiple-choice questions with good instruction sentences. After the repairs were made, there was an increase in the value of the material components of the instrument. After the expert test was carried out, then a limited trial was carried out on five students to find out whether there were errors in the editorial questions that could cause confusion or multiple interpretations for the reader. The results of the trial show that the question editor is quite good and does not cause multiple interpretations.

	Materials	Constructions	Language
Cycle I	82.50%	87.50%	87.50%
Cycle II	91.75%	87.50%	87.50%
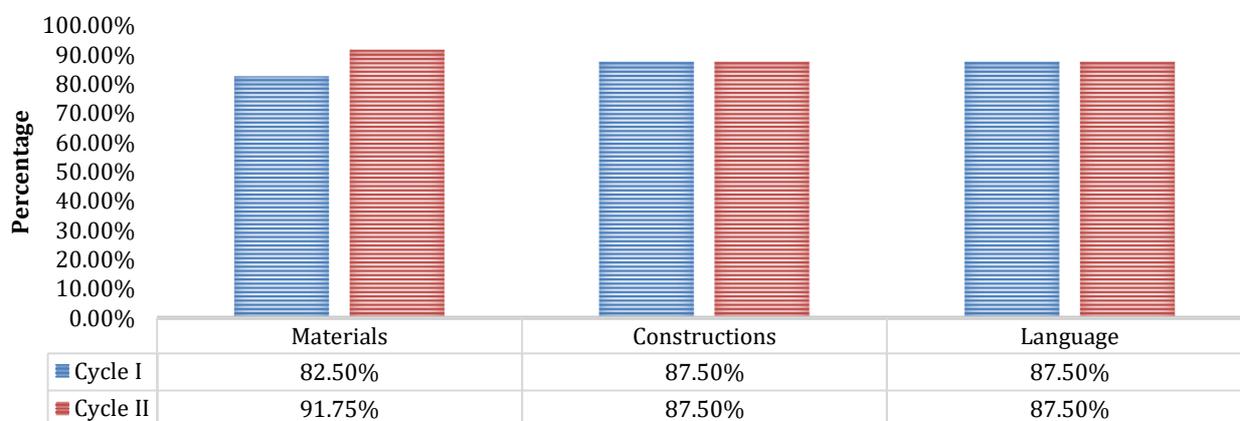
Figure 2. Comparison of the percentage of expert validation results in cycles I and 2

After expert validation and limited testing were carried out, a field trial was conducted on 30 students consisting of students from SMAN 1 Tangerang Regency, SMAN 19 Tangerang Regency, and MAN 2 Tangerang with 10 students each. After the trial was carried out, the validity and reliability tests were carried out on 20 multiple

choice questions that had been developed. Validity is the accuracy of an instrument in measurement, validity test can use the Bivariate Pearson method using the SPSS 25 application. The results of the validation test can be seen in Table 3.

Table 3
The results of the validity test using the Pearson Product Moment Correlation

Number Question	Score Pearson Correlation Validity Tst
Question number 6	.589**
Question number 7	.411*
Question number 8	0.347
Question number 9	.366*
Question number 10	.529**
Question number 11	.538**
Question number 12	.379*
Question number 13	.381*
Question number 14	.444*
Question number 15	.425*
Question number 16	.375*
Question number 17	0.360
Question number 18	0.230
Question number 19	.590**
Question number 20	.3
Question number 21	.54**
Question number 22	0.09
Question number 26	0.6**
Question number 27	.53**
Question number 28	.65**

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Based on the results of the validity test of multiple-choice questions using the Pearson Correlation method, 15 valid questions were obtained and 5 invalid questions were obtained. The cause of the invalid item can be caused by statement items that are not understood by the respondent, the statement items that we have compiled are not in accordance with objective conditions, or the respondent himself answers haphazardly (Raharjo, 2015). No repairs were made to invalid items because each component of COVID-19 literacy is still represented by several questions, so it is able to measure students' COVID-19 literacy ability. The validity of the items tested were only multiple-choice questions, while the questionnaires were not tested because they only aimed to obtain descriptive data. The recap of the validity of the questions can be seen in Table 4.

Table 4
Recapitulation of the validity test results of multiple-choice questions

No	Validity category	Question Number
1	Very Valid	6, 10, 11, 19, 21, 26, 27, 28,
2	Valid	7, 9, 12, 13, 14, 15, 16
3	Not Valid	8, 17, 18, 20, 22

Table 5
COVID-19 literacy instrument reliability test results

Cronbach's Alpha	Part 1	Value	0.683
		N of Items	9[a]
	Part 2	Value	0.709
		N of Items	9[b]
		Total N of Items	18
Correlation Between Forms			0.655
Spearman-Brown Coefficient	Equal Length		0.792
	Unequal Length		0.792
Guttman Split-Half Coefficient			0.791

After the validity test was carried out, it was continued with the instrument reliability test. Reliability test is used to determine the consistency of the measuring instrument, whether the measuring instrument used is reliable and remains consistent if the measurement is repeated, reliability test using the SPSS 25 application. After the calculations have been carried out, the calculated r value > r table (0.361), then the instrument used is reliable. The calculation results can be seen in Table 5.

The results of the validity test show that there are 15 multiple choice questions that can be used to measure students' COVID-19 literacy skills, plus eight questionnaires to obtain descriptive data on students' attitudes in dealing with the COVID-19 pandemic. Then 15 questions that were declared valid were tested for reliability and obtained r count as in Table 5, so that the developed instrument was included in the reliable category.

CONCLUSION

Based on the results of the development of the COVID-19 literacy instrument, 28 questions were produced consisting of eight questionnaires and 20 multiple choice questions. The results of the expert test made improvements to the question instructions to make it clearer, then obtained a score of 3.56 so that the instrument was included in the very feasible category. At the field test stage, validity and reliability tests were carried out on 30 students and 15 valid multiple-choice questions were obtained, five questions were invalid. Then 15 valid questions were tested for reliability with the results of r arithmetic being greater than r table so that the developed instrument was included in the reliable category.

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