PILLAR OF PHYSICS EDUCATION
Vol. 17 (2), 2024, page.99-106
ISSN (Print) : 2337-9618
ISSN (Online) : 2684-8880

Quality of Wordwall-Assisted Physics Learning Outcomes Assessment Instrument

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ABSTRACT

The instruments used in research must meet the criteria for instrument feasibility so that accountable data is produced. The feasibility of the instrument can be measured by means of a trial. Through trials, the validity and reliability of the instrument can be determined. This research aims to develop a physics learning outcomes test instrument assisted by wordwall. To achieve the research objectives, we used research and development (R&D) model of 4D design (Define, design, development, dissemination). The instrument develop was a multiple choice test consisting of 15 items. The subject of trial involved 30 students of class X SMAN 1 Tanjung Mutiara. Based on the results of the trial 13 of the 15 items of the instrument proved to be valid with the value of $t_{count} > t_{table} =$ *2,05 which means it meets the valid criteria. The results of the reliability test measurement of 13 instrument items obtained a value of 0,72 which means it has high reability. Based on the findings of validity test and reability test, it is conclused that the instrument development has met the feasibility to measuring the physics learning outcomes on global warming material.*

Keywords : *Learning Outcome; Instruments; validity; reliability; wordwall.*

I. INTRODUCTION

To produce accountable data, a proper instrument is needed in the research. An instrument can be used if it meets the instrument eligibility requirements. The instrument will provide reliable results if the instrument meets the eligibility requirements. There are several indicators that must be met so that the instrument is suitable for use. Among several indicators of instrument feasibility, there are 2 indicators of feasibility that must be met, namely validity and reliability [1]. An instrument that will be used in research must go through data validity and reliability tests to become an acceptable and feasible instrument [2]. There are 2 main things that determine whether a measuring tool really measures and the ectent to which the measuring tool is reliable and useful, anmely validity and reliability [3]. The quality of research data is highly dependent on the validity and reliability of the instrument used [4]. The higher the validity values, the more accurate the data obtained [5]. To test the validity and reliability can be done through trials in order to produce an instrument that is suitable for use.

Validity is a measure that indicates how legitimate an instrument [6]. Validity explains how well the data collected can cover the actual area of investigation [7]. Validity concerns the accuracy of the assessment tool on the concept being assessed so that it really assesses what should be assessed [8]. The validity test serves to determine whether a scale is able to produce accurate data and in accordance with its measurement objectives [9]. There are 2 important elements contained in validity, namely validity shows the existence of levels (perfect, medium, and low) and validity is always associated with somethings specific [10]. If an instrument can accurately disclose variable data and does not deviate fromo the actual state the instrument is considered valid [11]. An instrument can be said to be valid if it is truly appropriate and answers carefully about the variables to be measured [12]. To measure the validity of an instrument can be done in 3 ways namely through content validity, construct

validity and empirical validity [13]. Empirical validity tests measure teh same variable to determione the extent to which various tools can measure the same variable [14].

A consistent method of measuring something is called reliability [15]. The ability to measure an isntrument that gives the same results when applied at different times is called reliability [16]. Reliability tests are carried out to find out how consistent the instrument used by researchers are so that the instruments can be relied on to measure research variables even though the instruments are used repeatedly [17]. The reliability value of an instrument is influenced by the subject being measured, the user of the instrument, and the instrument itself [18]. A reliable instrument will produce the same data even it tested several times [19]. An instrument can be said to be reliable if the measurement results are close to the actual state of the test taker [20]. Instrument reliability can be measured in various ways, such as test-retest, equivalence, and internal consistency. Internal consistency reliability testing uses various test techniques, such as Cronbanch's Alpha, Kuder Richardson 20, Kuder Richardson 21, and split half [21].

A physics learning outcomes assessment instrument for the knowledge aspect assisted by wordwall has been developed. An interesting assessment instrument can increase students understanding and enthusiasm for learning [22]. In the digital era, educators need to utilize technology to improve the learning process, one of which is by using wordwall as a tool in assessing student learning outcomes [23]. Wordwall is a learning media in the form of an interactive game with an attractive and varied appearance so that it can motivate students in the learning process and can be accessed easily [24]. Wordwall offers various advantages that make it an effective learning tool: 1) meaningful and easy to follow learning system; 2) easy access via mobile phones; 3) creativity and engagement [25]. With the various advantage possessed by wordwall, then a wordwall can be a valuable asset as a tool for measuring the achievment of innovative and effective physics learning outcomes. In order for this instrument to be used to measure learning outcomes, it is first necessary to measure the the quality of the instrument through an instrument quality test. This article presents the results of empirical validation measurements and instrument reliability.

II. METHOD

The type of research carried out is Research and Development R&D (Research and Development) by developing physics learning outcomes assessment instruments assisted by wordwall on cognitive aspects. The purpose of developing this instrument is to test the reability and of the physics learning outcomes assessment instrument for wordwall assisted students. In this study 4D research and development steps from thiagajaran which includes (Define, design, development, dissemination). And modified into 3D until the development stage [26]. The steps in developing this instrument are: Define, this activity starts from analyzing the curriculum to determine the scope and depth of the material and the essential concept contained in the material. The next step is to conduct a literature review on a quality instrument, then determine the purpose of the instrument. Design, contains activities to make the lattice of physics learning outcomes achievement instruments assisted by wordwall on cognitive aspects. Development, contains activities aimed at developing tools to assess physic learning outcomes with the help of a wordwall on cognitive aspects tool physics academic achievement assisted by wordwall on cognitive aspects, then conduct empirical validity and reliability tests of research instruments and conduct data processing.

The instrument test subject were conducted on class X students of a SMAN 1 Tanjung Mutiara consisting of 30 people. The wordwall assisted physics learning outcomes assessment instrument used a grid and a multiple choice test totaling 15 items. Research data obtained from student test results were then analyzed using validity and reliability tests. To test validity, the Pearson/Product Moment formula is used to calculate the correlation value for each item [27], namely:

$$r_{xy} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{\{n\sum X^2 - (\sum X)^2\}\{n\sum Y^2 - (\sum Y)^2\}}} \quad (1)$$

Information :
r_{xy} = Coefficient between varaibles X and Y
X = Score for question item
Y = Total score for question item
n = the number of respondent

Next, the t test is calculated using the formula based on Sundayana [27] namely:

$$t_{count} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \quad (2)$$

Information:
r = Correlation coefficient of the result r count
n = Number of respondent

Next is to find t_{table} with formula based on Sundayana [27], namely:

$$t_{table} = t_{\alpha}(dk = n - 2) \quad (3)$$

After obtaining the validity value from the formula above, the next step is to determine the acceptance criteria for the items, namely with the following test criteria:

If $t_{count} > t_{table}$ means valid
If $t_{count} \leq t_{table}$ means invalid

This research instrument is considered valid if the t_{count} value is greater than the t_{table} value. And this research instrument is considered invalid if the t_{count} value is less than the t_{table} value.

To measure the reliability of the test can be done using the Kuder Richardson 20 formula based Sugiyono [27], namely :

$$r_i = \frac{k}{(k-1)}\left\{\frac{S_t^2 - \sum p_i q_i}{S_t^2}\right\} \quad (4)$$

Information:
K = Number of items in the instrument
S_t^2 = Total Variance

After obtaining the reliability value using the formula above, then checking the reliability level is carried out. As a refrence in determining the reliability level of these instruments is used:

Table 1. Classification of Reliability Index

Reliability Coefficient	Interpretation
$0,00 \leq r < 0,20$	Very Low
$0,20 \leq r < 0,40$	Low
$0,40 \leq r < 0,60$	Medium
$0,60 \leq r < 0,80$	High
$0,80 \leq r \leq 1,00$	Very High

(Source : Sundayana [27])

This research instrument is considered reliable if it meets the high reliability criteria with a minimum reliability coefficient of $r \geq 0,60$.

III. RESULTS AND DISCUSSION

Results

The study's findings are presented based on the stages of the research. The first stage is define, where the results are in the results are in the form of coverage and depth of material to be measured, literature review on quality instruments and instruments objectives. The material to be measured is global warming material, while the scope of the material includes the definition of global warming, the process of global warming, the causes of global warming, the impact of global global warming, and alternative solutions to global warming. An instrument can be said to be of high quality if it refers to two main things, namely validity and reliability [20] The purpose of this instrument is to measure the achievement of students' physics learning outcomes in the cognitive aspect.

The second stage is design, at this stage producing a lattice of instruments for achieving physics learning outcomes assisted by wordwall for cognitive aspects can be seen in table 2:

Table 2. Wordwall assisted physics Learning outcomes instrument grid cognitive aspects

Indicator	Question indicator	Number	Cognitive Level
Definition of global warming	Recognize the definition of global warming	1	C1
	Determine the greenhouse effect cycle	3	C3
	Interpret the function of the greenhouse effect	4	C2
The process of Global warming	Identify the process of global warming	2	C2
The causes of global warming	Determine the type of gas home greenhouse gas in daily life	6	C3
	Recognize causes occurrence of global warming	7	C1
	Determine the causes of global warming from the field of agriculture	8	C3
The impact of global warming	Diagnose climate change as a result of global warming	5	C4
	Determine the impact of global warming for life on earth	11	C3
	Interpret the causes of rob flooding due to the impact of global warming	9	C2
Alternative solutions To global warming	Convey ideas for alternative solutions to overcome the impacts of global warming	10	C5
	Mention concept of reduce, reuse, recycle	12	C1
	Categorize efforts to minimize the effect of global warming	13	C6
	Recognize function plants at urban reforestation program	14	C1
	Examine solutions to global warming	15	C4

A set of knowledge instruments should cover the cognitive levels from the lowest level to the highest level. At the senior high school, level the proportion of medium level should be more when compared to the proportion of low and high levels. Based on table 2, it can be seen that the distribution of this knowledge instrument includes 30 percent low cognitive level, 40 percent medium cognitive level and 30 percent high cognitive level. Low cognitive level includes domain C1. While for medium cognitive level includes domain C2 and C3. For high cognitive level includes domain C4, C5, and C6.

The third stage is development, where the results is to compile an instrument for achieving wordwall assisted physics learning outcomes on cognitive aspects as a multiple choice examination consisting of 15 instrument items prepared based on the grid in table 2. The questions that have been prepared are continued with internal validity tests and empirical validity tests. Researchers conducted a test of questions to 30 class X students at SMAN 1 Tanjung Mutiara in the even semester of 2023/2024. After tests the questions to students, continued with testing the validity of the questions using the Pearson/Product Moment formula with level significance of 0,05 through manual calculations assisted by Microsoft Excel. The results of the validation test of the physics learning outcomes assessment instrument are displayed in table 3.

Table 3. Recapitulation of Calculation Results of Validation of learning outcomes assessment instruments

Question item number	t_{count}	t_{table}	Criteria Valid
1	2,16	2,05	Valid
2	5,37		Valid
3	3,71		Valid
4	2,73		Valid
5	6,36		Valid
6	3,08		Valid
7	2,53		Valid
8	2,73		Valid
9	2,49		Valid
10	1,82		Invalid
11	3,72		Valid
12	2,72		Valid
13	1,22		Invalid
14	3,07		Valid
15	4,21		Valid

Based on the recapitulation of validity test results seen in table 3 with the Pearson/product moment formula and the t test, it is known that questions items number 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 15 meet the valid criteria because they have a $t_{count} > t_{table}$ value, and all 13 instrument items have a t_{count} above the t_{table} value = 2,05. Meanwhile, instrument items number 10 and 13 are declared invalid because they have a t_{count} value below the t_{table} value = 2,05. Therefore, there are 13 instrument items that can be used as an instrument for assessing student physics learning outcomes in the cognitive aspect and continued with the reliability test.

Test the reliability of the physics learning outcomes assessment instrument using the Kuder Richardson 20 formula through manual calculation using Microsoft Excel. Results of the Kuder Richardson 20 test are displayed in table 4.

Table 4. Recapitulation of Calculation Results Reliability of Learning Outcomes Assesment Instruments

Question Item	p	q	pq	∑pq	S_t^2	KR 20	Criteria
1	0,50	0,50	0,25	3,18	9,58	0,72	Tinggi
2	0,53	0,47	0,25				
3	0,40	0,60	0,24				
4	0,47	0,53	0,25				
5	0,63	0,37	0,23				
6	0,50	0,50	0,25				
7	0,63	0,37	0,23				
8	0,47	0,53	0,25				
9	0,57	0,43	0,25				
11	0,53	0,47	0,25				
12	0,63	0,37	0,23				
14	0,53	0,47	0,25				
15	0,53	0,47	0,25				

In table 4 it can be seen that the reliability test value of the physics learning outcomes instrument using the Kuder Richardson 20 formula is 0,72. Thus it can be concluded that the 13 items of the instrument have high reliability. Therefore, this instrument can be trusted as a measuring tool to determine the achievement of students' physics learning outcomes on global warming.

Discussion

Further study of the material produces essential concepts and cognitive abilities that must be achieved in accordance with the results of material identification and curriculum analysis. Global warming material is one part of the physics learning outcomes of phase E. The sub materials that can be studied form global warming material are the definition of global warming, the process of global warming, the causes of global warming, the impact of global warming and alternative solutions to global warming. By paying attention to the indicators of the sub material on global warming material and cognitive levels on the grid, so that it can be seen the balance and variation in the preparation of instruments so that the distribution of cognitive levels can be seen. The requirements of the grid must show indicators and cognitive levels, so that the distribution of cognitive levels from low to high can be

seen. The six cognitive domains are divided into three levels of thinking ability, namely LOTS, MOTS, and HOTS. LOWS or low level which includes the dimension of remembering (C1). MOTS or Medium level in the dimension of understanding (C2) and applying (C3). HOTS or high level in the dimension of analyzing (C4), evaluating (C5), and creating (C6) [28]. Based on the grids that have been developed, there are 4 instrument items with low cognitive levels, 7 instrument items with medium cognitive levels, and 4 instrument items with high cognitive level. From the distribution of cognitive levels found in the instrument grids, the distribution of grid with medium difficulty levels is more when compared to low difficulty levels and high difficulty levels. So that the instrument grids have been produced in accordance with the results of cognitive curriculum analysis. This is supported by sudjana [31], which states that the ratio of good questions criteria for easy, medium, and difficult questions for each cognitive level of bloom's taxonomy C1 is 30 %, C2 and C3 is 40%, and C4,C5 and C6 is 30% [32].

An instrument in the form of a test is needed to determine students' achievement of physics learning outcomes. This grid was then developed into a multiple choice test consisting of 15 instrument items. The purpose of the preparation of this instrument is to determine the achievement of students' physics learning outcomes in cognitive aspects with wordwall assistance. The measuring instrument in this research must be tested through validity and reliability tests. The validity test is carried out to determine whether the instrument can measure what should be measured. The reliability test is carried out to determine whether the instrument used can be produce consistent data even though it is measured repeatedly. Therefore, instrument quality testing is carried out so that the data generated in the research can be trusted and accountable. The results of this research \contributed to producing a valid and reliable physics learning outcomes test to assess students' physics learning outcomes in cognitive aspects.

Testing the validity of the instrument using internal validity with a team of research members and empirical validity by conducting trials to schools. After empirical testing, the next step is to process the data using the Pearson/Product Moment formula at a significance level of 0,05. Based on the validity test results, the results are interpreted in table 3. Table 3 shows that 13 instrument items meet the valid criteria and 2 instrument items do not meet the criteria valid. So it can be concluded that there are 13 out of 15 instrument items that are proven valid. Then from 13 questions that are categorized as valid. This is because the 13 items of the instrument have a t_{count} value greater than the t_{table} value. Meanwhile, instrument items 10 and 13 are not proven to be valid, so there are 2 invalid instruments. This is because the twi invalid instruments do not meet the criteria for determining the validity of the instrument, where the instrument is said to be valid if the t_{count} value is less than the t_{table} value. Then from 13 items of instruments that have a valid category continued with the reliability test.

To test the reliability of the instrument, the Kuder Richardson 20 formula was used. All instrument items that proved valid were tested for reliability. The reliability tests results are interpreted in table 4 where the results show that the reliability of the instrument for assessing students' physics learning outcomes is valid and reliable. A valid a reliable instrument will show consistent results when tested at different times and on different subjects [17]. Therefore, the wordwall assisted physics learning outcomes instrumen can be used in the assessment of physic learning outcomes,

Through a valid and reliable wordwall assisted physics learning outcomes assessment instrument, teachers can determine the achievement of student physics learning outcomes. However, student learning outcomes are highly dependent on various circumstances. This is supported by Gunawan et al. [29], that IQ, learning models and learning motivation have an influence on student learning outcomes. In addition, suryanti [30], stated that student learning outcomes are not only influenced by their cognitive style, but also influenced by the reinforcement provided by the teacher. Therefore, the measurement of student learning outcomes needs to be accompanied by careful preparation of learning activities from teachers on a regular basis.

With the instrument of physics learning outcomes for cognitive aspects assisted by wordwall, it can help improve student learning outcomes. This is line with kusumati & Fardian [31], which states that the use of wordwall as an evaluation media can improve student learning outcomes, so teachers need to vary evaluation methods, one of which is by using wordwall educational games in order to increase student enthusiasm for learning and have a positive impact on improving learning outcomes. the use of wordwall media as an instrument to measure student learning outcomes is certainly one of the beneficial things, both form the student's side, and from the teacher's side. From the teacher's side, with the wordwall it can make it easier for teacher to check student learning outcomes, because student score appear directly in the wordwall. Beside that, the wordwallcan also hel pin analyzing questions. This is because the wordwall shows the distribution of student learningoutcomes in detail. The number of students who answered correctly and incorrectly at each number is clearly visible so that it can help the teacher in evaluating the level of difficulty of the question. While for students with the wordwall this can inscrease enthuasism and make them not easilybored because of the attractive and varied appearance of wordwall. Based on this, it is necessary to make variations in the process of evaluating student learning outcomes so that the evaluation becomes more interesting, effective and efficient.

The important role of this research theoretically is that it can expand the literature references regarding instrument making, especially the assessment of student learning outcomes in physics learning. While practically,

the student learning outcomes instrument discussed in this study can provide variations in conducting learning evaluations conducted by teachers so as to improve the quality of learning evaluations and improve students learning outcomes. Therefore, the wordwall assisted physics learning outcomes instrument that has been prepared can be applied to the assessment of student physics learning outcomes in the cognitive aspect.

This research shows the advantage in the preparation of instruments with the help of wordwall as an intrument for assessing student physics learning outcomes. The preparation of the planned instrument is also in accordance with the stage of the research method. The learning outcomes test was prepared based on the results of curriculum analysis and literature review from several sources as well as the opinions of expert working in the field of research related to this research. Furthermore, the instrument was tested in class. Apart form that, the results of this research offer creative solutions to improve the process of assessing physics learning outcomes with the help of wordwall. By implementing this interesting and interactive educational technologuy, teachers anbd students can better achieve physics learning goals.

The weakness of this research is that there are still limited learning outcomes tests that can measure the achievement of student physics learning outcomes. This research is still limited to the assessment of physics learning outcomes in the cognitive aspect, it is hoped that further research can develop wordwall assisted physics learning outcomes instruments in other aspects.

IV. CONCLUSION

Based on data of the research and discussion that has been submitted, it can be concluded that the physics learning outcomes assessment instrument assisted by wordwall is empirically proven to be feasible to use as an instrument to measure physics learning outcomes for global warming material on cognitive aspects

ACKNOWLEDGMENT

I would like to express my gratitude to my parents who always provide support and i also thank my supervisor Prof. Dr. Desnita, M.Si who has guided, provided advice and input for writing this article.

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