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DEVELOPMENT OF AN INQUIRY-BASE CHEMISTRY LEARNING TOOL ASSESSMENT INSTRUMENT WITH LEARNING READINESS

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Abstract

This research is research into the development of an inquiry-based learning model instrument which aims to obtain a suitable instrument for assessing learning tools. This research method uses ADDIE (Analysis, Design, Development, Implementation, Evaluation). In the initial stage of the research, data analysis was carried out regarding the needs of the model to be developed so that an instrument for assessing learning tools could be designed and continued with implementing it, then evaluating it to obtain the final results as to whether the development of an instrument for assessing learning tools was suitable for use. The test results obtained from the feasibility test of the learning device assessment instrument were through a validity test using the Aiken's Value formula and a reliability test. Testing the validity of the learning tool validation questionnaire assessment instrument obtained an average CVI (Content Value Index) value of 0.839 with high validity criteria and a reliability test by calculating Cronbach's Alpha value of 0.740 with reliable criteria. Testing the validity of the learning device assessment instrument, the average CVI value for the learning device assessment instrument was 0.808 with high validity criteria. The general conclusion obtained by the results of the validity test and reliability test has shown that the validation of the assessment of learning tool instruments in the development of inquiry-based models is stated to have high validity and reliable or trustworthy criteria used as a measuring tool for collecting data on the aspects studied.

Keywords: Validity, reliability, instrument, inquiry

1 INTRODUCTION

One way a country's progress is supported by the education sector. Education is a basic foundation that plays an important role in improving the quality of human resources (HR) in a country. Education is now starting to be designed as practically and effectively as possible to build convenience in the world of education. Creative, innovative, critical and analytical are now highly developed in improving human resources. One of them is by improving the quality of thinking. Education that so far has not invited students to struggle harder to obtain the education they achieve with independent thinking. World turmoil continues to open up ways to innovate in the world of education, so that in this era it is known as Higher Order Thinking Skills (HOTS). The echoing of the term HOTS has opened up the development of ways of thinking. The application of creative, analytical, critical and open ways of thinking is part of high-level thinking skills.

Learning carried out today must involve students actively in seeking and building knowledge through higher level thinking and inquiry, problem solving and collaborative work and collaborative learning. Students must have the ability to think critically, be able to apply conceptual and procedural knowledge to solve problems and be able to explain the relationship between concepts in a subject matter effectively and creatively [1], [2], [3]

The learning carried out so far is still patterned at a low level of thinking, so that students' thinking skills have not been developed in carrying out learning. The expected learning is one that builds students' high-level thinking skills that are broad-minded, critical, analytical, innovative and open. Another factor that influences success in the learning process is the learning readiness factor. Learning readiness is an important point in the learning implementation process, because not all students are ready to carry out learning, so that it will produce good learning outcomes.

Field conditions continue to show that the world of education continues to require improvements in various factors that influence the success of a learning process. This fact requires educators to provide the best teaching and provide opportunities for students to have Higher Order Thinking Skills (HOTS) and mastery of the abilities needed according to their future profession. One way to improve The quality of human resources in the 21st century is to improve the quality of education by prioritizing a new curriculum that reflects the active learning curriculum. The active learning curriculum means that learning is not only about transferring knowledge but also building students' Higher Order Thinking Skills (HOTS) by preparing themselves for learning readiness [4].

Field conditions require educators to continue to innovate to improve factors or methods that will influence success in the learning process. One of them is by improving the learning model by developing a learning model that is appropriate to the times required by the students' circumstances and supports the conditions to produce a good implementation process and also good learning outcomes. Based on this situation, the researcher wants to research the development of an inquiry-based model with learning readiness which begins with the stage of creating a validation instrument for learning tools which will be a measuring tool for collecting the data needed in this research aspect. Furthermore, these two instruments will be tested for validity and reliability. It is hoped that the results of the validity test and reliability test will have high validity and reliability criteria, so that the learning device validation instrument and this learning device instrument can be used for the next research stage which will become a measuring tool for collect data needed in future research aspects.

Several ways to develop an inquiry learning model to improve critical, analytical and creative thinking, as well as to master chemistry concepts, namely the New Inquiry-Based Learning (NIBL) model developed to improve students' multiple higher-order thinking skills (MHOTS), such as critical thinking, analytical, creative and practical (CACP) with a foundation prepared through learning readiness [5]. Several efforts have been made to overcome obstacles, namely developing the ability to assess mastery of conceptual knowledge through inquiry-based learning processes in schools, by utilizing teacher working groups (KKG) and support from school principals/assessors to create relevant assessment tools [6].

2 METHODOLOGY

This research is a development research that develops an inquiry-based chemistry learning tool for class XII high school electrochemistry material to obtain a valid instrument for this research. The learning device instrument development process refers to the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The ADDIE model is a product development paradigm. The ADDIE concept is applied to build performance-based skills when students are learning in the teaching process. The advantage of the ADDIE model is that it is easy to use and can be applied to curricula that teach knowledge, skills or attitudes [7]. The subjects in this research are device validation instruments and inquiry-based learning device instruments consisting of lesson plans, worksheets, videos and PPTs for validity testing and reliability testing. The population in this study were high school (SMA) chemistry teachers in Lhokseumawe City.

The sample was five senior chemistry teachers at Lhokseumawe City High School who had at least 5 consecutive years of teaching experience, who were validators or assessors of learning tool validation instruments and learning tool instruments. The instrument used in this research is an instrument to measure the validity and reliability of the learning tool validation instruments and learning tools developed. The

validity of the validation instruments and learning tools used in this research consists of (1) Learning Implementation Plan (RPP) validation instruments, (2) RPP validation sheets, (3) Student Worksheet Plan (LKS) validation instruments, (4) validation sheets LKS, (5) Video validation instrument, (6) Video validation sheet, (7) Power Point validation instrument (PPT), and (8) PPT validation sheet [8].

Data analysis in this research uses quantitative analysis techniques and the data analysis carried out is data analysis of the validity of learning devices for two tests: Validity test: Using Aiken Value index analysis or CVI (Content Index Value) value to test the validity of an instrument in research. The following is presented in Table 1. description of the Aiken Value analysis value.

***Table 1**. Aiken Value analysis value criteria*

Criteria	Index	
VR	Low Validity	CVI < 0.4
VS	Medium Validity	0.4 ≤ CVI ≤ 0.8
VT	High Validity	CVI ≥ 0.8

The assessments of the five validators are tabulated and calculated using Aiken V for each indicator and statement using the formula [9].

$$CVI = \frac{\Sigma s}{n(c-1)}$$

Information:
CVI = Content Validation Index
∑s = total score set by the validator minus the low score (s=r-1)
n = Number of validators
c = number of categories/scales chosen by the validator.

Reliability testing is carried out using internal consistency reliability (Cronbach's alpha) with the formula:

$$r_{ac} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\Sigma_{\sigma_b^2}}{\sigma_t^2}\right)$$

Information:
r_{ac} = Instrument reliability
K = number of questions
$\Sigma_{\sigma_b^2}$ = Number of item variants
σ_t^2 = Total number of variants

Decision making is based on if the Cronbach Alpha value is > 0.6 then the data is reliable, but if the Cronbach Alpha value is < 0.6 then it is not reliable [10].

3 RESULTS

The design of the learning tool assessment validation instrument through validity and reliability tests consisting of (1) Learning Implementation Plan (RPP), (2) Student Activity Sheet (LKS), (3) Video and (4) Power Point (PPT) is based on development of an inquiry-based learning model with learning readiness. The quality of the design of the validation instrument for assessing learning tools and learning tool instruments is carried out using validity and reliability tests. The validity test refers to three criteria, namely high validity (VT), medium validity (VS) and low validity (VR). These three criteria are determined through calculating the Aiken Value index value or CVI (Content Value Index) which has provisions for determining

criteria according to Analysis. Aiken Value. The decision on the validity test is to determine whether the designed instrument is suitable for use and has a high validity criterion value to be used as a data collection measuring tool in the next research stage.

In the reliability test, the determination is through calculating the Cronbach's Alpha value which compares it with the standard value which must be greater than the value of 0.6 to be considered a reliable or trusted instrument to be used as a measuring tool for collecting data on the aspect of the research you want to research. The following is the result data and discussion of the validity test and reliability test on the learning device assessment validation instrument and learning device instrument.

Results of validity and reliability tests on the learning tool assessment validation instrument consisting of: (1) Learning Implementation Plan (RPP), (2) Student worksheets (LKS), (3) Videos, and (4) Power Point (PPT). The list of questions in the learning tool validation instrument consists of eleven questions which are included in six indicators: (1) Clarity (2) Accuracy of content (3) Relevance (4) Validity of content (5) no bias and (6) Accuracy of language. The following is in Table 2. Validity test data was obtained from testing to calculate the Aiken Value or CVI (Content Validity Index) value of the learning device validation instrument which is presented in Table 2 as follows.

***Table 2**. Validity Test Results of Learning Tool Assessment Validation Instruments*

Question	Lesson Plan	Student Worksheet	Video	Power Point	Average CVI	Criteria
1	0.90	0.90	0.90	0.90	0.90	High Validity
2	0.90	0.90	0.90	0.90	0.90	High Validity
3	0.85	0.85	0.85	0.85	0.85	High Validity
4	0.95	0.90	0.95	0.95	0.93	High Validity
5	0.95	0.95	0.90	0.90	0.92	High Validity
6	0.90	0.90	0.90	0.90	0.90	High Validity
7	0.90	0.85	0.90	0.90	0.88	High Validity
8	0.80	0.75	0.80	0.80	0.78	Medium Validity
9	0.75	0.75	0.75	0.75	0.75	Medium Validity
10	0.75	0.75	0.75	0.70	0.73	Medium Validity
11	0.70	0.60	0.70	0.60	0.65	Medium Validity
Average	**0.85**	**0.82**	**0.84**	**0.83**	**0.83**	**High Validity**

Table 2, it shows the data validity test of the average CVI (Content Validity Index) value resulting from eleven questions by five validators resulting in a CVI value of 0.85 on the RPP, 0.82 on the LKS, 0.84 on the video and 0.83 on the PPT. All CVI values from the devices are above 0.80, so the validity test results of the learning device validation instruments have high validity criteria. The average CVI (Content Validity Index) value for the four learning device validation instruments produces a validity test value of 0.83, which overall has high validity criteria. Next, its reliability will be tested by calculating the Alpha Cronbach's value which is compared with the comparison standard value of (> 0.6). Presentation of result data Reliability test of the learning device validation instrument which consists of: (1) RPP, (2) LKS, (3) Video, and (4) PPT, can be seen in Table 3 as follows.

***Table 3**. Reliability Test Results of Learning Tool Assessment Validation Instruments*

Item	Lesson Plan	Student Worksheet	Video	Power Point	Average
Validator 1	50	50	50	50	50
Validator 2	53	52	53	52	52,5
Validator 3	47	43	46	45	45,25
Validator 4	47	47	47	47	47
Validator 5	45	45	45	45	45
Total variance	9,8	13.3	10.7	9.7	10.9
Variance of item	3.3	4.3	3.4	3.3	3.6
Alpha Cronbach's Value	0.729	0.744	0.750	0.737	0.740
Standard	0.6	0.6	0.6	0.6	0.6
Information	0.729 > 0.6	0.744 > 0.6	0.750 > 0.6	0.737 > 0.6	0.740 > 0.6
Conclusion	Reliable	Reliable	Reliable	Reliable	Reliable

Table 3 shows the results of the reliability test of the learning tool assessment validation instrument data, the Cronbach's Alpha value is 0.729 for RPP, 0.744 for LKS, 0.750 for video and 0.737 for PPT, the fourth Cronbach's Alpha value of the learning tool assessment validation instrument is above the set standard, namely above 0.6, then the reliability test has reliable criteria. The average Cronbach's Alpha value for the four learning tools assessment validation instruments produces a reliability test value of 0.740 which is greater than 0.6, so overall it has reliable criteria. In the validity test and reliability test, the validation instrument for assessing learning tools produces high validity and reliable criteria data, which means that this instrument can be trusted as a measuring tool for collecting data in future research aspects.

Results of validity tests and reliability tests on learning tool assessment instruments consisting of: (1) Learning Implementation Plan (RPP), (2) Student Worksheets (LKS), (3) Videos, and (4) Power Points (PPT). Below is Table 3. Validity test data was obtained from testing to calculate the Aiken Value or CVI (Content Validity Index) of the learning tool instruments presented in Table 4 as follows.

***Table 4**. Validity Test Results for Learning Tool Validation Instrument Assessment*

No	Learning Media	Question	CVI	Criteria
1	RPP (Lesson Plan)	19	0.829	High Validity
2	LKS (Student Worksheet)	21	0.809	High Validity
3	VIDEO (Video)	18	0.797	Medium Validity
4	PPT (Power Point)	13	0.800	Medium Validity
	Average		**0.808**	**High Validity**

Table 4 shows the CVI value data from the validity test of the learning device assessment instrument assessed by five validators. Each learning tool has a different number of questions and number of indicators. The learning tool consists of four items including: (1) RPP, (2) LKS, (3) Video, and (4) PPT. Table 3. Shows data from the RPP validity test results consisting of 19 questions consisting of 8 indicators: (1) identity (2) formulation of learning objectives and indicators (3) selection of materials (4) selection of learning approaches (5) planning of learning activities (6) selection of learning resources (7) Developing assessments and (8) language. Table 3 data shows that the CVI value of the RPP learning tool is 0.829,

because the CVI value is above 0.8, the RPP learning tool has high validity criteria. LKS validity test results data consisting of 21 questions consisting of 3 indicators: (1) Suitability of material / content (2) appearance and (3) suitability of language. Table 3 data shows that the CVI value of the LKS learning tool is 0.809, because the CVI value is above 0.8, the LKS learning tool has high validity criteria.

4 CONCLUSIONS

This research is research into the development of inquiry-based learning model instruments with learning readiness which aims to determine the results of validity and reliability tests on learning device validation instruments and learning device instruments which will be used as measuring tools to collect data on the aspects studied so as to produce learning devices that are consisting of lesson plans, worksheets, videos and PPTs which have high validity and reliability. The test results obtained in the initial stage of the instrument feasibility test were carried out through a validity test using the Aiken's Value formula and a reliability test calculating the Cronbach's Alpha value on the learning tool validation questionnaire and learning tool instruments. Testing the validity of the learning tool validation questionnaire instrument obtained an average CVI (Content Value Index) value of 0.839 with high validity criteria and a reliability test by calculating Cronbach's Alpha value of 0.740 with reliable criteria. Testing the validity of the learning device instrument obtained an average CVI value of 0.808 with high validity criteria and a reliability test by calculating Cronbach's Alpha value of 0.714 with reliable criteria. The results of the validity test and reliability test have shown that the validation of the learning tool questionnaire and the validation of the learning tool in the development of an inquiry-based model are stated with the criteria of high validity and reliability or can be trusted to be used as a measuring tool for collecting data on the aspects studied.

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