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Development of Discovery Learning-Based Student Worksheets to Improve Students Higher Order Thinking Skills on Salt Hydrolysis Material

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Abstract:- This study aims to produce a salt hydrolysis worksheet based on discovery learning to measure the validity and practicality of the worksheet. Worksheets arranged in a discovery learning model and equipped with multiple representations. The research method is a research and development using the Plomp model which consists of 3 phases, they are 1) preliminary research, 2) prototype phase, 3) assessment phase. The subject of this research was conducted at SMAN 5 and SMAN 8 Padang. The validity test was carried out by 4 chemistry lecturers in Padang State University, 1 chemistry teacher at SMAN 5 Padang and 1 chemistry teacher at SMAN 8 Padang. The practicality test (field test) was carried out by 35 students of SMAN 5 Padang and 35 students of SMAN 8 Padang. The result of the study found that discovery learning-based worksheets had a validity level of valid categories (v = 0.93) and the level of practicality ofstudents with very high categories (k= 0.86) and chemistry teachers (k = 0.95) were very high practicality category.

Keywords:- *Discovery Learning, Student Worksheet, Higher Order Thinking Skills, Salt Hydrolysis Material.*

I. INTRODUCTION

Chemistry is a branch of science that is very important in science which studies matter and the changes that accompany it [1]. Chemistry is a science that built by thinking and experimenting consists of the stages of observing, measuring, analyzing, and concluding. Chemistry subjects, especially salt hydrolysis material in the structure of the 2018 revised Curriculum 2013, were studied in class XI even semester. Salt hydrolysis a material that students find difficult [2]. Because students it links several concepts, analyzes the hydrolysis reaction, types of hydrolyzed salt, and calculates the pH of the hydrolyzed salt. The 2013 curriculum demands a change in the learning process from students being told to learn to find out. Changes in the learning process like this will improve the thinking skills of students from low order thinking skills to higher order thinking skills (HOTS). HOTS concept is a level of thinking ability based on the revision of Bloom's Taxonomy A Revision of Bloom's Taxonomy, which states that indicators for measuring HOTS include analyzing (C4), namely the ability to describe a problem or object into its elements and determine how the elements are related, evaluating (C5), namely making a judgment based on existing criteria and standards, and creating (C6), namely the ability to combine elements into a form of unity [3].

Familiarizing HOTS in the learning process for students requires the right approach and strategy from the teacher. Chemistry is one of the subject in high school. Many students complain of difficulties in learning chemistry process. From the results of a questionnaire given to 40 students of high school education in Padang city, 90% of students stated that learning chemistry was difficult, because chemistry subject matter contained many concepts relating to chemical reactions, calculations and concepts that were abstract and considered relatively new material for learners. The low learning outcomes of students are due to the low understanding of chemical concepts and the lack of interest of students in lessons [4].Therefore, in the learning process the teacher uses teaching materials, namely text books and Student Worksheets. The LKPD used contained material descriptions and practice questions, did not involve three levels of chemical representation and had not used a learning model. LKPD is one of the teaching materials that helps and makes it easier for students in learning activities. In addition, LKPD can be used for evaluation and concept reinforcement [5]. Nurfidianty and Mulyani stated that the use of LKPD would not give satisfactory results without the use of learning models in the learning process [6]. One of the learning models in the 2013 curriculum is discovery learning.

Discovery learning models can encourage students to think and analyze independently so that they can find their own knowledge and better understand [7]. This is the same as what Risdianto (2013) said, learning using discovery learning models provides a way for students to develop thinking skills [8]. Learning using discovery learning can improve students' higher order thinking skills because students are trained to observe, ask, try, reason and communicate through the stages of learning in the model. At the stimulation stage, the students are invited to observe and ask questions. The problem statement stage, the students are invited to ask questions and collect information. The data collection stage, the students are invited to try and observe. the data processing stage, the students are invited to reason and ask and the verification and generalization stages of participants students are invited to reason and conclude. So the discovery learning model is

considered suitable to improve the higher order thinking skills of students [9].

Based on the observation results and the questionnaire results that given to 4 chemistry teachers and 40 students in several schools including SMAN 3, SMAN 5, SMAN 7 and SMAN 8 in Padang, several problems were found. Teaching materials used are textbooks and LKPD from publishers. Based on the problem, the authors developed teaching material innovations in the form of student worksheets (LKPD) for that the authors submitted a research proposal entitled "Development of Discovery Learning-Based Student Worksheets (LKPD) to Improve Student Higher Order Thinking Skills (HOTS) of Students at Salt Hydrolysis Material in Senior High School ".

II. RESEARCH METHOD

1. Research Design

This research used Research and Development (R & D). The research method is Plomp model. Based on the Plomp development cycle, the Plomp model is divided into three phases, the first stage is preliminary research , the second stage is the development or prototyping phase, and the third stage is assessment phase [10]. Formative evaluation use in this research can be seen in figure 1.

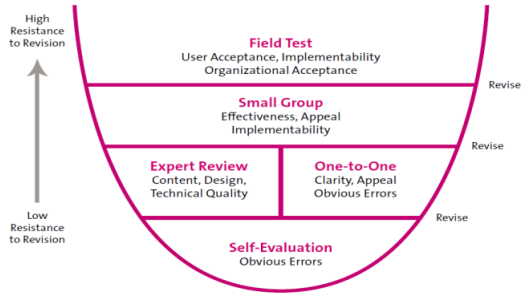

Figure 1. Formative evaluation layer

2. Research Subject

The subjects in this study were chemistry lecturers as validators of Universitas Negeri Padang.

3. *Data Collection*

a. Validity Analyisis

The validator's assessment of each statement was analyzed using Aiken's V formula. The formula proposed by Aiken is as follows [11] :

$V = \sum s / [n(c-1)]$
$S = r - lo$

Information:
Lo= the lowest number of validity assessments (for example 1) C = the highest number of validity assessments (eg 4)
R = number given by the assessor
N = number of evaluators

The level of validity of the discovery learning-based student worksheet will be seen after being converted to the categories in Table 1.

Table 1. Validity level categories

V value	Category
$V \leq 0.4$	Less
$0.4\ V \leq 0.8$	Moderate
$0.8 < V$	Valid

b. Practicality Analysis

The practicality of a teaching material is used to test the practicality of the teaching material being developed. The product assessment is based on a questionnaire sheet that has been filled in by the practitioner. Scoring for each indicator uses a Likert scale. Practical data analysis by teachers and students can be obtained using the following formula [12].

$$\text{Practicality Score} = \frac{Score\ obtained}{Maximum\ Score} \times 100$$

Next, the practicality values obtained are categorized according to Table 2 below.

Table 2. Criteria for giving practical value .

No	Persentase (%)	Kriteria
1.	0 - 20	Impractical
2.	21 – 40	Less Practical
3.	41 – 60	Quite Practical
4.	61 – 80	Practical
5.	81 - 100	Very Practical

III. RESULTS AND DISCUSSION

3.1 Preliminary Research

In this stage, the identification and analysis needed to develop research to development a salt hydrolysis material worksheet based on discovery learning is carried out. Preliminary research begins with needs analysis, curriculum analysis, and concept of analysis. The findings in this stage are applied as the basis for the initial design of student worksheets. After this analysis has been completed, the next step is design a student worksheet based on discovery learning chemistry.

3.2 Prototyping Phase

In the prototyping phase of making this prototype, a formative evaluation was carried out. Formative evaluation is carried out in each prototype produced. Prototyping Phase produces prototype 1, prototype 2, and prototype 3 which is the result of formative evaluation. Formative evaluation was conducted based on Tessmer's formative evaluation. Tessmer's formative evaluation includes four stages, namely: self-evaluation; expert review and one-to-one evaluation; small group evaluation test; and field test.

a. Prototype 1

After formulating goals based on the Basic Chemistry syllabus, development activities were continued by designing a Student Worksheet (LKPD) for Discovery Learning on salt

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hydrolysis material . LKPD components designed are cover, foreword, table of contents, list of pictures, characteristics of LKPD, instructions for use of LKPD, dimensions of knowledge , instructions for using student worksheet, competencies (KI, KD, indicator and objectives of learning), learning materials, student"s activity sheet , evaluation sheet, and references. Following are some views of the LKPD components, see figures 2 and 3.

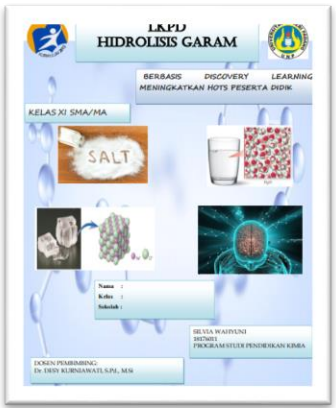


Figure 2. Cover of LKPD

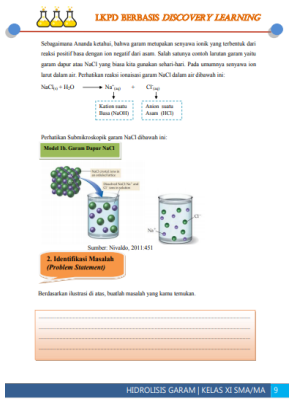


Figure 3. Contents of LKPD

b. Prototype 2

After producing prototype 1 in the form of an initial design, then at this stage a formative evaluation was carried out in the form of self-evaluation. Self-evaluation is carried out by means of a check list system of the important parts that must be included in student worksheets discovery learning based on salt hydrolysis material the results of this evaluation, the compiled student worksheets already have components that must be included in the LKPD so there is no revision in this evaluation.

c. Prototype 3

Based on the self evaluation results obtained Prototype II. Prototype was verified by skilful persons (lecturers and chemistry teachers) and individual assesment (one-to-one evaluation) was carried out with three students. After the revision was made, a prototype III was produced. Then the validator provides an assessment of the LKPD on the validation sheet. The validation value given by the validator using the Aiken's V formula. The results of the LKPD validity resolved are summarized in Table3.

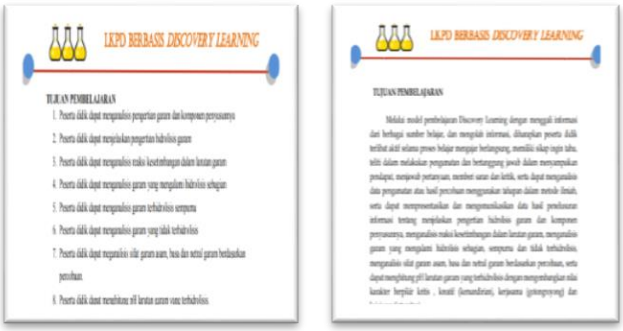
Table 3. LKPD Validation Result

Aspect	V	Validity Category
Component of content	0,92	Valid
Component of construct	0,91	Valid
Component of linguistic	0,94	Valid
Component of graphic	0,96	Valid
Average	0,93	Valid

Based on components of the feasibility of the LKPD content have an average 0.92 of Aiken's V of with valid category. The category of Aiken's V is valid indicating that discovery learning based students worksheet to increase the HOTS of students developed in agreement with the core of competence, basic competence, indicators and competency achievement must be achieve indicator. The content of the student worksheet which contains material of learning in the form of facts, concepts, principles and procedures is scientifically correct in accordance with the 2013 curriculum guidance. In conclusion, the problems provided are to be investigated by students to lead other students to figure the concept is in agreement with the subject material taught [13]. Validity of product in terms of content if they are appropriate with the need and component based on the latest scientific knowledge [14]. Based on the assessment of the construct components, the student worksheet an average 0.91 of Aiken's V with valid category. The assessment shows there is a systematic fit between the student worksheet preparation and discovery learning model steps.

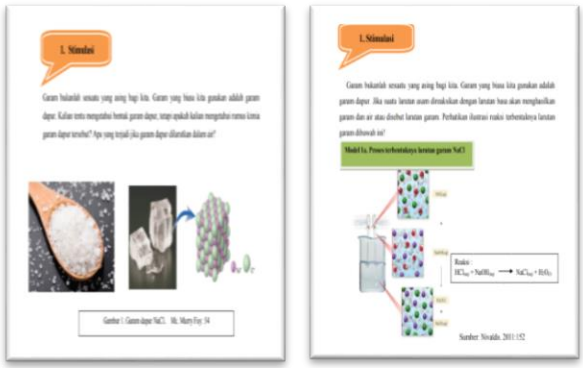
The validity of the student worksheet from the linguistic are an average 0.94 of Aiken's V with a valid category. It indicates that the language used in the module is in accordance with good and correct Indonesian rules and could be understood confortability. In addition, text and pictures can be read clearly. This is consistent with the statement that the indicator valued by language including legibility,information clarity, suitability of writing Indonesian correctly rules and use of effective and efficient language. In the graphic component, the student worksheet validity has a Aiken's V value of 0.96 with a valid category. The graphic component shows the aspects of using type and font size, student worksheet layout, illustrations, images, designs and product colors that are developed so that the student worksheet is attractive as a whole [15]. The existence of visual images and symbols in the module can help students understand the concepts being learned [16].

Although the validity of discovery learning based student worksheet to increase the HOTS of the students produced was high, there were still several components that had to be fixed according to the suggestions given by the validator. One of the improvements suggested by the validator can be seen in Figures 3 and 4. From Figure 3 the validator suggests changing the appearance of learning objectives and in Figure 4 the validator corrects the image to make it clearer.



(a) Before revision (b) After revision

Figure 4. Display Competency Achievement Indicators (a) Before and (b) After Revision



(a) Before revision (b) After revision

Figure 4. Display of stimulation (a) Before and (b) After Revision

d. Prototype 4

To produce prototype 4, a small group evaluation test was carried out on prototype 3. In this evaluation there were 9 students with low, medium, and high abilities. The practical results of small group evaluation can be seen in table 4.

Table 4. Results of student response questionnaire on small group evaluation

No	Aspect	Value practicality	Category
1	Ease of Use	94%	Very practical
2	Time efficiency	92.5%	Very practical
3	The benefits	94%	Very practical
Average		93.5%	Very practical

The result of small group practicality analyzed with the value practicality were 93.5% with very practical

3.3Assesment Phase

At this stage, a field test is carried out to get the practical level of the worksheets that have been produced. Field tests were carried out on 2 chemistry teachers and 70 students. The results of the questionnaire analysis given to lecturers and students can be seen in table 5.

Table 5. Results of Chemistry teachers and student response questionnaires

No	Aspect	Chemistry teachers	Students
1	Ease of Use	94.4%	93.65%
2	Time efficiency	100%	92.32%
3	The benefits	93.8%	93.30%
Average		96.06%	93.30%
Category Practicaly		Very practical	Very practical

Based on table 5 the practicality of field test obtained a value practicality of 93.30% means very high practicality category. This showed that LKPD was practically used or easy to use , efficiency time, and benefits to the student. This showed that practicality considerations can be seen from the aspects of easy to use, efficiency time, and benefits [17]. Based on table 5 showed that the practicality of the field test based on chemistry teacher response questionnaire has a value practicality of 96.06% means very high practicality category. The results of practicality show that the LKPD developed has been practically used in the learning process.

IV. CONCLUSION

Discovery learning-based student worksheets on salt hydrolysis material developed had very high validity category with a value of (V= 0.93). The result of practicality test on the field test had an average value practicality value of 93.30% from the student response questionnaire with the very high practicality category and 96.06% from the chemistry teacher response questionnaire with the high practicality category.

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