Validation of Intructional Learning Based on M-APOS Approach to Improve Students' Reasoning

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Abstract—**The purpose of this research is to develop the instructional learning based on M-APOS approach to improve students' reasoning abilities valid. This research is a development research. It is consists of three stages: the initial investigation stage, development stage, and assessment phase. The result of the development stage is a valid instructional learning according to experts. They are three mathematicians, one language expert, and one technology expert. The validity of instructional tools is based on the following aspects: 1) the didactic aspects (presentation); 2) content feasibility aspects; 3) language aspects; and 4) the graphic aspects. The validation result of instructional learning are 1) the didactic aspects (presentation) 3.59 (very valid), 2) content feasibility aspects 3.56 (very valid),3) language aspects 3.00 (valid), 4) the graphic aspects 4.00 (very valid).**

Keywords—M-APOS, Validation, Reasoning Capability

I. INTRODUCTION

This Mathematical reasoning ability is very important in achieving the goal of learning mathematics learners. In mathematics learning is not only to improve and change the facts and skills, but more emphasis on the importance of assuming, communicating, solving problems and logical thinking. This is because learning mathematics not only studies it as a fixed and unchanging set of facts and skills, but it should be an emphasis on the importance of conjecturing, communicating, problem solving and logical reasoning [3].

Reasoning is a mental process in developing the minds of some fact or principle [2]. Based on the Big Indonesian Dictionary, reasoning is: (a) the way (about) using the flow, thinking or logical thinking; range of thinking; (b) Things that develop or control things with reason and not with feelings or experiences; (c) mental processes by developing thoughts from several facts or principles. One of the objectives of learning mathematics based on the Minister of Education and Culture Regulation No. 58 of 2014 in point 2, which is using patterns as a guess in solving problems and being able to make generalizations. It can be concluded that reasoning is an activity or activity to draw a conclusion or a new statement that is found by connecting the facts given to solve the problem and make a generalization.

To achieve improved reasoning abilities required its learners learning device. Learning devices become a handbook for teachers in learning implementing in the classroom, laboratory or outside the classroom. Device learning device is a tool or equipment to carry out the process that will enable educators and learners perform the learning activities [9]. In this study, the learning device developed using M-APOS theory approach. M-APOS is modification of APOS (Action, Process, Object and Scheme). APOS theory developed by Dubinsky, consists of Action, in which participants conduct various activities from the teacher, the process by which the participants take repeated actions, the things that the participants do from the process carried out Make a lesson from students Keywords: actions, actions, actions, objects that students do in the learning process. The learning tools developed need to be validated so that the device can be used for learning, validation of two uses of validity, construct validity.

Validity refers to the accuracy of an instrument for measuring what is desired [8]. The validity of the content is the need for intervention (devices made), and the design is based on scientific knowledge [7]. While designing interventions construct validity (the learning device) in accordance with the logic/ reason right (logical). With the M-theory based learning valid APOS can improve mathematical reasoning abilities of learners.

II. METHODS

The method in this research is the development method using a questionnaire validation to some of the experts. Three mathematicians, linguists one person, one person technology experts. The validity of the learning device from the aspects of: 1) the didactic aspect (presentation), 2) feasibility aspects of content, 3) language aspects, 4) aspects of the graphic.

Determining the value of the validity of the learning device by using the formula proposed by Muliyardi is as follows [5] :

$$R = \frac{\sum_{j=1}^{m} \bar{x}_j}{m}$$

Information:
R = Validity learning device
$\bar{x}_j$ = Average validity of the assessment results to the item-j
m = Sum of items

Interpretation of the validity of the learning device is determined by the following criteria [6]:

TABLE I.   CRITERION VALIDITY OF LEARNING TOOL

Criteria	Interpretation
R ≤ 0.08	Invalid
0.08 <R ≤ 1.60	less valid
1.60 <R ≤ 2.40	enough valid
2.40 <R ≤ 3.20	Valid
R> 3.20	very valid

III. RESULT AND DISCUSSION

Valid devices can be used if aspects of the indicator can be used for anything. Validation of the learning device carried by five experts among its Three mathematicians, linguists one person, one person technology experts. The results of the validation of the device by the experts:
1.   Validity RPP

No.	Rated aspect	Average	Category
1	Subjects Identity	4	very valid
2	Basic Competency (KD)	4	Very valid
3	Learning Indicators Formulation	3.4	very valid
4	Formulation of Learning Objectives	3:43	very valid
5	Selection of learning materials	3:12	valid
6	Selection of learning strategies	3:16	valid
7	Selection of Learning Resources	2.75	valid
8	Selection of Instructional Media	3:25	very valid
9	Steps Learning Activities		
	Preliminary activities	3:14	valid
	Core activities	3:13	valid
	The activities cover	3:08	valid
10	appraisal	3:12	valid
11	Language and writing	3	valid
12	Benefit RPP	3.5	valid

2.   The results of the validation LKPD

No.	Aspect	Average	Category
1.	didactic	3.59	very valid
2.	Material or Content	3.56	very valid
3.	Language	3.00	valid
4.	Graphic	4:00	very valid
Average		**3.54**	**very valid**

Results of the RPP and LKPD validity of some of the experts, it can be said that the RPP and LKPD that use M-APOS theory approach is valid and can be used in the learning process. It is expected that with a valid learning devices will be able to improve mathematical reasoning abilities of learners, so that mathematics learning objectives can be achieved.

IV. CONCLUSION AND RECOMMENDATION

From the above, it can be concluded that the learning tools that will be used in this study was valid. The validity of the RPP can be seen from 12 aspects, as well as the validity LKPD seen from four aspects (didactic, material/ content, language, graphic). Results of the validity of the RPP and LKPD very valid..

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