The validity of learning devices with generative learning models to improve mathematical problem-solving ability

Melda Gustia\*, Irwan\*

1Student of Postgraduate Program Of Faculty Mathematics and Natural Sciences, Padang State University, Padang-West Sumatera, Indonesia
2Lecturer of Postgraduate Program Of Faculty Mathematics and Natural Sciences, Padang State University, Padang-West Sumatera, Indonesia

\*meldagustia30@gmail.com

Abstract. This validity aims to determine the validity of mathematics learning tools based on generative learning models to improve students' mathematical problem-solving abilities. The validity seen is constructed validity and content validity. Construct validity is the suitability of the product that is developed with theories that are the basis of product development, while content validity is the suitability of the product developed with the established curriculum. Validated learning devices are Learning Implementation Plans and Student Worksheets class VII junior high school. This learning tool is validated by 5 Expert Experts consisting of 3 Mathematical Experts, 1 Indonesian Language Expert, and 1 Educational Technology Expert. Validity test data was obtained from the results of validation by experts using the instrument validity test sheet form questionnaire. The results of the experts' validation indicate that the learning device meets valid criteria.

1. Introduction

Problem-solving ability is a process to solve a problem so that the problem is not a problem for him. [1] Mathematical problem solving is a complex cognitive activity, as a process to overcome a problem that is encountered and its solution requires a strategy. [2] So, the problem-solving ability is a potential that someone has by applying mathematical knowledge that is used to solve a problem with the strategy.

In fact, the mathematical problem-solving ability of students is still not optimal. This problem was encountered when a preliminary study was conducted in January 2018 in junior high schools in the city of Padang, namely Padang 10 Junior High School, Padang 14 Junior High School and Padang 24 Junior High School. The Preliminary study was carried out on students of class VII of the academic year 2017/2018 in mathematics. The results of the problem-solving ability test are given, the average problem-solving ability of students is only 5.81 out of the 20 maximum scores that must be achieved by students.

Based on the problems encountered, the need for improvement in mathematics learning, especially for problem-solving abilities. Efforts to improve problem-solving skills in mathematics learning are necessary learning tools. Learning tools used are Student Worksheets and Learning Implementation Plans using the 2013 curriculum.

The student worksheet is a guide for participants who are used to conduct investigative or problem-solving activities. [3]. The development of this Student Worksheet is supported by the Learning...
Implementation Plan. Availability of Learning Implementation Plans will help students in carrying out the learning process so that the objectives of the learning objectives are expected to be achieved. The development of learning tools implements a learning model that is in accordance with the 2013 curriculum, namely the generative learning model.

Generative learning models are learner-centered learning models that enable active interaction. Generative learning is that the brain does not receive information passively, but instead actively constructs an interpretation of information. So, it can be concluded that generative learning can provide benefits for training to improve thinking and problem-solving skills and gain knowledge of important concepts.

Based on the description above, it is necessary to develop a mathematics learning tool in the form of Learning Implementation Plans and Student Worksheets with a valid generative learning model. Something is said to be valid if the thing said is right, in other words, validity is often interpreted with accuracy. Valid research if there are similarities between the data collected and the actual data on the object under study. Validity is 2, that is content validity is a need for intervention (a device made), and design is based on existing scientific knowledge while construct validity (consistency) is the design of interventions (learning devices) in accordance with the logic / the right reasons.

The formulation of the problem in this study is how the validity of mathematics learning devices in the form of Learning Implementation Plans and Student Worksheets with generative learning models developed for students of class VII junior high school?

2. Research Method

Learning tools are validated by experts to determine product validity in the form of Learning Implementation Plans and Student Worksheets. The data used in this study were analyzed descriptively and quantitatively by the method of filling out the validation assessment sheet.

The descriptive techniques are used because this study describes the validity of learning devices, while quantitative techniques are used with the analysis process using the validity criteria table. The method of filling out the validity sheet by giving a checklist for each indicator. The interpretation of the validity of learning devices is determined by the following criteria.

| Criteria | Interpretation |
|----------|----------------|
| V < 0.667 | Invalid        |
| 0.667 ≤ V | Valid          |

Author: (Azwar, 2013: 134)

The learning devices validated by lecturers at Padang State University consisting of 3 people in the field of mathematics, namely Dr. Dony Permana, M.Sc., Drs. Hendra Syarifuddin, M.Si, Ph.D., Dr. Rudi Chandra. Wj, S.Pd., M.Pd., M.H, M.M., 1 person in the field of language, namely Dr. Ngusman Abd Manaf, M.Hum and 1 person for the field of Educational technology namely Dr. Ramalis Hakim, M.Pd.

3. Results And Discussion

At the stage of development and prototyping, the design and validation process was carried out by several experts. The prototype-making phase begins with designing LKPD based on generative learning models. The results of this design are called prototypes 1. After the LKPD is produced based on generative learning models, self-evaluation is carried out by the researchers themselves.

When self-evaluation is still found typing letters, imperfect sentences, and incorrect punctuation. After correcting errors encountered in self-evaluation, the learning tools are submitted to the experts to be validated. The aspects validated in the Learning Implementation Plan are component aspects, learning activities, and linguistics. Validation of Learning Implementation Plans is carried out by 4 experts consisting of 3 mathematicians, and 1 Language expert. The results of RPP validation by experts can be seen in Table 2 below.
Table 2. Results of Assessment of Validation of Learning Implementation Plans

| No | Aspek yang dinilai                      | Average Assessment Score | Average Criteria |
|----|----------------------------------------|--------------------------|------------------|
|    |                                        | V1  | V2  | V3  | V4  |          |                 |
| 1  | Components of Learning Implementation Plans | 0.96 | 0.85 | 0.88 | -  | 0.90   | Valid           |
| 2  | Learning Activities                     | 0.94 | 0.93 | 0.96 | -  | 0.94   | Valid           |
| 3  | Linguistic                              | -   | -   | -   | 0.75| 0.75   | Valid           |
|    | Overall average                         | -   | -   | -   |    | 0.86   | Valid           |

Information:
V1 = Validator 1 is Dr. Dony Permana, M.Sc.
V2 = Validator 2 is Drs. Hendra Syarifuddin, M.Sc, Ph.D.
V3 = Validator 3 is Dr. Rudi Chandra, Wj, S.Pd., M.Pd., M.H, M.M.
V4 = Validator 4 is Dr. Ngusman Abd Manaf, M.Hum.

Table 2 obtained the results of the validity of the Learning Implementation Plan designed using a generative learning model is valid according to experts. The average assessment of each aspect is on valid criteria, although there are still improvements in the Learning Implementation Plan that have been designed by researchers.

Validators give the advice to separate each Basic Competency and add Basic Competency 4 for each Learning Implementation Plan that is developed and improve writing in the form of punctuation that is still inappropriate. Based on the validator's suggestion, the researcher revised the Learning Implementation Plan developed so that it could be used to assist in the learning activities process. One example of steps in the Learning Implementation Plan before and after being revised can be seen in Table 3 below.

Table 3. Results of Revision of Learning Implementation Plans Based on Validator Suggestions

| No | Before Revision | After Revision |
|----|----------------|----------------|
| 3  | 3.1 Menjelaskan dan menentukan urutan pada bilangan bulat (positif dan negatif) dan pecahan (偏, campur, desimal, persen) | 3.1.1 Membandingkan bilangan bulat |
|    | 3.1.2 Menjelaskan dan menentukan urutan pada bilangan bulat (positif dan negatif) | 3.1.2 Membandingkan bilangan bulat |
|    | 3.1.3 Membandingkan bilangan pecahan | 3.1.3 Membandingkan bilangan pecahan |
|    | 3.1.4 Menjelaskan dan menentukan urutan pada bilangan pecahan (偏, campur, desimal, persen) | 3.1.4 Menjelaskan dan menentukan urutan pada bilangan pecahan (偏, campur, desimal, persen) |
Student worksheets are designed based on preliminary analysis by researchers on the analysis of students, analysis of learning problems, curriculum analysis, and concept analysis. From the results of the preliminary analysis, the Student Worksheet was designed based on the generative learning model. The Student Worksheet that has been designed is validated by 5 experts consisting of 3 mathematicians, 1 language expert, and 1 educational technology expert.

The validated aspects of the Student Worksheet are aspects of presentation, content feasibility, graphics or appearance, and language. After the improvements are made, the validators provide an assessment of the learning device. The results of the validation of the Student Worksheet by experts can be seen in the following table.

| No | Aspek yang dinilai | Average Assessment Score | Average | Criteria |
|----|--------------------|--------------------------|---------|----------|
| 1  | Presentation       | 0.96 0.89 0.93 - -         | 0.93    | Valid    |
| 2  | Feasibility of content | 0.93 0.93 0.96 - -         | 0.94    | Valid    |
| 3  | Linguistic         | - - - 0.83 -              | 0.83    | Valid    |
| 4  | Integrity          | - - - - 0.83             | 0.83    | Valid    |
|    | Overall Average    |                          | **0.88**| **Valid**|

**Information:**

V1 = Validator 1 is Dr. Dony Permana, M.Sc.
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V3 = Validator 3 is Dr. Rudi Chandra, Wj, S.Pd., M.Pd., M.H, M.M.
V4 = Validator 4 is Dr. Ngusman Abd Manaf, M.Hum.
V5 = Validator 5 is Dr. Ramalis Hakim, M.Pd.

Overall the Student Worksheet based on generative learning model validated by mathematicians has fulfilled valid criteria with a validity index on the presentation aspect is 0.93. The results of the validation describe the Student Worksheet in accordance with the competencies to be achieved. The addition to the presentation aspects of the Student Worksheet, another aspect that is seen is the aspect of the feasibility of the content on the Student Worksheet with a validity index of 0.94. Validation results illustrate that there is a match between the material and training.

The aspect that is seen next is the aspect of language with a validity index of 0.83. Validation results illustrate that the use of sentences in LKPD is in accordance with the good and communicative Indonesian language rules. The last aspect seen is the graphics aspect of 0.83. Validation results illustrate the characteristics and suitability of LKPD with generative learning models can help students to improve mathematical problem-solving skills. So, it can be concluded that LKPD with learning based on generative learning models is valid according to experts.
The validator gives suggestions to improve the Student Worksheet, one of which is to change the type of writing at the beginning of the Student Worksheet and pay attention to the punctuation marks that are not correct. One example of a Student Worksheet before and after being revised can be seen in Table 5 below.

| No | Before Revision |
|----|-----------------|
| 1. | Risa dan Rani akan memulai sekolah di SMPN Bakti Jaya menjadi siswa baru kelas VII. Oleh karena itu Risa dan Rani mengganti toko buku untuk membentuk peralatan sekolah. Risa ingin membuka toko buku, pena, penghapus, buku mata pelajaran matematika dan buku mata pelajaran IPA, sedangkan Rani akan membuka toko buku, pena, buku mata pelajaran bahasa inggris, dan buku pelajaran IPS. Sekarang kita perhatikan ternyata Rani dan Risa sama-sama membuka toko buku. Oleh karena itu dapat dikatakan irisan dari perangkap yang dibeli Risa dan Rani adalah pena dan buku tulis. |

### Table 5. The Student Worksheet Revision Results Based on Validator Suggestions

| No | Before Revision |
|----|-----------------|
| 1. | Risa dan Rani akan memulai sekolah di SMPN Bakti Jaya menjadi siswa baru kelas VII. Oleh karena itu Risa dan Rani mengganti toko buku untuk membentuk peralatan sekolah. Risa ingin membuka toko buku, pena, penghapus, buku mata pelajaran matematika dan buku mata pelajaran IPA, sedangkan Rani akan membuka toko buku, pena, buku mata pelajaran bahasa inggris, dan buku pelajaran IPS. Sekarang kita perhatikan ternyata Rani dan Risa sama-sama membuka toko buku. Oleh karena itu dapat dikatakan irisan dari perangkap yang dibeli Risa dan Rani adalah pena dan buku tulis. |

4. The Conclusion
The results and discussion in the description above, the tools that have been developed can be said to be valid and have been used. The assessment of the validity of the device in the form of a Learning Implementation Plan produces an overall validity value of 0.86 with a valid category. Whereas for devices in the form of Student Worksheets produce overall validity values of 0.88 with valid categories. Learning tools based on generative learning models generated from this study have met valid product quality criteria.

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