Design of Internet Integrated Students Worksheet for Developing the Ability of Mathematical Reasoning

Selvi Riwayati, Yuriska Destania
Mathematics Education Study Program
Muhammadiyah University of Bengkulu
Bengkulu, Indonesia
riwayatselvi@gmail.com

***Abstract*—The learning process is the availability of adequate learning resources to support student learning activities. Learning resources that are often used in lecture activities so far are textbooks of publishers that were also used in the course of Introduction to Probability. However, the use of the book is less supportive in the lecture activities. Therefore this research intends to develop student's worksheet (LKM) which can optimally develop the ability of mathematical reasoning and can be accessed by internet. The research model used in this study was Research and development / R & D. The subjects of this study were the students of mathematics education study program. The data collection techniques used was Walk through to determine the validity of LKM highlighted on the content, constructs, and languages. The tests and interviews were also used to know the practicality of the potential effects of LKM of internet integrated toward the ability of mathematical reasoning of the students. The results of this study were 7 problems of the ability of valid and practical mathematical. In addition to a good worksheet, students can develop thinking patterns to maximize mathematical reasoning skills so that human resources with high competitiveness are created in the face of advances in science and technology.**

Keywords—student worksheet; mathematical reasoning ability

I. INTRODUCTION

Mathematics is an understanding. By studying mathematics, a person is required to be able to understand a problem faced. The solution of the problem is arranged hierarchically with patterns that are mutually sustainable so that the desired results are achieved from the resolution of the problem. Learning mathematics will be more meaningful if the child "experiences" what he learns, not "knows". Mathematical learning which is still oriented towards mastery of material has proven successful in short-term remembering competitions, but failed to equip children in solving problems in long-term life. This is what also happens in mathematics learning today. Students are more passive, reluctant, afraid or ashamed to express their opinions.

Students' understanding of the material needs to be improved with the right actions to make it easier to understand the concept and stimulate thinking skills, especially the reasoning ability in exploring and maximizing the competition owned by students.

Rapid advances in technology and information have an impact on progress in the field of science. This has implications for how a person acquires knowledge, not only through formal education that demands direct interaction with lecturers but can also use the internet as a learning resource.

The selection and use of appropriate learning resources in the activities of the teaching and learning process plays an important role in directing student learning experiences. Worksheets as learning resources can be used as alternative learning media. LKS is included as a print media the results of the development of print technology in the form of books and containing visual material [1]. Worksheets are a type of handout that is intended to help students learn directed.

By using worksheet, students can learn systematically and get information about the concepts being studied. An integrated internet worksheet can make it easier for students to access it. Therefore, the main objective in this research is to develop teaching materials in the form of valid and practically integrated internet MFIs that can develop students' mathematical reasoning abilities, namely basic competencies that are expected to be applied in learning processes and activities.

The development of an LKM is an alternative learning resource that can help students and lecturers in the teaching and learning process. According to Ahmad, in the teaching dharma, each lecturer is required to prepare himself in class learning by compiling GBPP, teaching materials and lecture event units [2]. Developing worksheet should be the ability that every lecturer must possess. If the lecturer does not have the ability to make worksheet with varied questions, the learning will be monotonous and boring.

The expected mathematical reasoning ability is to develop the student's thinking process so that it can support the ability of students to give reasons for arguments from what is stated by connecting the facts they have known. According to Lithner, reasoning is thought adopted to produce statements and reach conclusions on problem solving that is not always based on formal logic so that it is not limited to evidence [3].

According to the NCTM in Rosita, to support the implementation of mathematics learning, teachers should pay attention to five aspects of teaching mathematics, namely [4]:

- Connections (connections).
- Reasoning (reasoning).
- Communications (communications).
- Problem solving *(problem*-solving).
- Representation (representation).

Some indicators of mathematical reasoning in mathematics learning, among others, students can [5]:

- Draw logical conclusions explain.
- Models, facts, traits, and relationships.
- Estimating answers and process solutions.
- Using patterns and relationships to analyze mathematical situations.
- Compile and test conjectures.
- Formulate opponent's example (*counter example*).
- Follow the inference rule and check the validity of the argument.
- Compile valid arguments.
- Arrange proofs directly, indirectly, and use mathematical induction.

Based on the indicators of mathematical reasoning stated above, in this study students are said to have mathematical reasoning ability if students have the ability to construct and evaluate arguments both themselves and their colleagues' arguments, and can generalize when drawing.

The development of teaching materials in the form of tertiary LKM has a very important role in determining the success of learning. Learning resources can help lecturers and students in the teaching and learning process where students are given the opportunity to learn mathematical concepts both individually and in groups. Therefore, it is reasonable if Suryani found that LKM are able to increase student activities in the lecture process and can improve student learning outcomes in Many Variable Calculus 1 [6]. In line with that given by Pala the development of socialization skills and integration of character education were an important part of a child's academic success [7]. Therefore Leo states the character of education that focuses on the students identity development to be smart and having students character needs to be forced though informal and formal education [8]. Buchori from the results of implementation from class and test evaluation were already in action, the result was obtained in the experimental class average is 8.9 and 6.5 in the control class [9]. This suggests that learning model of education through e-comic character can stimulate student motivation to learn and can improve student character education from an early age so that it will successful for further education.

The results of the study show that by using LKM, students are more motivated in learning so they can improve learning outcomes. After analyzing the material to the needs of teaching materials taking into account the limitations that exist, this study only developed teaching materials in the form of student worksheets on permutation and combination material.

Therefore, the main objective in this study is to develop teaching materials in the form of integrated internet LKM that can optimally develop students' mathematical reasoning abilities, namely basic competencies that are expected to be applied in learning processes and activities. Development activities will be carried out in collaboration between students and lecturers, so it is expected that the results of this study can provide teaching materials in the form of LKM that are in accordance with the need to improve learning outcomes and can also develop students' mathematical reasoning abilities.

II. RESEARCH METHODS

The sample in the study was students of Mathematics Education Study Program of Muhammadiyah University of Bengkulu who took the Introduction to Probability course. This research instrument is an integrated internet Student Worksheet (LKM) to develop students' mathematical reasoning abilities. The research model used in this study was Research and development / R & D. According to Sugiyono, R & D is a research method used to produce certain products and test the effectiveness of these products [10].

The developer procedure is presented in the following diagram:

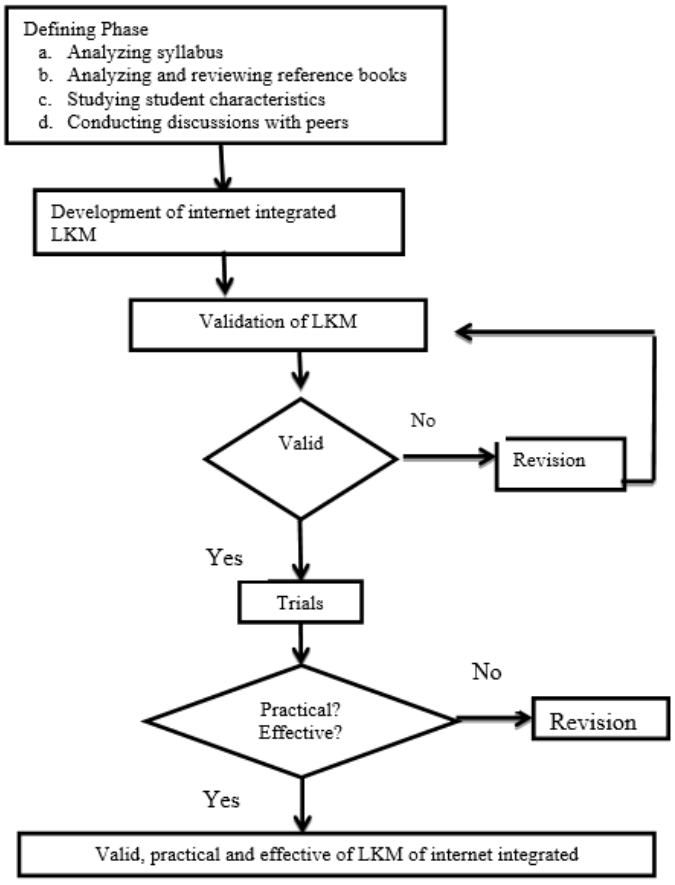

Fig. 1. Flowchart of research procedures.

The data collected from the trial will determine the quality of the products produced, namely in the form of qualitative data and quantitative data about mathematical reasoning abilities related to product quality. So the data in question is related to the accuracy of the substance, the accuracy of the method, and the accuracy of the product design. This data leads to two aspects, namely media aspects and instructional aspects.

III. Results and Discussion

In this study the teaching material developed was in the form of student worksheet (LKM). The development model has gone through 4 steps according to the stages of research. After analyzing the material on the needs of teaching materials by considering the limitations that exist, this study only develops teaching materials in the form of student worksheet on permutation and combination material.

The initial design of student worksheet (LKM) that are internet integrated is designed to be adjusted to the stages of each learning activity. LKM of Internet-integrated that are developed direct students to develop mathematical reasoning skills, including students can draw logical conclusions, provide explanations with models, facts, traits, and relationships, estimate answers and process solutions, use patterns and relationships to analyze mathematical situations .

The problems that exist in an LKM of integrated internet are presented contextually so that students can more easily understand the concept of the material and identify the problems learned. An LKM of internet integrated design is made as attractive as possible in the presence of color and supporting images in order to foster student motivation to learn.

After an integrated internet LKM has been created, the next step is instrument validation for the validator who is competent in the field, in this case there are 4 validators. The validated form is the content or content and assesses the construction that is on the student worksheet. Specifically the criteria used are content, linguistic, presentation and graphical eligibility.

From the results of the validation it can be concluded that after making some improvements, the developed LKM are valid and can be used for the next stage. The results of the revision in several parts after being evaluated by the validators produced draft II which was then piloted on 10 randomly selected respondents. This respondent was a mathematics education student at the Faculty of Teacher Training and Education of the University of Muhammadiyah Bengkulu who had already received an Introduction to Probability course. This trial aims to see the clarity and readability of the internet-integrated student worksheets developed so that improvements can be made and produce draft III.

Based on the response of students to the developed LKM showing very good results, the revised III was not revised. This means that the teaching materials in the form of the LKM can be continued and are suitable for use in field tests in the learning.

This test is not a benchmark for whether or not teaching materials in the form of integrated internet LKM are used. But as a reference how much more effort is made to get better learning. The results of the analysis provide the following results.

TABLE I. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	*Std. Deviation*	*Std. Error Mean*	*95% Confidence Interval of the Difference*				
					Lower	*Upper*			
Pair 1	pretes - postes	-5.45455	1.22706	.21360	-5.88964	5.01945	-25.536	32	.000

The results of this output showed that it turned out that after the LKM based problem-based learning was carried out, the average mathematical reasoning ability of students had increased. Teaching materials in the form of LKM can support the achievement of better learning outcomes. LKM that are developed have potential effects, this can be seen based on the average value of students' mathematical reasoning abilities in good categories.

This is in line with the development of teaching materials in the form of LKM developed by Apriyani which conclude student activities in the learning process using 83% student worksheets, which are active students and positive responses [1]. This indicates that LKM are effective in increasing student activities and learning outcomes in Algebra Structure courses.

The development of LKM was also developed by Mairing who concluded that the use of LKM can encourage students to have meaningful knowledge skills, enjoy data analysis courses and the learning methods they use, motivated to learn and solve problems and projects in student work independently, active during lectures, and have the ability to analyze using Minitab and Microsoft Excel [11]. Thus the provision of teaching materials in the form of LKM in addition to being in accordance with the ability of students must also be in accordance with the curriculum objectives. The results of these studies indicate that the learning activities and processes supported by the availability of adequate learning resources greatly support the success of students.

IV. Conclusion

Based on the results of this study, it can be concluded that the internet integrated Student Worksheet (LKM) that has been designed and developed is valid and practical and feasible to be tested in the learning process to facilitate students' mathematical reasoning abilities. Teaching materials in the form of internet integrated LKM are interesting and can lead to learning motivation amid the limitations of teaching materials. This LKM produces 7 problems in Permutation and Combination material.

ACKNOWLEDGMENT

This research was funded by the Directorate of Research and Community Service Directorate General of Strengthening Research and Development of the Ministry of Research, Technology and Higher Education, 2017-2018.

REFERENCES

[1] E.P.W. Suminar, D. C. N. Apriyani, "Pengembangan Lembar Kerja Mahasiswa pada Mata Kuliah Struktur Aljabar untuk Mahasiswa STKIP PGRI Pacitan". Humaniora, vol. 04, No. 01, Oktober 2016, pp. 410-473.

[2] S.S. Ahmad, Pengantar Pengembangan Bahan Ajar di Perguruan Tinggi. Disampaikan pada Pelatihan Pengembangan Bahan Ajar Bagi Dosen. Pekanbaru 30 April 2009.

[3] J. Lithner, "A Research Framework for Creative and Imitative Reasoning". Education Study Mathematic, vol. 67, pp. 255-276, 2008.

[4] D.C. Rosita, "Kemampuan Penalaran dan Komunikasi Matematis: Apa, Mengapa, dan Bagaimna Ditingkatkan pada Mahasiswa". Euclid, vol. 1, No 1, pp. 1-59, 2012.

[5] U. Sumarmo, Berpikir dan Disposisi Matematik: Apa, Mengapa, dan Bagaimana Dikembangkan pada Peserta Didik. Makalah disajikan dalam Seminar Nasional. Bandung: Universitas Pendidikan Indonesia, 2010.

[6] M. Suryani, "Validitas Lembar Kerja Mahasiswa (Lkm) Untuk Materi Logaritma Pada Perkuliahan Aljabar Dasar Di Stkip Pgri Sumatera Barat". Jurnal Pelangi. 2015 Jul 29, vol. 7(2).

[7] A. Pala, "The Need For Character Education", International Journal Of Social Sciences And Humanity Studies, vol 3, No 2, 2011 ISSN:1309-8063 (online) diakses 30 Januari, 2011.

[8] A. Leo, "Character Education Integration In Social Studies Learning". International Journal of History Education, vol. 12, No. 2, 2011.

[9] A. Buchori, R. D. Setyawati, "Development Learning Model Of Character Education Through E-Comic In Elementary School", International Journal of Education and Research, vol. 3 No. 9 September 2015.

[10] Sugiyono, Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif dan R&B) Bandung: Alfabeta, 2010.

[11] P.J. Mairing, "Pengembangan Lembar Kerja Mahasiswa Berbasis Masalah dan Proyek pada Mata Kuliah Analisis Data". Jurnal Pendidikan, vol. 14, Number 2, September 2013, pp. 53-61.