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**Developing Discovery Learning Model on the Theme of Tofu
Industry to Improve Students' Numeracy Skills**



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Developing Discovery Learning Model on the Theme of Tofu Industry to Improve Students' Numeracy Skills

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Abstract

Purpose: This research was purposed to develop learning tools consisting of teaching module, student worksheet, and numeracy test questions using the Discovery Learning as a learning model on the theme of the tofu industry that are valid, practical, and effective.

Methodology: The research type was R&D research by using Thiagarajan 4D as the development model. The used data collection techniques were observation, numeracy test result, and student response questionnaire. The observation technique itself was implemented in the form of learning tools implementation and student observation. The research participants consisted of 33 students in the trial class, 32 students in the experimental class, and 32 students in the control class.

Findings: The research result obtained that the developed learning tools have valid, practical and effective criteria. Validity is obtained from the validity coefficient of learning tools and research instruments including teaching module, student worksheet, and numeracy test questions of 4.45; 4.52; and 4.54 respectively. Practicality was obtained from the result of practical analysis based on the observation of implementing learning tools, student observation, and student response questionnaires of 91.63%; 91%; and 88.22% respectively in very good category. Effectiveness was obtained based on the result of the numeracy test of 87.8% with an increase in the average N-Gain value of 0.79 with a very high category. In addition, another finding is that the developed learning tools have a significant effect on improving students' numeracy skills as indicated by the average N-Gain value of the experimental class is greater than the control class. Based on statistical tests conducted, the pretest and posttest values of the experimental class and control class based on statistical tests obtained Sig. (2-tailed) = 0.000 (sig. <0.05). It shows that there is a significant effect of implementing the Discovery Learning as learning model on the theme of tofu industry on increasing the students' numeracy skills.

Unique contributions to theory, practice and policy: It is suggested that teachers can develop and apply Discovery Learning by presenting problems in everyday life on other learning materials. This is because The Discovery Learning model can improve students' numeracy skills.

Keywords: *Discovery Learning, Learning Tools, Numeracy Skills*

1. INTRODUCTION

In the era of society 5.0, the government has been trying to improve the quality of education in Indonesia through the Minimum Competency Assessment (MCA). Two important competencies in the minimum competency assessment are literacy and numeracy which are essential for students to develop their abilities and participate positively in society (Purnomo et al., 2022). Assessing the quality of education in Indonesia through minimum competencies is based on the results of the Program for International Student Assessment (PISA) (Marhami et al., 2023). PISA is one of the programs used to evaluate mathematical literacy and numeracy in various countries that are members of PISA (Mouli et al., 2023). Based on the results of PISA assessment in the last 5 years according to OECD (2019), Indonesia is ranked 73 out of 78 PISA member countries. This is because Indonesia obtained an average mathematics score of 379 less than the average mathematics score of PISA members, while the average mathematics score of PISA members is 489 (OECD, 2019). It shows that the numeracy skills of students in Indonesia are still relatively low.

Numeracy skills are the ability to think using concept, procedure, fact, and mathematics in the context of solving everyday life problems (Pusat Asesmen dan Pembelajaran, 2020). The low numeracy skills in Indonesia can be shown from several research results such as (1) research conducted by Sa'dijah et al. (2023) showed that students' numeracy skills at the junior high school level in East Java are low with different levels such as 62% of students are at a low level, 30% of students are at a medium level, and 8% of students are at a high level. This is because students' mathematical abilities are low; (2) research conducted by Rezky et al. (2022) showed that students have low numeracy skills because their mathematical abilities are also low. Not only in East Java, Southwest Sumba also shows that students' numeracy skills are at low level; (3) research conducted by Ate & Ledes's research (2022) showed that the numeracy skills of students at St Josef Freinadementz Junior High School as many as 73.3% of students are categorized as very poor and 26.7% of students are categorized as poor in numeracy skills indicators; so that, the numeracy skills of these students are classified as low.

Based on the interview result with mathematics teachers at one of State Islamic Junior High Schools in Jember regency, it was found that most students' numeracy skills were in special intervention. One of the factors that influence the low numeracy skills of students include the fact that students are still not used to and have difficulty in solving Higher Order Thinking Skills (HOTS) problems and PISA questions (Maharani et al., 2019). In addition, the factor of student motivation towards mathematics subject is less attractive.

Rohmah et al (2022) mentioned that students who have low learning motivation and low understanding still think that mathematics is a difficult subject; so that, students are less interested in mathematics. Therefore, these factors can cause other factors such as students are not careful in noting material; so that, students still experience difficulties and lack ideas in solving the problems (Saragih et al., 2023). Maharani & Prabawanto (2022) mentioned that if the condition stated above happens to students, students also have difficulty in making mathematical formulation in solving the problems.

The recent research used the discovery learning model to improve students' numeracy skills by using the theme of tofu industry. This is because the discovery learning model can help students solve problems; so that, it can meet the first indicator of numeracy skills, and the theme of tofu industry is taken because this industry exists in the surrounding school area. Therefore, students can learn mathematics and gain knowledge about the role of mathematics in everyday life, especially in the home-based tofu industry. According to Jana & Fahmawati (2020), the discovery learning model can improve students' mathematical problem-solving skills at SMP PGRI Kasihan with the result of the average test scores for each cycle increased and the scores for each aspect of mathematical problem-solving ability also increased. Khairunnisa & Juandi (2022) found an increase in students' mathematical abilities from the effect of applying the discovery learning model of 0.815 with a high effect category; so that, the discovery learning model becomes an alternative mathematics learning in improving students' numeracy skills (Saniah & Nindiasari, 2023). Therefore, learning tools are needed to improve numeracy skills including teaching module, student worksheet, numeracy test questions on the theme of tofu industry.

2. RESEARCH METHODS

This reserach used research and development by using Thiagarajan's 4D model. The 4D model consists of four stages, namely the defining stage, the designing stage, the development stage, and the dissemination stage. One of State Islamic Junior High Schools in Jember Regency was used as a research site due to there was no learning tools used in improving students' numeracy skills. In addition, based on the pretest result, the average numeracy ability of students was still relatively low. The research participants consisted of 33 students of the trial class, 32 students of the experimental class, and 32 students of the control class. The developed research products were teaching module, student worksheet, and numeracy test questions with the theme of tofu industry. In this research, the used

research instruments included observation sheet for the implementation of learning tools, student observation sheet, and student response questionnaires.

To determine the quality of learning tools, analysis was needed to meet the criteria of valid, practical, and effective. Valid criterion was based on the analysis of validity obtained from the analysis of expert validation consisting of two lecturers of Mathematics Education FKIP University of Jember and one mathematics teacher of MTs Negeri 2 Jember. The validity of learning tools is based on table 1 as follows.

Table 1. Validity Criterion

Validity Coefficient (Va)	Category
$1 \leq Va < 2$	Highly Invalid
$2 \leq Va < 3$	Not Valid
$3 \leq Va < 4$	Less Valid
$4 \leq Va < 5$	Valid
$Va = 5$	Very Valid

Source: Hobri (2010)

The next data analysis was the practicality analysis which is used to determine the level of practicality obtained from the observation data of implementing the learning tool, student observation, and student response questionnaires. The practical criterion for learning tools is based on table 2 as follows.

Table 2. Practical Criterion

Score	Category
$90\% \leq SR \leq 100\%$	Very Good
$80\% \leq SR < 90\%$	Good
$70\% \leq SR < 80\%$	Enough
$40\% \leq SR < 70\%$	Poor
$0\% \leq SR < 40\%$	Very Poor

Source: Hobri (2020)

The effectiveness analysis was based on the numeracy test results. The learning tools meet the effective criteria if the completeness of learning outcomes is $\geq 70\%$; the average numeracy improvement based on N-Gain is high category; and statistical test shows the effect of implementing learning tools on improving students' numeracy skills.

3. RESULTS & DISCUSSION

This section describes the process and result of developing learning tools using Thiagarajan's 4D model. The description is as follows.

3.1 Defining Stage

In the defining stage, five things were carried out consisting of beginning-end analysis, student analysis, concept analysis, task analysis, and specification of learning objectives. At this stage, problems were obtained in the learning process. Based on the pretest result, students' numeracy skills were still relatively low. In addition, the learning that was done still could not improve students' numeracy skills. Therefore, it was necessary to hold a learning tool that was in accordance with the problems encountered.

3.2 Designing Stage

In the designing stage, the learning tools included teaching module, student worksheet, and numeracy test questions. Test preparation, media selection, format selection, and initial design of learning tools were also conducted in this stage. The design of learning tools used the System of Linear Equations of Two Variables as the material with the theme of tofu industry using the discovery learning model. The design of teaching module and student worksheet was adjusted to the steps of the discovery learning model. The teaching module and student worksheet were used for three meetings, and numeracy test questions were presented in the form of problems found in tofu industry. The examples of the design of teaching module, student worksheet, and numeracy test questions were presented in Figure 1, Figure 2, and Figure 3.

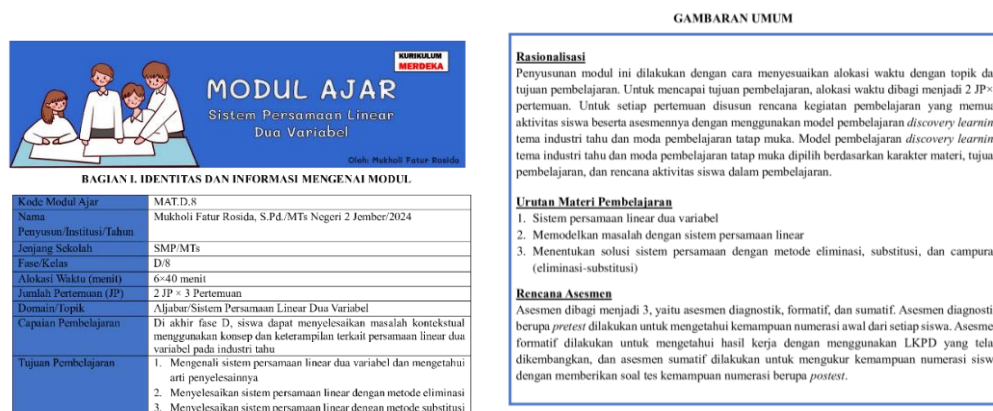


Figure 1. Teaching Module



Figure 2. Student Worksheet

SOAL TES

Mata Pelajaran : Matematika	Jawablah pertanyaan berikut ini !
Satuan Pendidikan : MTs Negeri 2 Jember	1. Berdasarkan paragraf ke-1, harga 1 kg kedelai jenis C di toko “ Kedelai Rosda Jaya” adalah ...
Materi : Sistem Persamaan Linear Dua Variabel	2. Berdasarkan paragraf ke-3 jika karyawan pak Fadli memotong tahu dalam ukuran besar dan ukuran kecil sebanyak 250 biji dan pendapatan yang diperoleh sebesar Rp104.000,00, maka banyak masing-masing tahu /biji pada potongan ukuran besar dan ukuran kecil adalah ...
Kelas : VIII	3. Jika Naura membeli 2 plastik tahu susu maka ia harus membayar Rp17.000,00, berapakah uang yang harus dikeluarkan Zoya jika ia membeli 2 tahu biasa dan 3 tahu kuning di kedai tahu pak Fadli? Jenis tahu apakah yang harganya paling murah?
Waktu : 60 Menit	4. Pada proses pembuatan tahu jika sebanyak 800 mL larutan garam dengan kadar 16% dicampur dengan larutan garam dengan kadar 20% dan 10 %, maka berapa mL larutan garam 20% dan larutan garam 10% yang dicampur?

Petunjuk Pengerjaan

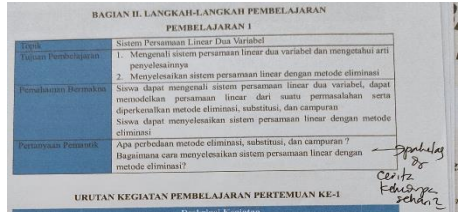
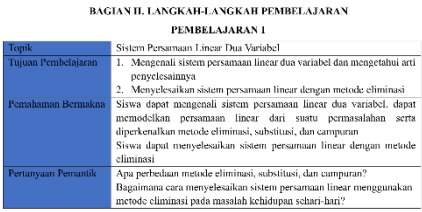
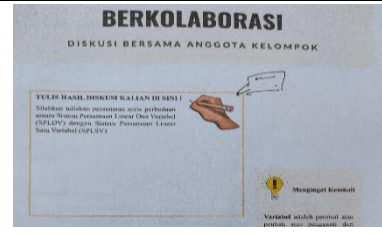

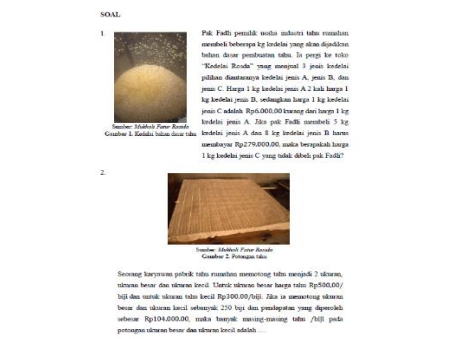

1. Tulislah identitas diri pada tempat yang disediakan.
2. Jawablah pertanyaan secara sistematis dan benar sesuai ketentuan berikut.
 - a. Tuliskan apa yang diketahui dan ditanya
 - b. Modelkan permasalahan dalam bentuk pernyataan matematika atau model

Figure 3. Numeracy Skill Test Questions

3.3 Development Stage

The design of learning tools developed was then validated to experts to get suggestions to make improvements; so that, it could be tested on students. The experts consisted of two mathematics education lecturers and a mathematics teacher at the trial school. The suggestions from the validators are presented in Table 3.

Table 3. Validators' Suggestions

Learning Tools	Before Revision	After Revision
Teaching Module		
Student Worksheet		
Numeracy Test Questions		

Based on data analysis, the validation of teaching module, student worksheet, and numeracy test questions are 4.45; 4.52; and 4.54 respectively. This shows that the validity coefficient value (V_a) is at $4 \leq V_a < 5$ and is categorized as valid. The validation result is presented in table 4.

Table 4. Validation Result

No	Learning Tools	Validity Coefficient (V_a)	Criteria
1	Teaching module	4.45	Valid
2	Student worksheet	4.52	Valid
3	Numeracy test questions	4.54	Valid

After the learning tools were declared valid, then the trial was conducted in the experimental class. The trial was conducted for three meetings, and tests were conducted at the beginning of the meeting and at the end of the meeting. Based on the result of the trial, the learning tools were declared to be practical and effective. Practicality indicator was based on the observation result of implementing the learning tools, student activity, and student response questionnaires. Data on the results of practicality test on the learning tools are presented in Table 5.

Table 5. Results of Practicality Test on Learning Tools

Observation Results	Meeting			Average	Category
	1	2	3		
Learning Implementation	90%	91.6%	93.3%	91.63%	Very Good
Student Activity	89%	91%	92%	91%	Very Good
Criteria					Practical

In table 5, the average observation result of learning implementation in three meetings is 91.63%, and it is in the range of $90\% \leq SR \leq 100\%$ with a very good category. The average student observation result in three meetings is 91% with a very good category. The third indicator of practicality test is based on the student response questionnaire that is 88.22% of students responding well to learning. From the three indicators of practicality, it can be said that learning tools are practically used in learning activities.

The effectiveness analysis of the learning tools is based on the result of the numeracy test. 29 out of 33 students obtained an average score of 86.15 with classical completeness of 87.8%. It shows that the learning tools developed are said to be effective because students' numeracy skills are classically complete. The effect of learning tools is based on the posttest scores of experimental and control classes through statistical tests which is presented in Table 6.

Table 6. Statistical Test of Posttest of Experimental Class and Control Class

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference	Lower	Upper
POSTES Equal variances assumed	3.304	.074	4.363	62	.000	13.781	3.159	7.467	20.096
Equal variances not assumed			4.363	56.296	.000	13.781	3.159	7.454	20.109

Based on table 6 above, the value of Sig. (2-tailed) = 0.000 (Sig. <0,05). Therefore, there is a significant effect of the developed learning tools. Thus, the teaching module, student worksheet, and numeracy test questions are declared valid, practical, and effective.

3.4 Dissemination Stage

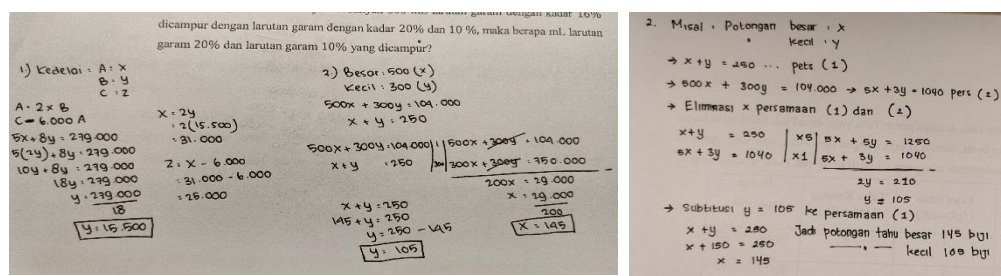
The last step is the distribution of learning tools through offline and online modes. Offline dissemination was carried out at the research site at one of State Islamic Junior High School in Jember Regency by distributing hard files of learning tools. Online dissemination was carried out by uploading learning tools to Google Drive and spreading links on social media such as Instagram and WhatsApp; so that, learning tools can be accessed by anyone.

Based on the analysis of the research results, teaching module, student worksheet, and numeracy test questions that met the valid criteria were then tested. The developed teaching module and student worksheet were adjusted to the syntax of the discovery learning model. At the first meeting, there were still many students who were still not active both in group discussion and presenting the discussion result; so that, at this meeting, the numeracy indicators had not been seen because there was no initiative to ask. It happened because they were not used to doing group discussion and were still shy to ask. In the second meeting, there was an increase which showed that students were more active than the previous meeting. At this meeting, students could use concept, fact and reasons to solve the problems given. In the third meeting, students already understood the flow of discovery learning and they were more active and confident in discussing and presenting the results of discussion and question and answer activities. This is in line with Geong & Mahmudi (2023) who showed that the discovery learning model can orient mathematical concept

understanding and foster self-confidence. Based on this, the research finding is that students must be accustomed to practicing actively in discussion and question and answer activities; so that, it can foster student learning activeness, and students need to be accustomed to solving problems related to daily life.

Discovery learning can improve the problem solving process and encourage students to be active in learning through student worksheet (Nurchayani & Sumardi, 2022). This is because there is scaffolding that can guide students independently in solving problems in the student worksheet. In this 3rd meeting, students could work together with their respective groups by utilizing the scaffolding contained in the student worksheet. Putri et al. (2022) which states that student worksheet can provide a stimulus for students to work together. The numeracy test result in the trial class obtained classical completeness of more than 70%, namely 87.8%. This is in accordance with the effectiveness analysis indicator which is stated that students have completed classically.

The learning tools that have been categorized as practical and effective were then given to the experimental class. In the control class, the lecture method was used in learning process. In this class, the teacher played a more active role during learning by giving questions without any treatment, and students waited for direction from the teacher. Some things that happened in this class included numeracy indicators did not appear, lack of interaction between teachers and students or students with students, and students were more passive compared to the experimental class that used the discovery learning model. This is in line with Butar & Jailani (2023) who stated that the discovery learning model can improve student communication during the learning process. In addition, the discovery learning model can improve students' problem solving and collaboration (Anggraeni & Jailani, 2022). Based on this explanation, the finding of this research stated that the discovery learning model learning tool can affect the improvement of students' numeracy skills.



dicampur dengan larutan garam dengan kadar 20% dan 10%, maka berapa ml. larutan garam 20% dan larutan garam 10% yang dicampur?

1) Kecil : A : x
B : y
C : z

$$\begin{aligned} A &= 2x + B \\ C &= 6.000 - A \\ 5x + 8y &= 279.000 \\ 5(2x) + 8y &= 279.000 \\ 10x + 8y &= 279.000 \\ 18y &= 279.000 \\ y &= 279.000 / 18 \\ y &= 15.500 \end{aligned}$$

2) Besar : 500 (x)
Kecil : 300 (y)

$$\begin{aligned} 500x + 300y &= 104.000 \\ x + y &= 250 \\ 500x + 300y &= 104.000 & | \times 5 & \rightarrow 2500x + 1500y = 520.000 \\ 500x + 300y &= 104.000 & | \times 1 & \rightarrow 500x + 300y = 104.000 \\ \hline & & & 2000x + 1200y = 416.000 \\ & & & \underline{-2000x - 300y = -208.000} \\ & & & 900y = 208.000 \\ & & & y = 208.000 / 900 \\ & & & y = 231.11 \end{aligned}$$

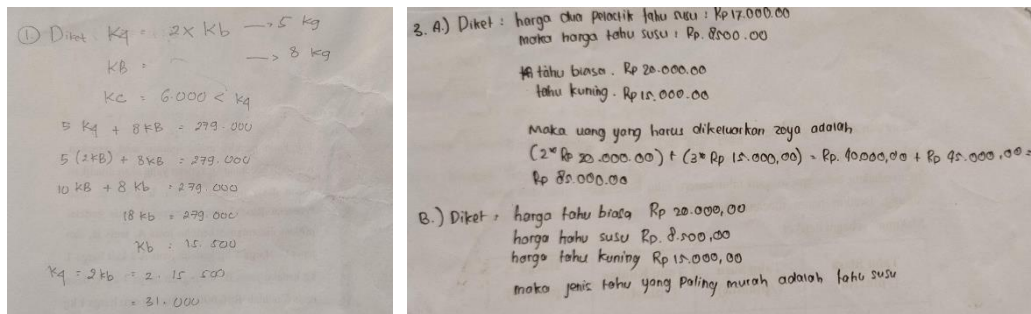
3) x + y = 250
145 + y = 250
y = 250 - 145
y = 105

4) x = 145

2. Kecil : Potongan besar : x
Kecil : y

$$\begin{aligned} x + y &= 250 \dots \text{pers (1)} \\ 500x + 300y &= 104.000 \rightarrow 5x + 3y = 1040 \text{ pers (2)} \\ \text{Eliminasi x persamaan (1) dan (2)} \\ \begin{array}{r|l} x + y = 250 & \times 5 \rightarrow 5x + 5y = 1250 \\ 5x + 3y = 1040 & \times 1 \rightarrow 5x + 3y = 1040 \\ \hline & 2y = 210 \\ & y = 105 \end{array} \\ \text{Substitusi } y = 105 \text{ ke persamaan (1)} \\ x + y = 250 & \text{ Jadi potongan tahu besar } 145 \text{ b(1)} \\ x + 105 = 250 & \text{ kecil } 105 \text{ b(2)} \\ x &= 145 \end{aligned}$$

Figure 4. Test Result of Numeracy Skills of Experimental Class Students



1. Diket: $Kq = 2 \times Kb \rightarrow 5 \text{ kg}$
 $Kb = \rightarrow 8 \text{ kg}$
 $Kc = 6.000 < Kq$
 $5 Kq + 8 Kc = 279.000$
 $5 (2Kb) + 8 Kc = 279.000$
 $10 Kb + 8 Kc = 279.000$
 $18 Kb = 279.000$
 $Kb = 15.500$
 $Kq = 2 Kb = 2 \cdot 15.500$
 $= 31.000$

2. A) Diket: harga dua pecahik tahu susu : Rp 17.000,00
 maka harga tahu susu : Rp 8500,00
 tahu biasa : Rp 20.000,00
 tahu kuning : Rp 15.000,00
 Maka uang yang harus dikeluarkan zoya adalah
 $(2 \times \text{Rp } 20.000,00) + (2 \times \text{Rp } 15.000,00) - \text{Rp } 40.000,00 + \text{Rp } 45.000,00 =$
 $\text{Rp } 85.000,00$

B.) Diket: harga tahu biasa Rp 20.000,00
 harga tahu susu Rp 8.500,00
 harga tahu kuning Rp 15.000,00
 maka jenis tahu yang paling murah adalah tahu susu

Figure 5. Test Result of Numeracy Skills of Control Class Students

The learning outcomes of students who used the discovery learning model were more improved compared to the learning outcomes of students who used the regular learning model. This is in line with Andrian et al. (2019) that the discovery learning model can improve students' reflective thinking skills and learning independence. High numeracy skills can help students in understanding and solving problems related to everyday life. Students have intelligence so that they can solve contextual problems and can analyze and interpret data (Milati et al., 2023).

The advantages of learning tools which used the discovery learning model on the theme of tofu industry in improving numeracy skills include: 1) the teaching module prepared has been adapted to the independent curriculum by presenting the discovery learning steps systematically at each meeting, 2) the developed student worksheet can make students actively work together and independently solve problem problems with the help of scaffolding, 3) the material and problems integrated into the student worksheet are adapted to the theme of tofu industry.

4. CONCLUSION AND SUGGESTION

Based on the results and discussion above, it can be concluded that the mathematics learning tool using discovery learning model on the theme of tofu industry developed using Thiagarajan's 4D development model can improve students' numeracy skills. The developed learning tools meet the criteria of valid, practical, and effective. The validity coefficient of the teaching module, student worksheet, and numeracy test questions are 4.45; 4.52; and 4.54 respectively. Practical criterion is obtained from the observation analysis of implementing learning tools, student observation, and student response questionnaires namely 91.63%; 91%; and 88.22% respectively with very good category. Effective criterion is based on the result of the numeracy test namely 87.8%. Therefore, the learning tools can be said to be valid, practical, and effective. In addition, the developed

learning tools can have an effect on improving students' numeracy skills based on statistical tests, and pretest and posttest scores of experimental and control classes obtained Sig. (2-tailed) = 0.000 (Sig. <0,05).

In this research, it is expected that other researchers can develop learning tools by presenting daily life problems using other learning materials or other research participants by developing similar learning tools.

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