Design Student Worksheets Based on Problem- Learning to Enhance Mathematical Communication

Ina Riyati¹, Suparman¹

¹Master of Mathematics Education, Graduate School, Universitas Ahmad Dahlan Yogyakarta, 55161, Indonesia

inariyati@gmail.com

DOI: https://doi.org/10.37134/ajatel.vol9.no2.2.2019

Published: 18 August 2019

Abstract

Mathematical communication ability is one of the abilities that must be possessed by students in 21st century learning. Worksheets of students who have not yet integrated mathematical abilities will hinder the achievement of learning objectives. Problem based learning is a model that can improve mathematical communication skills. This study aims to design mathematics student worksheets of problem-based learning models to improve mathematical communication skills. This research is a type of development research with the ADDIE model. This research focused on the design stage of ADDIE model. The subject of this study consisted of teachers and students of MTs Class VIII, Seleman, Indonesia. The instrument of data collection consists of observation guidelines, interview guidelines and documentation sheets. Observation guidelines are used for the characteristics of students' mathematical communication. The interview guide used to retrieve student characteristics data from the teacher's perspective during the learning process. The documentation sheet manual used to view curriculum implementation data that apply in the school. The data were analyzed by using quantitative data with the provisions of the Likert scale. Producing design products in the form of student worksheets as learning media, the quality of the design is "very good" with a score of 4.36. An average score of 4.08 by filling in the LKS design, 4.33 LKS design languages and 4.5 technical aspects. This study resulted in the design of student worksheets of problem-based learning models according to the needs of students. Student worksheets are designed to improve students' mathematical communication skills. The results of the study show that the quality of the design products produced based on the validity and the student worksheets met the criteria well. This research can be expanded at the stage of developing, implementing and evaluating.

Keywords: Design of student worksheets, mathematical communication, problem-based learning

INTRODUCTION

Mathematical communication is a way of sharing ideas and clarification of Understanding (NCTM. 2000). Accurate communication is vital to enable students to understand the processes, discussions, and decisions made (Viseu & Oliveira. 2017). Written precise communication is the intellectual activity that requires students to express their mathematical ideas or thoughts in writing (Pantaleon et al., 2018). Mathematical communication skills both oral and written can bring students to a deep understanding of mathematics. 21st-century skills consist of four main domains namely digital age literacy, inventive thinking, effective communication and high productivity (Turiman et al., 2012). The results of the study (Osman & Marimuthu, 2010) the skills found in the 21st century is one of them. Namely mathematical communication is critical and relevant to ensure that students are ready for a better future.

The National Mathematics Teachers Council (NCTM) states that learning programs in kindergarten to high school must give students the opportunity to: Organize and consolidate mathematical ideas and ideas by communicating them; Communicate their accurate thoughts logically and clearly to their friends, teachers, and others; Mathematical analysis and evaluation of other people's mathematical views; and using precise language to express the right idea (NCTM, 1989). The results of

the study (Lim & Chew, 2007) the importance of accurate communication in learning and learning mathematics.

But it is unfortunate, even though mathematical communication skills are, but there are still few students who have these abilities. Based on the results obtained by Indonesian students at the TIMSS event, it was seen that Indonesian students were still weak concerning mathematical communication, as happened with students' answers to one of the questions about reading data in a pie chart and presenting it in the form of bar charts (TIMSS, 2007).

Mathematical communication can be interpreted as the ability of students to convey something that they know through an event of dialogue or reciprocal relations that occur in a classroom environment, where there is a transfer of messages. Deleted messages contain mathematical material that studies, concepts, formulas, or problem-solving strategies (Rahmi et al., 2017). Communication mathematics is a dimension that is indispensable in teaching mathematics (Kaya, & Aydin. 2016). One effort that can be done by educators to develop students 'mathematical communication skills is by designing student-centered learning activities so that students' mathematical communication skills, both verbally and in writing, can be facilitated well. This is in line with the opinion (Lee, 2006) which states that to develop mathematical communication skills, what educators can do is change the way students interact with their work and other students. The first step we must take is to choose a learning model or strategy that is suitable for the goals to be achieved.

Problem Based Learning is student-centered learning (Bergstrom et al., 2016). Problem-based learning not only fosters the development of content knowledge, but also various skills, such as communication and collaboration skills, problem-solving, decision making, critical thinking, and independent learning (Wilder, 2015).

Student worksheets are guides used by students to carry out learning activities (Inan & Erkus. 2017). Student worksheets are created to help students connect problems with subject matter with everyday life (Yaden. 2017).

Learning with student worksheets allows students to learn more quickly to complete one basic competency (KD) or more, because students can learn it first, and student worksheets developed contain material and are rich in practice questions that will guide students in finding concepts, so that the student worksheets provided can direct students to solve mathematical problems related to real life.

Student worksheets are used because they are shorter, more comfortable and summarize the material along with questions to be able to help students in mathematical communication skills (Ruri et al., 2018). Student worksheets have not been widely used by teachers in most secondary schools in Pekanbaru (Murni & Anggraini. 2018).

Based on the identification of the problems above, the formulation in this study is the design of student worksheets with PBL models for class VIII MTS students on statistical material. Based on the wording of the problem, the purpose of this study is to improve students' mathematical communication.

METHODS

This research is design development research, developing student worksheets based on the problembased learning method. The model used in this study is ADDIE (Analysis, Design, Development, Implementation, and Evaluation). The ADDIE model can be seen in **Figure 1**.

Development procedures include analyzing, designing, developing, implementing, and evaluating. This research is limited only to the design stage to determine the design of student worksheets using the problem-based learning method to improve scientific communication. The subject of this study consisted of teachers and students of MTS Class VIII, Seleman, Indonesia. The instrument of data collection includes of observation guidelines, and documentation sheets. Observation guidelines are used for the characteristics of students' mathematical communication. Interview guidelines are used to see the need for teaching materials from teachers on PBL-based student worksheets. The documentation sheet manual is used to view data on the implementation of the curriculum, learning.



Figure 1. ADDIE model (Afifah & Suparman, 2018)

Materials and teaching materials that apply in the school. Qualitative techniques analyzed data. In this study validity data obtained from the results of the validator's assessment. The following is an explanation of data analysis techniques from the validity of student worksheets. Quantitative data with the provisions of the Likert scale.

Calculate the average score with the following formula

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Information: \bar{X} : average instrument score x_i : score on item I statement n: lots of statement items

Convert the average score to a qualitative value according to the assessment aspect as presented in Table 1. In this assessment, the learning device is said to be valid if it meets the classification of the minimum learning device assessment either.

Га	bl	e 1	1. (Convers	ion	score	for st	uden	t val	luatio	n and	l wor	ksl	heet of	classi	fication	score	range

Score Range	Classification
$\bar{X} > 4,2$	Very good
$3,4 < \overline{X} 4,2$	Good
$2,6 < \bar{X} \le 3,4$	Enough
$1,8 < \overline{X} \le 2,6$	Less
$\bar{X} \leq 1,8$	Very less

RESULTS AND DISCUSSION

Based on the ADDIE stage that has been explained in the research procedure, the problem-based learning based worksheet is produced as follows.

Step 1: Analysis

The analysis phase of the ADDIE model identifies performance gaps, differences between standards set in standard operating procedures (SOP) and some teacher performance. Gap performance is usually handled by learning products, namely: a collection of training and assessment materials in phase analysis in doing several stages. Methods of study can include surveys, interviews, and student observations and learning environments (Widoyoko, 2009). At this stage analysis of the needs and requirements for developing student, worksheets are carried out. Some analyzes at this stage are: Stage 1: Analysis of curriculum, teaching materials, and learning materials. The curriculum used in the MTS cadets is the 2013 curriculum. Mathematical communication skills are one of the abilities that must be possessed by students in 21st-century learning. According to interviews with teachers at MTS Taruna, for statistical material, the teacher uses student worksheets as teaching materials and uses conventional methods.

Stage 2: Analysis of learning methods. Regarding methods, conventional learning methods are also not able to help students in understanding statistical concepts because there is no real approach to objects that are learned and impressed with everyday life. Analysis of the learning method resulted in the thought that the need for PBL-based student worksheets to facilitate students in, so students were expected to be easier to understand statistical concepts and understand the problems to solve them.

Stage 3: Analysis of student characteristics. Based on the observation of the character of MTS Taruna VIII grade students, the first is when the teacher explains the lesson, some students do not pay attention to them, for example, telling stories with their peers, and some students are busy with their activities. Students are less interested in learning mathematics, so students lack concentration in learning. The three students were less active during the learning process.

Step 2: Design

Design Determine learning objectives, explore assessment strategies and choose teaching tactics (Rowland, 1993). At this stage design activities are carried out in the form of drafting in developing problem-based learning based worksheets. This stage is done by designing the product worksheets of students according to the results of the analysis at the define stage. Student worksheets consist of components (a) cover, (b) preface, (c) table of contents, (d) instructions for using student worksheets, (e) essential competencies, (f) PBL-based student worksheets, (g) problem orientation, (e) individual tasks. The activity steps are based on the problem-based learning model. In student worksheets, there are activities carried out by students in groups and provide opportunities for students to find their concepts to learn. The results of the initial design are called draft 1.

(a) Cover

Cover student worksheets are made interesting, so students are interested in working on student worksheets. Statistics material and is used for an eighth grade is illustrated in **Figure 2**.



Figure 2: Cover

The preface serves to provide the reader with the content or description contained in the student worksheet. This presentation not only thanks God and apologizes but the forward also consists of a general description of the subject and is equipped with stories that encourage others to read the student worksheet as shown in **Figure 3**.

An VII Ionuver 2 Katta Pi Propuber Inductions Addition to Associate Additional Ionemagnetisation a Annex Keep Kinney (Additional Schler Strein Herner Keep Kinney (Additional Schler Additional Schler Michael Market Market Additional Schler Additional Michael Market Market Additional Schler Additional Michael Market Market Additional Schler Michael Market Market Additional Schler Market Market Additional Schler Market Market Market Market Additional Schler Market Market Market Market Market Market Market Market Market Market Market Market Market Market Market Market Mark	dan kannin-Nya penik dan kannin-Nya penik ka Model Problem Band Konsu dengan harapan n konsuka samatanat a yang mengacu pada engkonstalkan konsep engkonstalkan konsep i manbi jash dari kana baca senantina penulis aplan terimakasib.
Nej nyskov krikelsen Allak Ber, brekar teknar bis norspersen kan Lenkar, Keg Bern (1202) Rome Renkar Kath Yull, Balewa tern sa konsense te sonsense kan	dan kannia-Nya pensis a Model Peoblem Based arccourts pada janjangan mu ikan. Kusuna dengan barapan a kommokasi matemati a membahami konsep engkonetsikan konsep engkonetsikan konsep i masih jash dari kata baca senaninas pensis aplan terimakanik.
Reg opping behavior of skill best, between theme the second second second second second second second second textures (Section VIII) the second secon	dan kanoni-Nya pendia dan kanoni-Nya pendia a Model Peothem Based nercursh pada janjungan nen dima. Kosmad dengan harapan n kosmadkasi matemati kosmadani kossep engkoneksikan konsep engkoneksikan konsep i mashi jash dari kata basa senantiasa pendia apkan terimakanih.
Lonzing Kelle VIII. Balawa teru sahan angay Ja- Ma Mahamadi Marin Manga undukuwa dalam samu Li Ki Shushka moli Patolan Based Lenzing Angan multi Malin saka kasaya dalam sang anya Kelle angangkan sahag cang perfaham rang angan Abada angang kasa kasaya dalam rang anananaka dalan pendahajana. Benda sang dalam teru manunaka dalan pendahajana. Benda sang dalam teru menguna. Oleh kareng dalam dalam kasaya dalam teru senguna. Oleh kareng dalam dalam kasaya dalam teru kareng dalam sang dalam teru dalam teru dalam teru kareng dalam teru dalam teru dalam teru dalam teru dalam teru kareng dalam teru dalam teru dalam teru dalam teru dalam teru kareng dalam teru dalam teru dalam teru dalam teru dalam teru dalam teru kareng dalam teru dalam teru kareng dalam teru	a mooti roomin bako kisuun dengan harapan homindkasi matemati a yang mengacu yada a menahami kinasep engkimetkukan kinasep i masih jouh dari kata beca senantisas penulti apkan terimakasih.
Nen Mahmmed KW urbget entrieste date mens LXS fentiske och instem fastes Laranig daget entrikklinis prakhanak konst date. Sampang med konst kan kan kan kan kan kan kan kan kan predskipten date metkin javat som kan kan predskipten date metkin javat som kan kan predskipten date metking kan kan kan kan kan kan kan predskipten.	natilam. Kisuun dengan harapan hommukusi matematk a yang mengacu pada a memahami konsep engkonekukun konsep imasih jash dari kata baca senanisa penulis spikan terimakasih.
LKB Streinis mol-Protein Rase Lereng der emsthältnissenan konze das knamagen sinns. LKB sin mergelan uter erne prefix eine predicionen des mehnts inst und wirken erne predicionen des mehnts inst und wirken erne Predicionen des mehnts inst und wirken eine Predicionen des sinnes der der bestehen der gen Predicionen des sinnes klächt des sams der jese hangeste. Atte pretakten des kerjassmange preside or	Sicuron dengan harapan n koemakasi matematk a yang mengacu pada a menahami konsep engkoneksikan konsep i masih jauh dari kata baca senamiata penulis apkan terimakasih.
dept encode likelitie in der Statistick im der Statistick im Statistick	n komunikasi matematk a yang mengacu pada a memalaani konsep engkoneksikan konsep i masih jauh dari kata baca senantiasa penulis spian terimakasih.
ume. LKB kin melogukan ukay erai perdik inu hagaha hotom Bede Lasening data data mengi pendukanan data melakah ukay ukuk utakan seja melokan pendukan pendukan pendukan pendukan hadia mengenan. Otok kerema ha, ketik das arasa dari pen mengunan. Otok kerema ha, ketik das arasa dari pen herejakan. Atas perlaktan dan kerjasamanya penduku	a yang mengacu pada a memahami konsep engkoneksikan konsep i masih jauh dari kata baca senamiasa penulis apkan terimakasih.
hagah Pathon Bood Learning dalan rangi pathojana dan matha inaw sank tarihan a mananaka dalan pendelagiana. Rendi angegatan dalan penamasa LKB ia segurana. Oleh keren itu, keliki dan saran dari pen hangkatu. Ana petuktua dan kerjanamanga penaltu ur	a memahami konsep engkoneksikan konsep i masih jauh dari kata baca senantiasa penulis apkan terimakasih.
pendrójana des meltas jares such terban annonita dan pendrójana. International dan anno pendrójana dan international dan anno pendrójana dan anno pendrójana dan anno pendrójana dan anno pendrójana dan anno pendrójana anno pendrójana dan anno pendrójana anno pendrójana anno pendrójana anno pendrójana anno pendrójana anno	engkoneksikan konsep i masih jauh dari kata baca senantiasa penulis apkan terimakasih.
natonalia dalos prodettajores. Pondo encopiari dalos presentantes LKS de nengonas. Colo kareta da, kella deu sarat dari per pendo de la construcción de la beljassenoyo presido se	i masih jauh dari kata baca senamiasa penulis apkan terimakasih.
Pendis negrateri dalan penunas KSB inagen dalam penunas KSB inagen dalam penunas hasi basi basi basi basi basi basi basi b	i masih jauh dari kata baca senantiasa penulis apkan terimakasih.
sempura. Oto karena itu, jene itu, jene itu	baca senantiasa penulis apican terimaicasih.
bargizan. Alsi perlahan dan kerjatemanju penda se	apkan terumakasih.
	Persona
	Ina Riyati
n Raped Learning	

Figure 3. Preface

(c) Table of Contents

•

The table of contents serves to make it easier to find the material you want to learn. The table of contents is arranged based on the page order on the student worksheet. The table of contents is shown in Figure 4.

		2
	DAFTAR ISI	
<u> </u>		
KATA PENGANTAR		
DAFTAK ISI		
Statistika		4
 Kompetensi Da 	ur.	4
 Lembar Kerja ! 	liswa Berbasis 98L	
 Lotihan 1 		
 Tugas Individu 		
Problem Based Learning	ŧ	 Page 2

Figure 4. Table of contents

(d) Instructions for Using Student Worksheets

Instructions for using student worksheets contain steps to use student worksheets to make it easier for students to use student worksheets as presented in **Figure 5**.

Petunjuk Penggunaan LKS	
Borchh LNS dergen reini Dickrakten mansch dahm LNS dergen rennen unter kriempele (4- er ang) Telden an kull dahm LNS dergen rennen vorse kriempele (4- der dahm LNS dergen reinigten dahlam tenher yong reinh die dahkan 4. Jedachan kull dahm kriempele kalam didegan guru dan rennennen.	
Kningk: Agen: 9	_
Problem Based Learning	Page 3

Figure 5. Instructions for use student worksheet

(d) Basic Competence

Basic competency is the result of a curriculum analysis that contains the achievement of learning outcomes that must be achieved by students as illustrated in **Figure 6**.

Nargarahin data terdapadan darihin data, dala rats-rata, median, molos, data Nargarahin data terdapadan darihi sengi terdapada pententi das, ada terastra, media, molecular data sengi terastra degrada data sendur tegratasa, data mendipat pendigi. Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Internet: Interne: Internet: Inter	Mangaothin data berdanakan denbiai data, sinki ena-eran, median, monku, data erkenan data sunki mengundi karangana, menhan keputana, dia menhari pendaka erang data sunki mengundi karanganakan data sunki mengundi kebungukan, senahari keputanakan data sunki mengundi kebungukan, menhari keputanakan data berdasakan disebuah data 1312 Manganakhin data berdasakan disebuah data 1313 Manganakhin data tera sunki angangka beranduaka menduai keputana, 1313 Manganakhin data seru, matada kanga databata data 1313 Manganakhin data seru, matada kanga databata data 1314 Manganakan data seru, matada kanga databata dataga databata	Kompetensi Da	ar l			
Meganalan den bedalanten derivela den den erstenen ersöne, mohan kon- kongenen den ersönen ersönen den ersönen ersönen ersönen den den den ersönen ersönen ers	 Desgatasia dara berdatasian denya dara dara marana angkan publik kenya dara dara dara dara dara dara dara da					
tester de la coloni angel de la regiona, nombre la pipusa, esta decidar pipusa regiona de la coloni angel de la coloni de la c	eristen das such anegado la sengenta, nombus legitarias, des antenber (pedia) neres, moles, moles, moles, des arbites das units mengando la mingrado, annotas personas, des mentions perdia) 131 1 Menganakin das berdiastatas darabas das 132 2 Menganakin das berdiastatas darabas das 133 2 Menganakin das berdiastatas darabas das 133 2 Menganakin das berdiastatas darabas das 134 2 Menganakin das berdiastatas darabas das 135 2 Menganakin das berdiastatas darabas das 135 2 Menganakin das berdiastatas darabas das 136 2 Menganakin das berdiastatas darabas das 136 2 Menganakin das berdiastatas das das das das 137 2 Menganakin das berdiastatas das mendos 138 2 Menganakin das berdiastatas das mendos 138 2 Menganakin das berdiastatas das mendos 139 2 Menganakin das berdiastatas dengan darabas das 139 2 Menganakin das terus, motada, das mendos 139 2 Menganakin das mentas yang berdiastas dengan darabas das 139 2 Menganakin das mentas yang darabas das das das 139 2 Menganakin das menganakiharan dengan das berungaka, mendosa tepunas, das mendoas yang das mendos das gas das berungakas, mendos tepunas, das mendoas yang das berungakas das das das das das das das das das d	Menganalisis data berd	asarkan distri	busi data, nilai	rata-rata, med	kan, modus, dan
mericina, methoda, finale factore de la succión energiando la seriego de la succión energiando la succión de la succión energiando la succión de la succi	ren verke, meletak, meleka, dan setekan data sarak arengande kainepulas, anenhas tepratesa, dan semelan perdiki. 1.1.2. Mengelamian dan bertantak dari barak arengande kainepulas, anenhas 1.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2	sebaran data untuk menj	pambil kesimpi	slan, membuat k	egutusan, dan n	nembuat prediks
14 14 15. Alexa (2010), 2010, 2017 Alexa (2011) and 2017 Alexa (2011),	 19 118. molecular tandom predicis. 19 119. molecular predicis. 19 119. Morganazio dai berkandra direkun dei anna battyatan etterpati, antenet predicis. 19 11 Morganazio dai berkandra direkun dei predicis. 19 10. Morganazio dai berkandra direkun dei predicis. 19 20. Morganazio dai terrenza direkun dei predicis. 19 20. Morganazio dai terrenza dei dai dai morganita direkun dei an anaburgerizia. 19 Morganiza dai dai errenza dai dai dai dai 20 Morganiza dai dai errenza dai dai dai dai 20 Morganiza dai dai errenza dai dai dai dai 20 Morganiza dai dai errenza dai dai dai dai 21 Morganiza dai dai errenza dai dai dai dai dai 21 Morganiza dai dai dai errenza dai dai dai dai 21 Morganiza dai dai dai errenza dai dai dai dai 21 Morganiza dai dai errenza dai dai dai dai 21 Morganiza dai dai dai errenza dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai 21 Morganiza dai dai dai errenza dai dai dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai 21 Morganiza dai dai dai dai dai dai dai dai dai da	Menyajucan dan menye.	esauan masa	an yang berkar	an oengan on	eroosi oasa, muar
Exploration, una restancia pressua Exploration de restancia discrimentaria Territoria de la construcción de la con	Explosions, una mentinara prevana. Explosions de la conseguración den terchica de la conseguración den terchica de la conseguración de la	rata-rata, median, modu	s, dan sebara	n data untuk m	ingambo kesur	pulan, membual
Initia sure 2 11 Marganetisis dan berdaneta darah dan dan dan darak darak dan darak	Existence Sections	keputusan, dan membuai	predicat			
	Subtaner 101 Mergenabis den berdaarine divelsui den 102 Mergenabis den treverse, media, den mede 102 Mergenabis den treverse, media, den meden 103 Mergenabis den treverse, media, den meden 104 Mergenabis den treverse, media, den meden 105 Mergenabis den treverse, media, den meden 103 Mergenabis den treverse, media, den meden 104 Mergenabis den treverse, media, den meden 105 Mergenabis den treverse, media, den meden 105 Mergenabis den treverse, media, den meden					
Industrie 21.51 Maryaniski die bestehenden 21.51 Maryaniski die instrumente onergehend begreisen einder begreisense der 21.51 Maryaniski die instrumente onergehend begreisense der 21.51 Maryaniski der einstrumente onergehende aussicht begreisense der 21.52 Maryaniski auf einstrumente onergehende bestehende aussicht einstrumente der 21.52 Maryaniski auf einstrumente onergehende bestehende aussicht einstrumente der 21.52 Maryaniski auf einstrumente onergehende bestehende aussicht einstrumente er 21.52 Maryaniski auf einstrumente onergehende bestehende aussicht einstrumente er 21.52 Maryaniski auf einstrumente erfahlten einstrumente der einstrumente er 21.52 Maryaniski auf einstrumente erstehende der einstrumente er 21.52 Maryaniski auf einstrumente erstehende der einstrumente einstrumente er 21.52 Maryaniski auf einstrumente erstehende der einstrumente er 21.52 Maryaniski auf einstrumente erstehende der einstrumente er 21.52 Maryaniski auf einstrumente er einstrumente er einstrumente er 21.52 Maryaniski auf einstrumente er einstrumente er einstrumente er 21.52 Maryaniski auf einstrumente er einstrumente er 21.52 Maryaniski auf einstrumente er 21.52 M	Balance 1 Margania Series Margania Series (Series) 1 Margania Series (Series) (Series) (Series) 1 Series (Series) (Series) (Series) (Series) (Series) (Series) (Series) 1 Series (Series) (Series) (Series) (Series) (Series) (Series) 1 Series) (Series) (Series) (Series) (Series) (Series) 1 Series) (Series) (S					
 10.11 Xeegaatiin itta berlänska förblut dra 10.12 Xeegaatiin sin servara, neika, den noku 10.13 Xeegaatiin sin servara, neika, den noku 10.13 Xeegaatiin sin servara, neika, den noku 10.13 Xeegaatiin sin servara, neika, den noku 10.12 Xeegaatiin sin servara, neika, den noku 10.12 Xeegaatiin sin servara, neika, den noku 10.13 Xeegaatiin sin sin servara, neika servara, neika servara, neika servara, servar	 13.11 Menganahin den berdasakan disubus dan 13.21 Menganahin skiller er van, meling, Alex molos 13.23 Menganahi serikari era van den sama dengangan keynana, methoda lapotasa, das 13.21 Menganahi serikari era van den sama dengangan keynana, methoda lapotasa, das 13.21 Menganahi serikari era van den sama dengan keynana, methoda lapotasa, das 13.22 Menganahi serikari era van den denga denga	Indikator				
3.11 Scienceshing Scienceshing 3.12 Scienceshing Scienceshing, Scienceshing 3.13 Scienceshing Scienceshing,	 Janganabia das berdasatas disorbus das Janganabia das berdasatas disorbus das Janganabia interventa, media, des modu Janganabia interventa, media, de modu<th></th><th></th><th></th><th></th><th></th>					
 2012 Despatibilis alla rearran, endes, des nodos 2012 Despatibilis alla rearran, endes, des nodos 2013 Despatibilis alla rearran, enaixía yeug bertaless des probais 2013 Despitais alla rearran, annais, das nodos 2013 Despitais alla rearran, annais, das nodos 2013 Despitais alla rearran, annais, das nodos 2014 Despitais alla rearran, annais, das nodos 2015 Despitais alla rearran, annais, das nodos 2016 Despitais alla rearranda das nodos 	2012 Zongonakisi aki raverata, melan, dan molos 2012 Xongonakis induri raverata, melan, dan sunda ingga dari kanga dan sunda varge pakasa mendoar targa dari kanga dan sunda varge pakasa dan sunda ingga dari kanga dari ka	3.10.1 Menganalisis dat	a berdasarkan	distribusi data		
312.3. Stepanshi inference dina mengandi Sepansa, mentonia taponas, du perdani 312.3. Stepanshi inference dina mengandi Sepansa, mentonia taponas, du perdani 312.3. Stepanshi inference dina mentonia 312.3. Stepanshi inference andira metanoli di sepansa, dana mentonia perdali 312.3. Stepanshi inference andira metanoli di sepansa, dana mentonia perdali 313.3. Stepanshi inference andira perdali di sepanshi, mentonia taponasi 314.3. Stepanshi inference di sepansi di sepansa, dana metano perdali. 315.3. Stepanshi inference di sepansi dana metano perdali. 315.3. Stepanshi inference di sepansi.	2013. Nenganakin interas dina unita mengandi keputana, membar inputana, di prefikai 1021. Mengipian dia menyetanikan masikin yang terkahan dengan dimihuli den 1022. Mengipian dina terkan, median, dia meningkan, mendurungkan selamat dana mengandi kerimputan, mendurungkan pertamban dina mengandi kerimputan, mendurungkan pertamban dina mengandi kerimputan, mendurungkan pertamban dina menduruk dina menduruk 1023. Mengipakan karian dari unita menduruk aputana 1024. Mengipakan karian dari unita mengandi kerimputan, menturuk keputana dasa menturu perdakai.	3.10.2 Menganalisis nila	i rata-rata, me	dian, dan modu		
profikia 10. Storegijskas oki na oznajelna kaja kaja bražalna degas darbou dati 10. Storegijskas oki na okaja maja da izvanja na okaja 10. Storegijska na okaja na okaja da izvanja na okaja 10. Storegijska na okaja na okaja da izvanja na okaja 10. Storegijskas na okaja na okaja da izvanja da izvanja 10. Storegijskas na okara da una okaja na okaja da izvanja 10. Storegijskas na okara da una okaja na okaja da izvanja 10. Storegijskas na okara da una okaja na okaja na okaja na okaja na okaja 10. Storegijskas na okara da una okaja na okaja na okaja na okaja na okaja 10. Storegijskas na okara da una okaja na okaja 10. Storegijskas na okara da una okaja na okaja 10. Storegijskas na okaja na	predela 19. Mercylaka die energebrauken maktik yang berkehen dengan diserbool den 19. Mercylaka die energebrauken das anvel 19. Mercylaka strategische die statistichen der 19. Mercylakan die strategische die strategische energische die 19. Mercylakan das die erreit, andikan die norden 19. Mercylakan die einer ein, andikan die norden 19. Mercylakan der deite einer strategische die norden	3.10.3. Menganalisi seba	ran data untuk	mengambil keş	utusan, membu	at keputusan, dar
4121 Mergukan den menyetasikan maskah yang berkalan dengan diserbasi den 1202 Mergukan diser interunsu, melan den medan 4123 Mergukan selaran den undi mengandri kasimpulan, menduat keputaan, dan menduan perdakai 4123 Merguhasakan mastah yang berkainan dengan diserbasi dan 4128 Merguhasakan selaran yang berkainan dengan di berianguka, menduat lagustaan dan menduan perdakai.	121. Mengihani dia mengetakana masilah yang tetakian dengan diarihui den 122. Mengihani diari mengetakana mandari yang tetakian dengan diarihui den 123. Mengihani melana diari mengendi berimpaka, menduai kepatana diari menterang perlahi perlama dengan diarihui den 123. Mengihaniana antala yang tetakan diaramatian 124. Sengetakana antala pengihan diara diaramatian 125. Mengihaniana antala pengihan diara diaramatian 126. Mengihaniana antala dan utuk mengendi kenulamian dea menduai pendasi.	prediksi				
4.102 Menyilan ahi ras-ras, andan, das modu. 4.103 Menyilan ahira dan umin mengambi lasimpulan, membuat keputnan, 4.103 Menyilan masiha yang berkaina dengan disebusi dan 4.103 Menyitan kan masiha yang berkaina dengan disebusi dan 4.105 Menyitan kan sebana dan umin mengambi lasimpulan, membuat keputnan den membuat pedaki.	4.10.2 Merguikas nilis ratu-tas, antikas, das modu (10.3 Merguikas antikas das und mengelik ksimpulas, das menduas predikai (10.3 Merguikas) antikas parkasinas desgas distribusi das (10.3 Merguikas) antikas unkis mengendi ksimpulas, menbast lapitusas, das menbast predikai.	4.10.1 Menyajikani dan	menyelesaika	n masalah yang i	berkaitan dengi	an distribusi data
4.103 Minopijana sebaran deta uantia mengandol kenimpulan, enerbiest keputasan, dan ametioapi perdekai 4.103 Minopistaikan mastaki yang berkainan dengan diaribuai data 4.105 Minopistaikan akitara data uantia mengandol kenimpulan, membuat keputasan dan membuan perdekai.	4.03 Menyikas sabara das umit mengambi kasimpulan, membasi kepataan, dan membasi prediki 4.03 Menyiérasikan masisih yang berkaina dengan distribusi dan 4.05 Menyiéra kan niki sara ran, metan, dan moku 4.16 Menyiéra kasi sabara dan umit mengambi kesimpulan, membasi keputaan dan menbasi prediki.	4.10.2 Menyajikan nilai	rata-rata, med	lian, dan modus		
dan membata perdalai 4.10.2 Menyekrasikan masala yang berkarian dengan distribusi data 4.10.5 Menyekrasikan sukai ratu-ratu, median, dan modus 4.10.6 Menyekrasikan sukara data sutuk mengambil insimpulan, membat loputusan dan membata perditai.	dan membua perdikiti 1933 Menyetenkian matakit yang berkalasa dengan disribusi data 1935 Menyetenkian niki tert-rata, mefan, dan modu 1965 Menyetenkian terkaru data untik mengambil kesimpulan, membuat keputaan dan membuat perdikiti.	4.10.3 Menyajikan seba	ran data untui	k mengambil ke	simpulan, men	duat keputusan,
4.10.3 Menyelesaikan masalah yang berkaitan dengan distribusi data 4.00.5 Menyelesaikan niti ratu-ratu, medan, dan modu 4.10.6 Menyelesaikan sebaran data sumik mengambil kesimpulan, membuat keputusan dan membuat prediki.	4.10.3 Menyvässäkan massikä yyng berksiine öngan distribusi data 4.10.5 Menyvässäkan miki essä-rata, median, dan moka 4.10.6 Menyvässäkan seharan data sunkit mengambil ässimpulan, membuat loputuan dan membuat peediasi.	dan membuat pre	dilmi			
4.10.5 Menyelesaikan nilai rata-rata, median, dan modus 4.10.6 Menyelesaikan sebaran data untuk mengambil kesimpulan, membuat keputusan dan membuat predikai.	4.10.5 Menyväsaikan niksi rata-rata, median, dan modus 4.10.6 Menyväsaikan urbaran data untuk mengambil kesimpulan, membuat loputusan dan membuat prediksi.	4.10.3 Menyelesaikan n	usalah yang b	erkaitan dengar	distribusi data	
4.10.6 Menyelesaikan sebaran data untuk mengambil kesimpulan, membuat keputusan dan membuat predikti.	4.10.6 Menyelesaikan sebaran data untuk mengambil kesimpulan, membuat keputusan dan membuat prediksi.	4.10.5 Menyelessikan n	ilai coto-cata, s	nedian, dan moi	tus	
dan membuat prediksi.	dan membuat prediksi.	4.10.6 Menyelesaikan p	baran data un	tuk mengambil l	esimpulan, me	mbuat keputusan
		dan membuat pre	dácsi.			

Figure 6. Basic competence

(e) PBL-based Student Worksheets

Content section, which consists of group division, chapter titles, material summaries, and exercises. Can be seen in **Figures 7** and **8**.

Berbasi									_	
	S PBL									
		N	ama An	ggota 3	Celompol	k:				
		10	1							
			2							
			3							
			4							
								1		
			INTIVITA:	-						
A. Me	mana	licie D	lata	-						

					_					
stistika ad	lalah ike	in yang	memp	relajari	pengua	opulan dat	a, perhi	tuogao,	pengga	nbara
atistika ad In pengan	lalah ikr alininan	to yang data, se	memp ecta per	relajari arikan	pengum kesimpu	ipulan dat lan berda:	a, perhi Iarkan f	tungan, airta da	pengan	nbacas alisisa
atistika ad In pengan Ing akuri	lalah der alisisan at sehin	to yang data, se aga da	memp erta per	eclajari arikan embuat	pengum kesimpu keputus	opulan dat lan berda: lan yang	a, perbi sarkan f rasiona	tungan, airta da 1 Sta	penggan spengan intika b	nbaras alisisa iasany
atistika ad In pengan Ing akun enampika	lalah ilm alininan at sehin in data y	to yang data, se gga da ang tela	i memp erta per ipat me	nclajari arikan mbuat ai diola	pengum kesimpu keputus h dalam	quian dat ian berda: ian yang bentuk gri	a, perhi Iarkan f rasiona 15. Dani	tungan, akta da 1. Sta grafik 1	penggar s pengan intika b ersebut i	nbara alisisa iasany cita bis
atistika ad In pengan Ing akum enampilka engetabui	lalah ilm alininan at sehin in data y berbaga	na yang data, se gga da ang tela ii maca	memp erta per spat me ab seles m infor	erlajari arikan embuat ai diola masi.	pengum kesimpu keputus h dalam	ipulan dat lan berda: lan yang bentuk gri	a, perhi sarkan f rasiona sfi Dan	tungan, akta da 1. Sta grafik t	penggar s pengan intika b ersebut i	nbara alisisa iasany cita bis
atistika ad a pengan ng akum nampika nagetahui	lalah ilm alininan at sehin in data y berbaga	na yang data, se gga da ang tela ii macai	s memp erta per spat me ah seles m infor	ndajari arikan ambuat ai diola masi.	pengum kesimpu keputus h dalam	ipulan dat dan berda: ian yang bentuk gri	a, perhi sarkan f rasiona s£ Dani	tungan, akta da 1. Sta grafik t	penggan s pengan istika b ecsebut S	nbara alisisa iasany cita bis
atistika ad in pengan ing akuri nampika nagetahui Pada gi	falah ike alisisan at sehin in data y berbaga ambar di	na yang data, se ugga da ang tela ni macai nampin	g memp erta per spat me als seles m infor g terlihe	eclajari arikan embuat ai diola masi. et seora	pengum kesimpu keputus h dalam ng guru	npulan dat dan berdar san yang bentuk gri	a, perhi sarkan f rasiona sf. Dari	tangan, akta da 1 Sta grafik t	penggan s pengan intika b ersebut i	nbaca alisisa iasany cita bis
atistika ad in pengan ing akuri enampika engetahui Pada gi sedang	falah ikr alisisan at sehin an data y berbaga ambar di mengula	to yang data, se ugga da ang telu ii maca isampin or tingg	; memp ecta per spat me ah seles m infor g terlihe ji badan	eclajari arikan embuat ai diola masi. It seora siswan	pengum kesimpu keputus h dalam ng guru ya kelas	ipulan dat Jan berda: Jan yang bentuk gri	a, perhi tarkan f rasiota sfi Dasi	tangan, akta da 1. Sta grafik t	penggar s pengan intika b ersebut i	nbara alisisa iasany cita bis
atistika ad n pengan ng akum nagetahui Pada gi sedang VIII Si	falah ilm alininan at sehin in data y berbaga ambar di mengulo MP, dar	na yang data, se ugga da nang tela ii maca iampin ur tingg i 30 da	; memp ecta per spat me ah seles m infor g terliha ji badan sta ting	erlajari arikan embuat ai diola masi. It seora siswan gi bada	penguar keputus h dalam ng guru nya keba n siswa	ipulan dat dan berdar tan yang bentuk gri	a, perhi sarkan f rasiona afi. Dasi	tangan, akta da 1. Sta grafik t	penggan a penggan intika b ersebut i	nbara alisisa iasany cita bis
atistika ad n pengan ng akum ngarahui Pada gi sedang VIII S sebagai	lalah ilm alininan at sehin an data y berbaga ambar di mengulo MP, dar iberikut	na yang data, se ugga da nang tela si maca nampin se tingg i 30 da	s memp ecta per spat me ah seles m infor g tecliha si badan sta ting	eclajari arikan embuat ai diola masi. at seora siswan gi bada	penguar kesimpu keputus h dalam ng guru ng guru nya kelas n siswa	spulan dat dan berdas san yang bentuk gri	a, perhi tarkan f rasiona afi Daei	tangan, akta da 1 Sta grafik t	penggan a penggan iatika b ecsebut S	nbara afinim ianany cita bi
n pengan ng akum mampilan magtahui Pada gu sedang VIII S sebagai 155	lalah ilm alininan at sehin in data y berbaga ambar di mengulo MP, dar i berikut 155	na yang data, se ugga da nang tela ai macas isampin ur tingg i 30 da 157	; memp ecta per spat me ah seles m infor g tecliha ji badan eta ting 158	eclajari arikan embuat ai diola masi. t seora gi bada 158	penguar kesimpu keputus in dalam ng guru ng guru ya kelas n siswa 157	opulan dat dan berda: san yang bentuk gri	a, perhi sarkan f rasiona afi Dasi	akta da 1 Sta grafik t	proggas a progac intika b scorbut i	nbara alisisa iasany cita bis
n pengan ng akur nampika ngetahui Pada gi sedang VIII Si sebagai 155 159	lalah ilm alinisan at sehin a data y berbaga ambar di mengula MP, dar iberikut 155 160	na yang data, si ugga da ang tela ni macai nampin si tingg i 30 da 157 158	; memp erta per apat me ah seles m infor g terliho ji badan eta ting 158 160	nclajari arikan mbuat ai diola masi. at seora siswan gi bada 158 155	pengum kesimpu keputas In dalam ng guru ng guru ng kelas n siswa 157 162	npulan dat dan berdar nan yang bentuk gri	a, perhi sarkan f rasiona afi Daei	taogan, akta da 1 Sta grafik t	penggan a penggan iintka b eccebut S	nbara alinia ianany cita bi
n pengan ng akur nampika ngetahui Pada gi sedang VIII Si sebagai 155 159 162	falah iku alinisan at sehin in data y berbaga ambar di mengulo MP, dar i berikut 155 160 163	na yang data, se agga da ang tela nampin se tingg i 30 da 157 158 158	s memp erta per ab seles m infor s terliho si badan sta ting 158 160 160	nclajari arikan mbuat ai diola masi. at seora siswan gi bada 158 155 163	pengum kesimpu keputus h dalam ng guru nya kelas n siswa 157 162 158	spulan dat ian berdat ian yang bentuk pri	a, perhi sarkan f rasiona afi Daei	tangan, aicta da 1. Dia grafik t	penggan a penggan intika b eccebut S	nbara afain innny cita bi
atistika ad a pengan ng akun mampika ngetabui Pada gu sedang VIII S sebagai 155 159 162 157	falah ilm alininan an data y berbaga ambar di mengulo MP, dar iberikus 155 160 163 160	na yung data, se ugga da mang tela ii mactai inampin; se tingg i 30 da : 157 158 158 155	s memp erta per ah seles m infor si badan eta ting 158 160 160 155	nelajari arikan aribuat ai diola masi. at seora siswan gi bada 158 155 163 157	pengum kesimpu keputus h dalam ng guru nya kelas n siswa 157 162 158 158	spulan dat ian berdat ian yang bentuk pri	a, perhi narkas f rasiona afi. Dasi	taogas, aicta da 1. Dia grafik t	progga a progac intila b accebut l	mbara atinina ianany cita bin

Figure 7. PBL-based student worksheets



Figure 8. PBL-based student worksheets

(f) Problem Orientation

Action steps are an example of Supporting Information, is additional information that can complement teaching materials so students more easily master the knowledge that will be obtained. Supporting information contains articles on data analysis prepared to make it easier for students to understand the material. The action steps comprise several procedural steps that students must do in studying the material and problems presented. In operations activities consist of issues presented for the work of students in groups, the process steps are based on the learning stages of Problem Based Learning as presented in **Figures 9** and **10**.

are abatin	
Latihan 1	
ORIENTASI MASALAR	1
o kita amati !	
ulailah dengan mengamat	i masalah di sekeliling anda
yo kita bertanya !	
ulailah dengan mencari to	pik
ENGUMPULKAN INFO	RMASI
Memahami masalah : Mer	gana anda mengambil tonik tercebut, membuat nemacalahan
lari topik tersebut, mengu	mpulkan data.
	•
DESCRIPTION OF A STATE	7
PENTELIDIKAN	
intalah bimbingan kepada	guru bila terdapat kesulitan !
o Kita menalar	
gaimanakah membuat dia	agram batang
veraksankan rencana : me	empuat osagram patang dan menesapkan strategi untuk
nenyelesakan masalan.	

Figure 9. Problem orientation

alah satu siswa mewakili ke	lompok mempersentasikan hasil	dari pemecahan masalah
e depan kelas. Siswa yang tel	iah menanggapi hasil kerja kelon	npok yang persentasi.
Menganalisis dan Mengeval	ussi Proses Pemecahan Masalah	-
Menyimpulkan dan mengeval	tvasi basil:	i

Figure 10. Problem orientation

(g) Individual Tasks

Individual assignments are forms of jobs given to students to practice skills after learning instructional materials (Hur & Suh. 2010). Questions are used to determine the level of mastery of students 'material and to measure students' problem-solving skills after following the learning process and in practice exercises have immediate problem-solving steps as illustrated in **Figure 11**.

1. Diagram								
	B	ESARN	YA UA	NG SA	κu			
14000					Plat	Acea		
₽ 10000						Y		
5 8000								
3 4000								
2000								
۰	35313	SELASA	RABU	EAMIS	JUMAT	SABTU		
			MAJ	RI				
a. Memahar	ni masalal	h : mengið	entifikasi	unsur-un	sur yang	6iketa hu	, dan dita	nyakan
a. Memahas b. Merenca masalah	ni masalal nakan pen	h : mengió necaban m	entifikasi asalah : m	unsur-un Herumusk	an masala	dibetaksi h matem	, dan dita nis dan p	nyakan emecahan
 Merenca masalah Merenca 	ni masalal nakan pen	a : mengió recaban m	entifikasi asalah : m	unsur-un	an masala an masala	diretalmi h matem	, dan dita nis dan p	nyakan emecaban
 Memahaa Merenca masalah Menarik: 	ni masalal nakan pen	a : mengió recaban m an menyim	entifikasi asalah : m pulkan m	unsur-un terumusk	an masala an basil p	dicetalmi h matem enyelesai	dan dita nis dan p	nyakan emecaban ih
 Memalaa Merenca masalah Menaciki 	ni masalal nakan pen	i : mengið æcaban m menyin	entifikasi salah : m pulkan m	versuer- ter	nor yang an masala an basil p	diketa hu h matem enyele sai	, dan dita nis dan p	nyakan emecaban ih

Figure 11. Individual tasks

The following are some validator input and suggestions from material experts ranked in **Table 2** and **Table 3**.

Suggestions and Comments	Follow-up
LKS design is equipped with KI, KD,	Revised
Indicators and learning objectives	
JThe title of the material on the cover	Cover is removed
was removed by "STATISTICS" only	from the material shelf
The questions in the design of KKS	Revised
LKS foster mathematical	
communication skills	

 Table 2. Inputs and Suggestions from the validator 1

Table 3. Inputs and Suggestions from the validator 2

Suggestions and Comments	Follow-up
LKS design is equipped with KI, KD, Indicators and learning objectives	Revised
The word "perfikir" is changed "thinking"	Has been replaced
The word "graph" is changed "graph	Has been replaced

The validity of the design of student worksheets is brief, the results of the assessment of student worksheet design are shown in **Table 4**.

Assessment	Maximum	Average	Information
Aspect	score	Score	
Fill in the LKS	5,00	4.08	Good
design			
LKS design	5,00	4.33	Very good
language			
Technical aspects	5,00	4.50	Very good
Information		4.36	Very good

Table 4. Results of assessment of student worksheet design by experts

CONCLUSION

Student learning designed based on curriculum analysis, material, learning methods, teaching materials, student characteristics and the needs of students with problem-based learning models. Student worksheets are designed to improve students' mathematical communication skills. Designing student worksheets are part of the ADDIE development procedure. The design component of the student worksheet consists of cover, introduction, necessary competencies, action steps, problem training.

REFERENCES

- Afifah, R.N. & Suparman. (2018). Design of Student Worksheet Based on Learning Cycle 5E Learning Model for VIII Junior High School Students un-Indonesia. *International Journal of Engineering & Technology*, 7 (4.30), 16-20.
- Bergstrom, C.M., Pugh, K.J., Phillips, M.M., & Machlev, M. (2016). Effects of Problem-Based Learning On Recognition Learning and Transfer Accounting for GPA and Goal Orientation. *The Journal of Experimental Education*, 84(4), 764-786.
- Ruri, H. & Suparman. (2018). Design of Mathematics Student Worksheet based on Realistic Mathematics Education Approach to Improving the Mathematical Communication Ability Students of Class VII Junioro High School in Indonesia. *International Journal of Engineering & Technology*, 7 (4.30) 31-35.
- Hur, J.W., & Suh, S. (2010). The Development, Implementation, and Evaluation of a Summer School for English Language Learners. *Professional Educator*, 34(2), 1-17.
- Inan, C., & Erkus, S. (2017). The Effect of Mathematical Worksheets Based on Multiple Intelligences Theory on the Academic Achievement of the Students in the 4th Grade Primary School. Universal Journal of Educational Research, 5(8), 1372-1377.
- Kaya, D., & Aydin, H. (2016). Elementary Mathematics Teachers' Perceptions and Lived Experiences on Mathematical Communication. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(6), 1619-1629.
- Lee, C. (2006). Language for Learning Mathematics: Assessment for Learning in Practice. New York, NY: Open University Press.
- Lim, C.S., & Chew, C.M. (2007). *Mathematical Communication in Malaysian Bilingual Classrooms*. In APEC-Tsukuba International Conference, Tokyo, Japan, December.
- Murni, A., & Anggraini, R. D. (2018). The development of student worksheets based on metacognitive approach to improve students' mathematical representation ability. *In Journal of Physics: Conference Series*, 1088(1), 1-6.
- NCTM, (1989). Curriculum and Evaluation Standards for School Mathematics. Reston, VA: National Council of Teachers of Mathematics. Available online: http://educare e-fkipunla.net.
- NCTM, (2000). *Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics.
- Osman, K., & Marimuthu, N. (2010). Setting new learning targets for the 21st century science education in Malaysia. *Procedia-Social and Behavioral Sciences*, 2(2), 3737-3741.
- Pantaleon, K.V., Juniati, D., Lukito, A., & Mandur, K. (2018). The written mathematical communication profile of prospective math teacher in mathematical proving. *In Journal of Physics: Conference Series*, 947(1), 1-6.
- Rahmi, S., Nadia, R., Hasibah, B., & Hidayat, W. (2017). The Relation between Self-Efficacy toward Math with the Math Communication Competence. *Infinity Journal*, 6(2), 177-182.
- Rowland, G. (1993). Designing and Instructional Design. *Educational Technology Research & Development*, 41 (1), 79 91.

- TIMSS, (2007). International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study the Fourth and Eight Grades. Boston: TIMSS & PIRLS International Study Center.
- Turiman, P., Omar, J., Daud, A.M., & Osman, K. (2012). Fostering the 21st century skills through scientific literacy and science process skills. *Procedia-Social and Behavioral Sciences*, 59, 110-116.
- Viseu, F., & Oliveira, I.B. (2017). Open-ended tasks in the promotion of classroom communication in mathematics. *International Electronic Journal of Elementary Education*, 4(2), 287-300.

Widoyoko. E.P. (2009). Evaluasi Proram Pembelajaran. Yoyakarta: Graha Ilmu

- Wilder, S. (2015). Impact of Problem-Based Learning On Academic Achievement In High School: A Systematic Review. *Educational Review*, 67(4), 414-435.
- Yaden, Z. (2017). A Development of Students' Worksheet Based on Contextual Teaching and Learning. International Journal of Learning, Teaching and Educational Research, 16(6), 64-79.