

Perception of Mathematics Teachers in Marginal Regions Toward The Use of ICT and Manipulative Tools as Learning Media

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Perception of Mathematics Teachers in Marginal Regions Toward The Use of ICT and Manipulative Tools as Learning Media

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Abstract. The aim of this research was to determine mathematics teachers' perception on ICT and manipulative materials as learning media, discover the difference between the usage of ICT and manipulative materials as learning media among participants responses based on their region and school level. A survey was designed within two domains, the usability of both ICT and manipulative materials and the importance of using both ICT and manipulative materials. The sample used was 84 mathematics teachers (29 Elementary, 41 Junior-High, and 14 Senior-High) for perception toward ICT and 81 mathematics teachers (33 Elementary, 36 Junior High, and 12 Senior High) for perception toward manipulative materials. They teach at various schools in marginal area of Indonesia. The findings revealed that in both media and domains, the participants' perception logit means differ significantly. Findings unveiled significant differences between the usage of ICT and manipulative materials and so did the importance of ICT and manipulative materials. They have a better perception of the use of manipulatives than ICT.

1. Introduction

Learning media is one of the solutions to resolve the difficulty in learning mathematics. Old learning paradigm was relied on "*chalk and talk*" had an impact on students' understanding process [1]. Learning media as a proponent in order to assist students' learning process, it could form an effective and efficient learning circumstance. The use of learning media was aimed as supplements on teachers directly [2]. Learning media that which can be used on mathematical learning are ICT and manipulative materials. Practically, teachers were starting to use both of those learning media already. Manipulative materials as learning media have an effect that students were able to receive a mathematical concept than using symbols abstractly. Meanwhile, the development of constructivism theory and ICT in learning process were rapidly improved, it encourages the alteration of teachers' teaching pattern in order to deliver materials [3]. That matters are challenges for mathematics teachers to involve ICT as learning media.

Manipulative material is one of learning media that becomes an option for teachers in learning process, especially mathematics. By using mathematical manipulatives, they capable to establish students in order to understand abstract concept [4]. Manipulative materials as learning media give positive influence toward mathematics learning result [5]. Some mathematics teachers agreed that using manipulative materials as mathematics learning media [6]. Some mathematics teachers also use manipulative materials to form mathematical learning in a fun way [7]. Rusmawati stated that by using manipulative materials on mathematics directly were able to improve students' learning result [8]. Manipulative materials were said capable as learning media when students had understood abstract



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concept. Teachers' creativity allows them to form manipulative materials even in any conditions of regions.

Alongside with manipulative materials, there is a technology-based media called ICT. ICT becomes important matters in life and educating system [9]. ICT is a technology that was able to hold information then produce them into communication assisted with software and hardware. ICT gives a huge influence as learning media in higher education, organization, and learning and teaching methods [10]. The use of ICT in learning process has become more popular in modern citizens [11]. ICT has a function as learning media that is a supplement in learning facilities, learning references, and the improvement of professionalism facilities [12]. A study found that there is an improvement of eight grade students' learning result after using ICT as learning media [13]. The usability of ICT based on computer instruction in the implementation of constructivism learning more effective than general constructivism methods [14]. The usage of ICT in learning media combined with creativity supports the students to gain learning experience with communication media [12]. There are several ICT as a mathematics software often used by mathematics teacher, such as; Geogebra, CarMetal, Algebrator, and so on. Also, interactive video, like Zenius, Khan Academy channel on youtube, and so on.

Start from the 2014-2016 era, digital poverty in Indonesia has already decreased [15]. It implies the increase of internet usage happened in e-commerce activity, e-government, and e-business whereas that matters only happens in citizens that had been connected with them. By considering that matters, it has known that there is a contrast between ICT access among citizens. In 2015, the percentage access toward ICT were: (1) 35,1% accessed internet, (2) 84,3% accessed handphone, (3) 29,8% accessed computer, (4) 4,5% accessed cable telephone, (5) 86,7% accessed television, and (6) accessed radio [16]. Household accessibility toward internet showed 47,9% in urban areas and 24,7% in rural areas. Household accessibility toward computer showed 41,9% in urban areas and 19,9% in rural areas. Those percentages showed contrast access in urban areas and rural areas. In urban areas, ICT accessibilities much easier than in rural areas [16]. That condition influenced the usability of ICT as learning media. ICT as learning media would be able to be applied in accessible area, that is urban areas. And it will face obstacles if ICT were applied in rural areas. Seeking from those conditions, it means the development of ICT in Indonesia has not fairly distributed enough and it impacted in marginal areas that ICT was not able to be applied there. Marginal region or Frontier, Outermost, and Disadvantaged Regions (3T) determined based on these criteria: (a) citizens' economy; (b) human resources; (c) facilities; (d) finance ability; (e) accessibility; and (f) regions characteristic. Education was not one of the criteria to determine marginal regions explicitly. However, regions need human resources to determine education's quality. Rural schools are inferior compared to urban schools [18]. It is due to urban's teachers have much access to media and learning materials and vice versa [19].

Some study found that there is no relation between the usability of ICT and students' performances [17, 10]. It implies, that manipulative materials as an alternative to learning media for learning process in place that has difficulties applying ICT. Even though, every learning media has its own benefits and deficiencies. Based on those differences between both of the usability of manipulative materials and ICT impacted contrast perception as well. Mathematics teacher on marginal regions' perception of the use of manipulative materials and ICT will turn out to be interesting information. It depends on the policy of usability and easy or not to get those learning media.

Mathematics teachers on marginal regions' perception are expected to be able to predict the use of learning media in terms of location of learning activities. Therefore, this study aims to know the differences of mathematics teacher on marginal regions' perception toward the use of ICT and manipulative materials as learning media.

2. Method

This study aimed to discover the differences between mathematics teachers in marginal regions. This study use survey research as method and quantitative research approaches. The data were collected using questionnaires about mathematics teachers perception. It mapped two domains; the first domain is the usage of ICT or manipulative materials in mathematics learning process, which includes 19 items for ICT and 17 items for manipulative materials. The second domain is the importance of ICT or manipulative materials in mathematics learning process, which includes 27 items for ICT and 26 items

for manipulative materials. These instruments were adapted from Albalawi [11]. All ordinal scale data gathered from the questionnaires were processed with Rasch model assisted with WinStep software to get logit interval.

This population has been determined, which are mathematics teachers in marginal regions. Marginal regions' criteria are based on Presidential Decree No. 131 Year 2015. Samples were collected using convenience sampling. It supposed to collect sample based on availability in a certain population. There are two types of samples in this research: 84 mathematics teacher in marginal regions who answered the use of ICT as learning media questionnaire and 81 mathematics teacher in marginal regions who answered the use of ICT as learning media questionnaire. Respondents on this research were mathematics teacher in marginal regions who taught in elementary, secondary, and senior high school which distributed in the west and east Indonesia.

This research tended to discover the differences between mathematics teachers in marginal regions' perception toward the use of ICT and manipulative materials as learning media, therefore it has to conduct a hypothesis test. There are three domains comprised this research; differences between the usage of both ICT and manipulative materials, differences between the importance of both ICT and manipulative materials, and differences both of domains of both ICT and manipulative materials. Data analyze technique that used were Rasch model and difference test, then Mann-Whitney test was used since perception data did not follow normality distribution assumption. The research scale can be seen on Table 1.

Table 1. Research's Scale on Questionnaires.

Domain 1 (Usability)		Domain 2 (Importance)	
Scale	Interpretation	Scale	Interpretation
1	Never	1	Unimportant
2	Seldom	2	Fairly Important
3	Sometimes	3	Somewhat Important
4	Often	4	Importance
5	Always	5	Very Importance

3. Results

Data used to discover mathematical in marginal regions toward ICT and manipulative materials and so do the differences between them. Then the data were proceeded with Winstep to get logit person value and followed with Mann-Whitney test and continue with analyzing. Logit item measured for ICT and Manipulatives can be seen on table 2 and table 3, while the whole logit item (combination between ICT and Manipulatives measure) are lies on table 4.

Table 2. The usability of ICT and manipulative materials statistics description

	ICT		Manipulative Materials	
	Item Count	Measure	Item Count	Measure
Mean	19	-2,56	17	0,57
P.SD	0	2,54	0	2,85
Max.	19	2,48	17	9,34
Min.	19	-6,56	17	-5,01

Table 3. The importance of ICT and manipulative materials statistics description

	ICT		Manipulative Materials	
	Item Count	Measure	Item Count	Measure
Mean	27	0,32	26	3,10
P.SD	0	3,53	0	3,30
Max.	27	8,84	26	10,64
Min.	27	-7,47	26	-3,64

Table 4. Both domains of ICT and manipulative materials statistics description

	ICT		Manipulative Materials	
	Item Count	Measure	Item Count	Measure
Mean	46	-0,79	43	1,42
P.SD	0	1,96	0	2,03
Max.	46	3,34	43	9,64
Min.	46	-6,73	43	-2,70

Table 2 shows logit mean on the usage of ICT, it is -2,56 and 0,57 on manipulative materials. Meanwhile, logit mean on the importance of ICT, it is 0,32 and 3,1 on manipulative materials as shown in table 3. Furthermore, logit mean on both domains (total) hits -0,79 for ICT and 1,42 for manipulative materials as shown in table 4. Based on these data, it showed that logit mean on manipulative materials has bigger value than ICT.

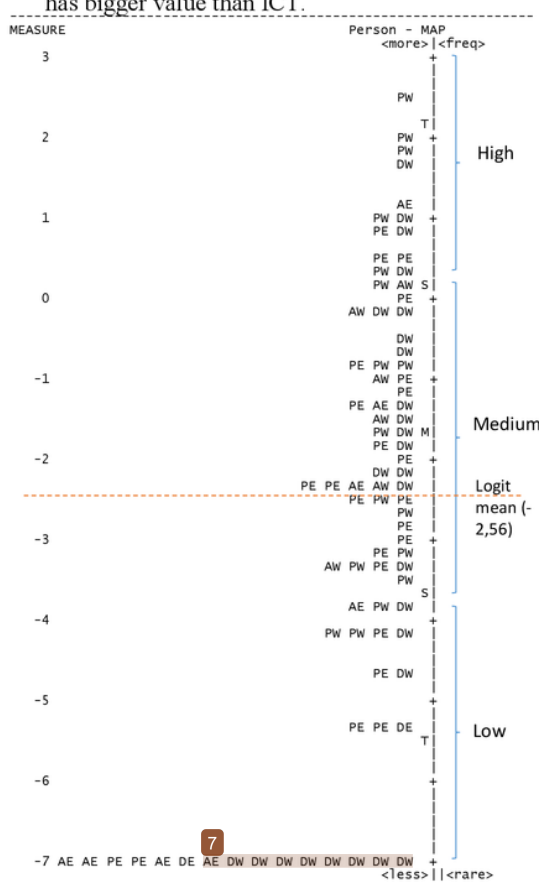
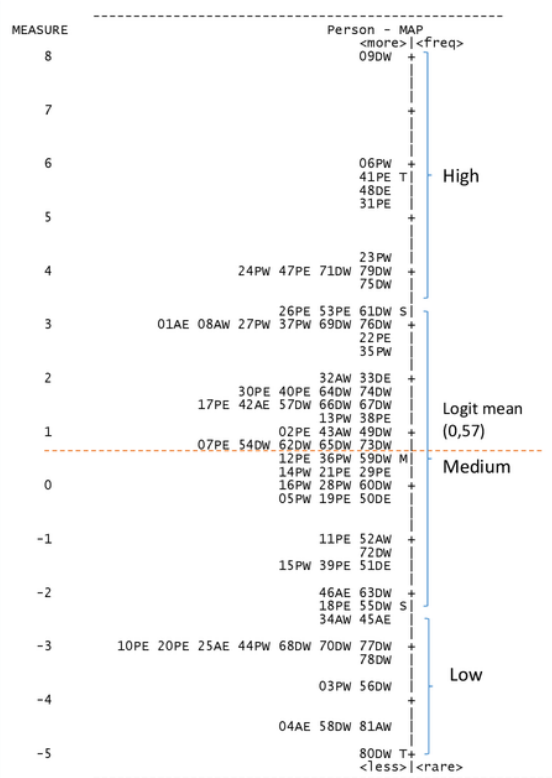
**Figure 1.** Variable maps of the usability of ICT as learning media**Figure 2.** Variable maps of the usability of manipulative materials

Figure 1 shows that logit mean of the usability of ICT were placed on medium and on Figure 2 also shows that logit mean of the usability of manipulative material were placed on medium category. Even though both of learning media have different mean, but ICT and manipulative materials were placed at

the same category, medium class. It concluded that the difference of the usability of ICT and manipulative materials is lied on its' logit mean.

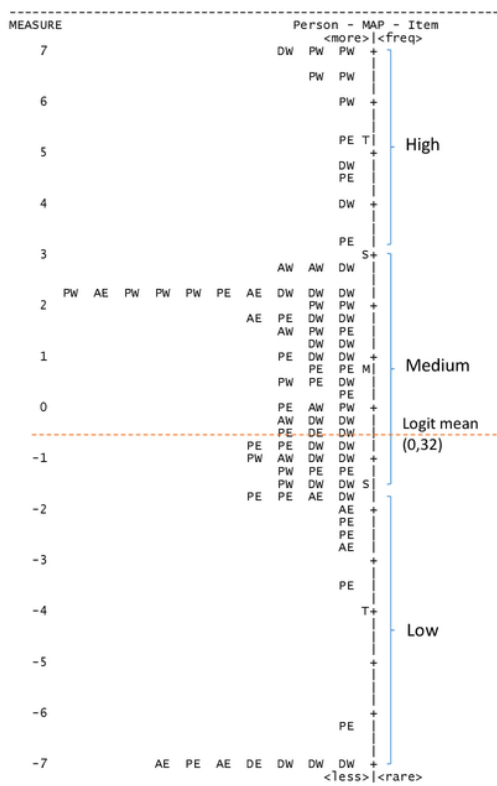


Figure 3. Variable maps of the importance of ICT

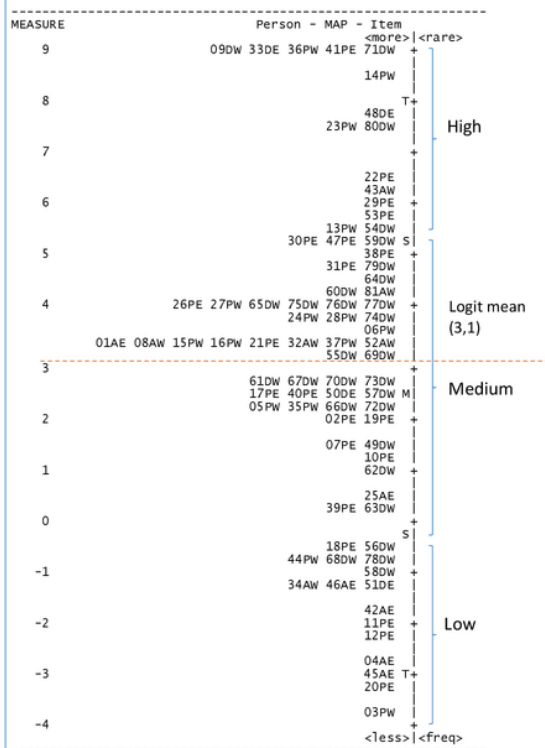


Figure 4 Variable maps of the importance of manipulative materials

Figure 3 shows that logit mean of the importance of ICT was placed on medium and on Figure 4 also shows that logit mean of the importance of manipulative material was placed on medium category. Even though both of learning media gain different mean but ICT and manipulative materials were placed at the same category (medium). It is concluded that the difference of the importance of ICT and manipulative materials was lied on its' logit mean.

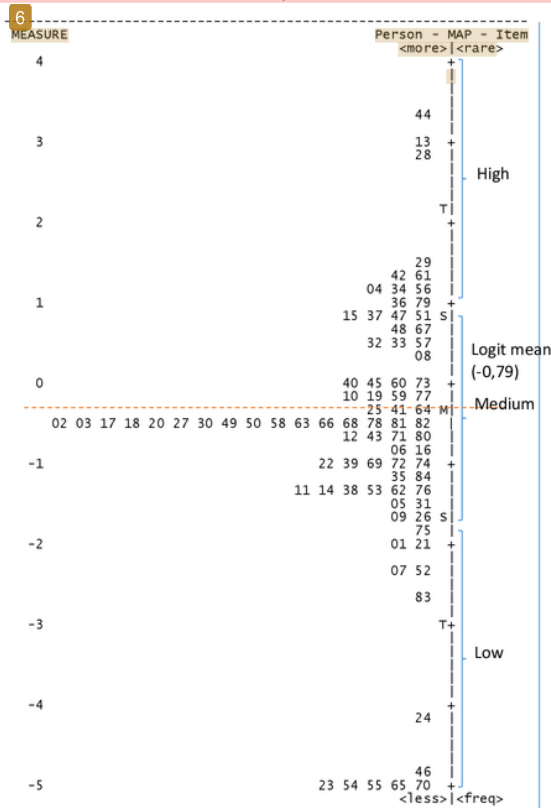


Figure 5. Variable maps on both domains for ICT

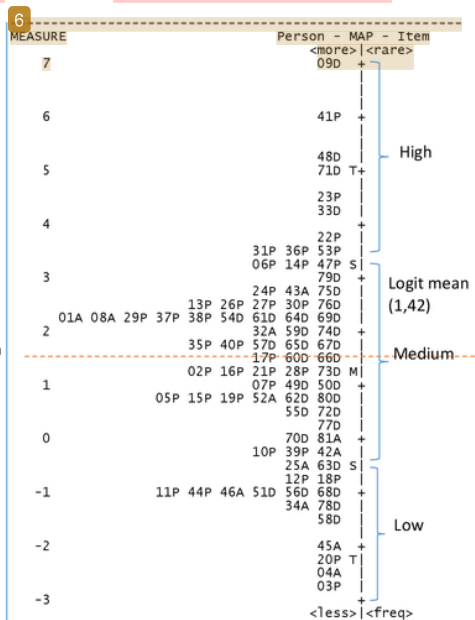


Figure 6. Variable maps on both domains for manipulative materials

Figure 5 represents logit mean on both domains for ICT was placed on medium category and on Figure 6 also represents logit mean on both domains for manipulative material was placed on medium category. Even though both learning media gain different mean, but ICT and manipulative materials were placed at the same class, (medium). It is concluded that the difference usage of ICT and manipulative materials was placed on its' logit mean.

In order to get information about the hypothesis, Mann-Whitney test was conducted on each domain.

Table 5. Result of Mann-Whitney test on the usability of ICT and manipulative materials

Test Statistics	
	Measure
Mann-Whitney U	1456,5
Wilcoxon	5026,5
Z	-6,345
Asymp. Sig. (2-tailed)	0

Results of Mann-Whitney test on usage of ICT and manipulative materials on table 5 shows Asymp. Sig. (2-tailed), the result is ($0 < 0,005$), thus it can be concluded that there is significant differences between the usability of ICT and manipulative materials in marginal regions. The average score for ICT is lower than manipulative materials. It seems that communication obstacles were the main problem in marginal regions [20]. It implies the use of ICT as learning media in marginal regions as confirm by Febriana et al. [19] that schools in marginal regions had an electric constraint. Another report found

that accessibility of computer and internet in rural areas presented a lower percentage than urban areas [16]. This conditions made teachers shifted on another alternative by using manipulative materials as learning media. Manipulative materials seem able to increase students' learning achievement [21]. There are a lot of types of manipulative materials, mostly some teachers utilize things that come from their surroundings.

Table 6. Result of Mann-Whitney test on the importance of ICT and manipulative materials

Test Statistics	
	Measure
Mann-Whitney U	1818
Wilcoxon	5388
Z	-5,265
Asymp. Sig. (2-tailed)	0

Results of Mann-Whitney test on the importance of ICT and manipulative materials gained Asymp. Sig. (2-tailed), the result is ($0 < 0,005$), it can be concluded that there is a significant difference between the importance of ICT and manipulative materials in marginal regions. Average score positively showed on importance of ICT although it has not pass manipulative materials' average. It means, mathematics teachers in marginal region persuaded that it is important to implement ICT in marginal regions even though the gap of distances and communicating obstacles could not easily be avoided. It flows confirm a study that one solution to solve communicating obstacles on applying ICT in marginal regions was long-distance associated [20]. On the other hand, manipulative materials were easy to get and able to deliver positive influence, furthermore, it increases mathematical learning achievement [5, 21].

Table 7. Result of Mann-Whitney test on teachers perception of ICT and manipulative materials

Test Statistics	
	Measure
Mann-Whitney U	3529
Wilcoxon	10550
Z	-5,627
Asymp. Sig. (2-tailed)	0

Meanwhile, based on the result of Mann-Whitney test on the usage of ICT and manipulative materials gained Asymp. Sig. (2-tailed), the result is ($0 < 0,005$), it can be concluded that there is significant differences between teachers perception of ICT and manipulative materials in marginal regions.

4. Conclusion

Based on collecting and analyzing research data, it can be concluded that there is a difference on marginal regions teachers' perception toward the use of ICT and manipulative materials. It was supported with acquisition of hypothesis test by using Mann-Whitney test in two and all of domains. The first domain is the usage of ICT and manipulative materials in marginal regions. In this domains showed that Asymp. Sig (2-tailed) was ($0 < 0,005$) so we conclude that there is a differences between the usage of ICT and manipulative materials in marginal regions. The second domain is the importance of ICT and manipulative materials in marginal regions. In this domains showed that Asymp. Sig (2-tailed) was ($0 < 0,005$) so we conclude that there is a differences between the importance of ICT and manipulative materials in marginal regions. And the third is the both domain of ICT and manipulative materials in marginal regions. In this domains showed that Asymp. Sig (2-tailed) was ($0 < 0,005$) so we conclude that there is a differences between both domain of ICT and manipulative materials in marginal regions. It can be concluded that there is a difference between the use of ICT and manipulative materials in marginal regions. Generally, the use of ICT is lesser than manipulative materials in learning process. Teachers on marginal regions agreed the urgency implementing both of learning medias eventhough manipulative materials gained bigger average than ICT. Teachers on marginal regions put more hopes on manipulative materials as learning media than ICT.

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