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Influence of Jakri Game on Elementary School Students' Understanding and Interests on Word Problem: Using Realistic Mathematics Education

Pengaruh Permainan Jakri Terhadap Pemahaman dan Minat Siswa Sekolah Dasar dalam Menyelesaikan Soal Cerita: Kasus dengan Pendekatan Realistic Mathematics Education

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Abstrak

Penelitian ini bertujuan untuk menjelaskan pengaruh dari permainan Jakri dalam meningkatkan pemahaman dan minat siswa dalam soal cerita. Dengan menggunakan Realistic Mathematics Education (RME), suasana kelas dirancang untuk mendukung siswa dalam memahami soal cerita. Delapan puluh satu siswa di Kabupaten Alor, Provinsi Nusa Tenggara Timur ditunjuk sebagai subjek penelitian. Penelitian ini menggunakan metode kuantitatif untuk mengukur pemahaman dan minat belajar siswa mempelajari soal cerita dengan cara bermain Jakri. Berdasarkan tingkat pendekatan RME, banyak siswa yang mampu mencapai tingkat 1, siswa mudah untuk membiasakan diri dengan permainan Jakri (tingkat situasi nyata), tetapi siswa masih sulit untuk beralih dari tingkat 2 ke tingkat 3 (model-of level ke model-for level). Tidak ada salah satu dari siswa dapat mencapai tingkat matematika formal (level 4). Siswa mengalami kesulitan dalam melakukan perhitungan tetapi siswa membuat kalimat matematika baru berdasarkan kisah mereka sendiri. Kuesioner yang mengukur minat siswa dalam permainan Jakri memberikan hasil bahwa siswa menyukai permainan Jakri dan menikmati pembelajaran matematika yang menggunakan permainan tersebut.

Abstract

This study aims to clarify the influence of Jakri game in improving students' understanding and interest in learning word problem. By using Realistic Mathematics Education (RME) approach, the classroom is designed to support students to understand word problem. 81 students in Alor Regency, East Nusa Tenggara Province, were pointed out in order to reach the objectives of the data. This research used a quantitative method to measure students' understanding and interest in learning word problem by playing Jakri. Based on the level of RME approach, many students are able to reach level 1, students easy to accustom with Jakri game (real situation level), but students have some difficult to shifting from level 2 to level 3 (model-of level to model-for level). No one of them can reach the formal mathematics level (level 4). Students also have difficulty to do computation but the students create new mathematics sentence based on their own story. The result based on the questionnaire which measures students' interest in Jakri game shows that the students like the game which mean that they interested to this game and enjoy the mathematics class.

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INTRODUCTION

Education has a major role in the human development, especially to create a high quality of human resources. Indonesian government recognises the importance of education as an investment in the human capital formation for future economic growth and development in Indonesia. The law has a significant role to create a legal framework for the major education goal, policies, and plans. The law seeks to open access to education at all levels and all forms-formal, non-formal, as well as informal for all the citizens of Indonesia. In the act of the Republic of Indonesia on National Education System No 20 Year 2003 in Article 3, Ministry of National Education Republic of Indonesia (2003) wrote as follows:

> The National Education functions to develop the capability, character, and civilization of the nation for enhancing its intellectual capacity, and is aimed at developing learners' potentials so that they become persons imbued with human values who are faithful and pious to one and only God; who possess morals and noble character, who are healthy, knowledgeable, competent, creative, independent, and as citizens, are democratic and responsible (p. 5).

All of the objectives in mathematics education in Indonesia are require the students to have and develop all those capabilities relate to the solving problem. One of the mathematics education objectives in Indonesia is to solve problems that include the ability to understand a problem (Indonesian Ministry of National Education, 2006), but the reality shows that Indonesian students still have low performance in word problem. The problem itself usually deal with word problem which always appears either in the textbook or the end of the topic and also occurs in the test of national examination for all level of education (Ministry of Education and Culture, 2015).

In the international level, especially in mathematics tests such as PISA and TIMSS, based on the Indonesian students' responses, Tiro *et al*. (2010) states that students have difficulty in closed and open constructed response and also literacy. Students also have huge difficulty in solving word problem in line with Gunawan (2010) states one of the factors why do students have difficulty is the context of the story rarely found by the students in their daily life. He found from analyzing the result of TIMSS that for the knowing part, students have a lack of knowledge about number such as decimal, percentage, a fraction (only 24, 2% able to provide the correct answer). For applying part students have difficulty to solve words problem (only 22, 5% can provide the right answer), use vertical subtraction, division and mix number operation (sequence of the operation). And the last for the reasoning part students have difficult to do reasoning or to get a conclusion from words problem. The strongest for number domain is relate with estimation (73.5% of the students can provide the right answer). These are the reasons Indonesian students' performance especially in mathematics for grade eight only got ranks 38th out of 42 countries (IEA, 2011).

In national level, education in Indonesia still has problems. Education in the rural area takes a lot of extra attention from the government to achieve the goals of education in Indonesia. One of the rural areas targeted by Indonesia is Alor Regency. This Regency is one of the regencies in East Nusa Tenggara province of Indonesia, which still has low graduation rate. Students are required to take either national examination or school examination test as part of governments` goal to develop the equity and quality of education. Around 30% of the test, examination consists of word problem. It is in line with TESS-India states that word problem very often appears at the end of the topic in mathematics, where students are trained to do reasoning and solve various problems related to the daily life problem. Addition to this, Cunningham (2014) states that word problem involves a lot more than just solving calculations. Schoenfeld (2016) in his lecture entitled "why are word problem so darned hard" mention word problem is not a simple just read the problem, make a model or diagram, write equation(s), solve equation and check. There are some issues like reading and language comprehension that affected students' work on it. He also mentions that for many kids, mathematics is not about sense-making. So the students only solve the problem without understanding the meaning of it, or in another word, the students never make sense of it.

Playing is one way to encourage students to interact with the situation directly and to give them good experience to interpret and reason mathematical meaning embedded in the situation. In line with Bishop (1991) states playing is one of the universal mathematical activities. So, the teacher is required to use an alternative method to develop the mathematics

Figure 1: Jakri Game

class to get the students` willingness to study mathematics. Game-playing itself is one of the activities that suit with young children to help the them to connect their informal knowledge to the formal knowledge in the classroom (Wijaya *et al.* 2011).

The experience gained by the students which are the basic level of Realistic Mathematics Education (RME) approach is a good stepping stone for the student to develop their understanding of the concept of word problem. Based on that, Jakri game, which is one of the traditional games in Indonesian which has mathematical activity is used in the class activity to help the students to understand the concept of word problem. By doing this experiment, hopefully, can encourage students` interests in learning mathematics. So this research aim is to clarify the influence of Jakri game in improving students' understanding and interests in learning word problem.

Using props in improving mathematics class in Indonesia is often to use, but it is so rare using the props from the daily life activity which is more close to the students such as a traditional game. Wijaya (2008) states games can be applied as a powerful support for traditional methods to reach the objectives of the learning process. He using two traditional games in Indonesia called Benthic (another name of Jakri) and gundu (marbles). He states the traditional Indonesian games as an experienced-based activity for learning linear measurement help the students to understand the basic concept of linear measurement and bridging their activities to formal linear measurement. Through these activities, he recommends for developing another mathematical concept by intertwining with other mathematics topics. So, the researcher tries to use this approach called RME and the traditional game called Jakri to address the students` difficulty on word problem topic in mathematics.

Originally, Jakri has mathematics activity in the rules. Beside Wijaya's finding to do mathematics activity relate with measurement, addition and multiplication concept already embedded to the rule. Based on that, students will see the pattern of Jakri game and this is the best way to introduce mathematics sentence for the early age students. (Intensifptn, 2013).

Caldwell & Goldin (1979) mention about the variable that affects word problem difficulty include the following: context familiarity, number of words, sentence length, read- ability, vocabulary, and verbal clues, magnitudes of numbers, the number and type of operations or steps, and the sequence of operations. Their finding shows that students have less difficulty for solving the concrete problem than the abstract problem.

Based on those previous studies, the researcher tries to analysed using Realistic Mathematics Educaiton approach to see the level of their understanding in word problem. This approach has two important views to see mathematics. According to Van den Heuvel (2001), mathematics must connect to reality and mathematics as human activity. It is one way to make mathematics meaningful stay close to children and be relevant to society in order to be of human value.

The purpose of this study is to clarify the influence of Jakri game in improving students' understanding and interests in learning word problem. The classroom is designed to support students to understand word problem based a Jakri game. Students' activities and responses are analyzed to identify their level of understanding in word problem. The following research question in order to achieve this

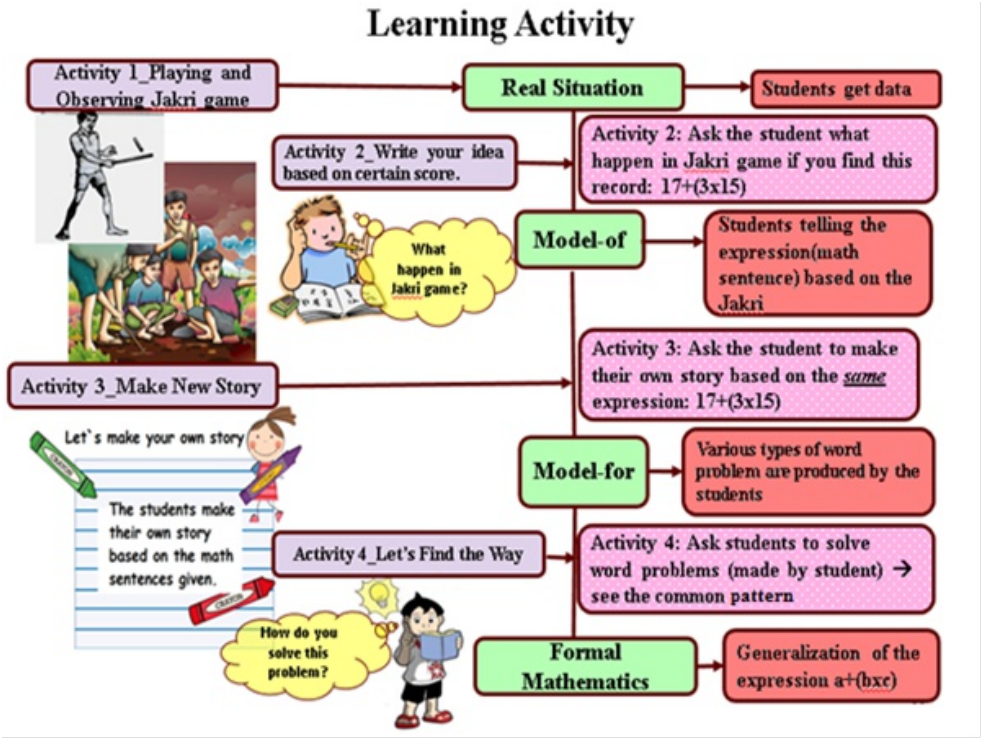

Figure 2: Learning Activity of Students in Learning Word Problem

research objective is what kind of influence of Jakri game given on students' understanding and interests in learning word problem?

METHODS

Alor Regency is one of the regencies in East Nusa Tenggara province in Indonesia which has 17 sub-districts. Because of accessible reason, only one sub-district appointed to be the subject of this research. There are 23 schools within this sub-district, and the total number of public schools are three schools. Researcher intentionally chooses public school only because of the curriculum matter. So, the grade 4 students from these three public schools, K-elementary school, H-elementary school and W-elementary school in Alor Regency in total 81 students appointed as an object observation. Quantitative analysis is performed by using this instruments (test, observation, and questionnaire). There are some activities in the class in order to reach level in RME approach and make it connected each other. Briefly, all of the activities can be seen in Figure 2.

FINDING AND DISCUSSION

The analysis was collected by observation during the lesson (students' worksheet, audio record) and test (pre and post-test). In order to answer research question "what kind of influence of Jakri game given on students' understanding in learning word problem" researcher try to confirm the students' basic knowledge. Through conducting the pre-test and post-test, researcher try to see the effectiveness of the lesson using Jakri game. But the results show the decrease mean score from pre and post-test each school. So it is very difficult to see the influence of this method quantitatively because the students only provide short answer without any explanations or just leave the sheet blank. The Table 1 shows the tests of normality.

Based on this figure, the distribution shows the pre-test and post-test were not normally distributed. Descriptive statistics showed the mean score of pre-test is 37.47 and standard deviation is 23.673. While the mean score of the post- test is 31.74, and standard deviation is 18.308. The researcher tries to identify the reason why the data is not normally distributed. The result of this cannot determine the students' ability to do mix operation and word problem. So addition to this, researcher try to analyze from observation of the students and also their worksheet of pre- test and post-test.

In this research, the teacher put more attention to the students' solution way in the word problem, so based on this experiment researcher find out some characteristics of students' answer.

Table 1: Normal Distribution for Pre-test and Post-test

Tests of Normality

	School	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pre_Test_Score	K-Elementary School	.280	20	.000	.654	20	.000
	H-Elementary School	.266	21	.000	.842	21	.003
	W-Elementary School	.176	26	.036	.895	26	.012
Post_Test_Score	K-Elementary School	.296	20	.000	.636	20	.000
	H-Elementary School	.262	21	.001	.829	21	.002
	W-Elementary School	.258	26	.000	.863	26	.003

a. Lilliefors Significance Correction

This figure showed the percentage of students' which can reach the goal of each activity during the lesson (categorized as yes). The category of "yes" is determined by the students' response as follows:

Students' response "Yes" divide into two parts in the activity 2. The first one is if the students answer using direct modeling and the second one is using semantic modeling. In the late of 1970, semantic characteristics of word problem began to receive attention (Yeap & Kautr, 2001), (Valentin & Sam, 2004). Direct modeling is labeled when students only provide a short answer without making any story according to mathematics sentence given. While in contrast with direct modeling, the semantics modeling is labelled when students provide the story meaningful based on the mathematics sentence given.

Students' response "Yes" in activity 3 is divided into a multiplicative structure and additive structure. In multiplicative structure, there are three characteristics, partition, quotation and repeated addition. While in additive structure, there are three features also consist of a combine, compare and change. It shows that most of the students make their story which is consist of change and repeated addition instead of other characteristics. It means that the students understand the meaning of mathematics sentence given. But not all the students because as shown on the table the percentage of "yes categorized" decrease which means some of the students still have difficulty.

Students' response "yes" in activity 4, categorized as long as students can solve the problem and provide the correct answer. The percentage is getting decrease because of students' weak point in multiplication and mix operation.

Based on the results above, the process in each activity has own characteristics which

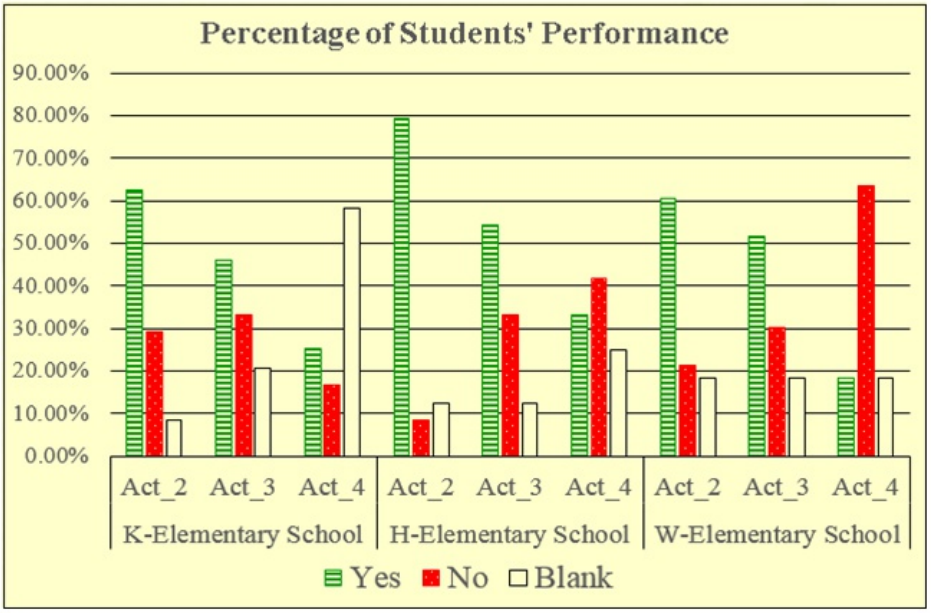

Figure 3: Percentage of Students' Understanding during Learning Process

Table 2: Percentage of Students' Ability in Word Problem in K-School

K-School (24 students)				
Activity 2		Computation (%)		
		Yes	No	B/A*
Telling Stories (%)	Yes	25	37.5	8.3
	No	0	29.2	
Activity 3		Computation (%)		
		Yes	No	B/A
Making Stories (%)	Yes	20.8	12.5	20.8
	No	12.5	33.4	
Activity 4		Computation (%)		
		Yes	No	B/A
Solving word problem (%)	Yes	16.7	4.16	58.3
	No	4.16	16.7	

*B/A: Blank/Absent

Table 3: Percentage of Students' Ability in Word Problem in H-School

H-School (24 students)				
Activity 2		Computation (%)		
		Yes	No	B/A*
Telling Stories (%)	Yes	29.2	50	12.5
	No	0	8.3	
Activity 3		Computation (%)		
		Yes	No	B/A
Making Stories (%)	Yes	54.2	0	12.5
	No	0	33.3	
Activity 4		Computation (%)		
		Yes	No	B/A
Solving word problem (%)	Yes	33.3	0	25
	No	0	41.7	

*B/A: Blank/Absent

Table 4: Percentage of Students' Ability in Word Problem in W-School

W-School (33 students)				
Activity 2		Computation (%)		
		Yes	No	B/A*
Telling Stories (%)	Yes	36.4	24.2	18.2
	No	0	21.2	
Activity 3		Computation (%)		
		Yes	No	B/A
Making Stories (%)	Yes	12.1	21.2	18.2
	No	18.2	30.3	
Activity 4		Computation (%)		
		Yes	No	B/A
Solving word problem (%)	Yes	18.2	0	18.2

Table 5: Percentage of students' answer in questionnaire type 1

This is what I think about Jakri game	Percentage of Yes (%)
Jakri is difficult to playJakri	27.2
I like to count in playing Jakri	**76.5**
The Jakri's rule very easy	63.0
I have difficult to write the observation sheet	23.5
I have difficult to write mathematics sentences for Jakri game	32.1

Table 6: Percentage of students' answer in questionnaire type 2

This is what I did	Percentage of Yes (%)
I follow Teacher's order	**82.7**
I heard my friend while talking	75.3
I do all of my assignment when I wish	63.0
I try my best in my assignment	74.1
I am responsible so that Teachers and my friends can count on me	55.6

Table 7: Percentage of students' answer in questionnaire type 3

This is what I think about mathematics	Percentage of Yes (%)
Mathematics is exciting and challenging subject	**64.2**
I learn mathematics when time for exam	60.3
I use props to help me learn mathematics easily	53.1
I have confused and difficult when learn mathematics in the class	28.4
If I cannot solve the test, then I will ask the teacher how to do	61.7

are very crucial to develop students' understanding of word problem. Especially in the activity 3 where students are shifting from model-of to the model-for.

Additionally, the researcher tries to investigate as well whether the students who are good to make a story also good work on computation as well in another word they can solve the word problem because they understand what "number operation" should be pose by the students for the word problem.

Based on the tables above, it is shown that the percentage of students who are good on word problem and computation are varied in each level.

Questionnaire was distributed in order to answer research question "what kind of influence of Jakri game given on students' interests in learning word problem". There are three types questionnaire of self-assessment. In each question there are five sub questions.

Based on the table 5, 6, 7 showed the students have good attitude to the teacher, they interested to this game as well although they found some difficult to do mathematics sentence and overall the students like the mathematics subject.

CONCLUSION

The finding and discussion of this study confirm that students got the influence by Jakri game pattern when they try to pose the new problem. But some of them able to provide the unpredictable word problem. Although their ability to do computation still low, but they become more aware of the keyword which has a meaning addition or multiplication concept. The idea to tell the story and make their own story is very though for students who has a lack of confidence. The students are used only to receive the information from the teacher, so it is very hard to make a meaningful story. This result in line with the TESS-India's (2008)

suggestion to let the student create the word problem by themselves. By engagement the students directly with a certain condition, students can perceive the meaningful of mathematics. Students' interest towards mathematics and Jakri game also very positive. Hopefully, by observing this class, teachers can be motivated to teach using daily activity from the students which is more closely connected with custom, tradition and culture.

REFERENCES

Bishop, A.J. (1991). Mathematics Enculturation: A Cultural Perspective on Mathematics Education. Dordrecht, Boston, London: Kluwer Academic Publisher.

Caldwell, J.H., Golbin, G.A. (1979). Variable Affecting Word Problem Difficulty in Elementary School Mathematics, Journal for Research in Mathematics Education 10(5), 323.

Cunningham, B. (2014). Good at Math, Bad at Word Problems: Hor to Help. Retrieved from https://www.understood.org/en/learning-attention-issues/child-learning-disabilities/math-issues/good-at-math-bad-at-word-problems-how-to-help, December 26, 2016

Gunawan, H. (2010). Analisis Konten dan Capaian Siswa Indonesia dalam TIMSS. Jakarta. Retrieved from

http://litbang.kemdikbud.go.id/data/puspendik/HASIL%20RISET/TIMSS/LAPORAN%20TIM SS%20-%20Analisis%20Konten%20dan%20Capaian%20Siswa%20Indonesia%20dalam%20TI MSS%20Tahun%201999,%202003,%202007%20(Matematika).pdf, July 19, 2016.

IEA. (2011). Overview TIMSS and PIRLS 2011 Achievement. IEA.

Intensifptn. (2013). 10 Permainan Jadul Anak Indonesia. Retrieved from http://www.kaskus.co.id/thread/51cd10131ad7196c0500000/10-permainan-jadul-anak-Indonesia, June 28, 2013.

Keijzer, R. (2003). Teaching formal mathematics in primary education. Fraction learning as a mathematising process. Utrecht: Utrecht University/Freudenthal Institute (Doctoral dissertation).

Ministry of Education and Culture. (2015). Laporan Hasil Ujian Nasional. Retrieved from http://www.kemdikbud.go.id/, June 10, 2016.

Minister of National Education Republic of Indonesia. (2003). Act of the Republic of Indonesia Number 20, Year 2003 on National Education System. Retrieved from http://planipolis.iiep.unesco.org/upload/Indonesia/Indonesia_Education_Act.pdf , October 29, 2015.

OECD. (2014). PISA 2012 Results in Focus What 15-year-olds Know and What They Can Do with What They Know. OECD.

Schoenfeld, A.H. (2016). Why are Word Problems So Darned Hard?. University of California Berkeley, CA, USA. Retrieved from

http://www.msri.org/attachments/workshops/454/Alan%20Schoenfeld%20power%20point.pdf

TESS-India. Mathematical Stories: Word Problems. The Open University UK and UK aid. Retrieved from

http://www.open.edu/openlearnworks/pluginfile.php/134932/mod_resource/content/3/EM04_AIE_Final.pdf, June 10, 2016

Tiro, M.A, Hamra, A, Sukarna. (2010). Analysis of the Determinants of Learning Outcomes Using Data from the Programme for International Student Assessment (PISA). Retrieved from

http://litbang.kemdikbud.go.id/data/puspendik/HASIL%20RISET/PISA/Laporan%20PISA%20-%20Analysis%20of%20the%20Determinants%20of%20Learning%20Outcomes%20Using%20Data%20from%20the%20Programme%20for%20International%20Student%20~1.pdf, July 19, 2016.

Valentin, J.D.,Sam, L.C. (2004). Roles of Semantic Structure of Arithmetic Word Problems on Pupils Ability to Identify the Correct Operation. Retrieved from http://www.cimt.org.uk/journal/valentin.pdf

Van den Heuvel-P, M. (2001). Realistic Mathematics Education as Work in Progress. Retrieved from

http://www.fisme.science.uu.nl/staff/marjah/documents/Marja_Work-in-progress.pdf

Van Hiele, P. (1986). Structure and Insight: A Theory of Mathematics Education. Orlando, FL: Academic Press.

Yeap, B.H., Kaur, B. (2001). Semantic Characteristics that Make Arithmetic Word Problems Difficult. 24th Annual Merga Conference: Sydney. Retrieve from https://www.merga.net.au/documents/Yeap&Kaur.pdf

Wijaya, A. (2008). Design Research in Mathematics Education: Indonesia Traditional Games as Means to Support Second Graders' Learning of Linear Measurement. Master Theses. Utrecht University. Netherlands.

Wijaya, A., Doorman, L.M., Keijze, R. (2011). Emergent Modelling: From Traditional Indonesian Games to a Standard Unit of Measurement. Journal of Science and Mathematics Education in Southeast Asia, 34(2), 149-173.