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TAEKWONDO SPORT CONTEXT IN ASIAN GAMES OF PISA-LIKE MATHEMATICS PROBLEMS

Dewi Rawani[1], Ratu Ilma Indra Putri[2]*, Hapizah[2]

[1] Master Program on Mathematics Education Sriwijaya University, Srijaya Negara Street Bukit Besar, Palembang, Indonesia
[2]Mathematics Education Departement Sriwijaya University, Srijaya Negara Street Bukit Besar, Palembang, Indonesia
Email: dewirawani@yahoo.com

Abstract

This research aims to produce taekwondo sport context PISA-like problems which validity ecticality on Asian Games and had a potential effects of these problems on students's mathematics ability. The research method d is Design Research type development studies which consist preliminary and formative evaluation. Formative evaluation which includes: self-evaluation, one-to-one, expert review, small group, and field test.. Researchers used the taekwondo context to require students to estimate the maximum total of athletes who can exercise in the hall with the specified size. Based on the analysis can concluded that problems have been valid qualitatively based on the framework PISA who validated by 3 expert reviews; practical, students are easy to understand the problem. Based on the analysis of student answer results, the developed problems have a potential effects on student's diverse basic mathematical abilities of the various process of answering the problems. The basic mathematics abilities that arise in this issue among which there are reasoning and argument ability, it appears that students can develop and solve the problem by modeling using their own assumptions. In addition, the ability to design strategies to solve problems, it appears that student uses various procedures in solving problems by leading to the conclusion.

Keywords: Development research, PISA, Taekwondo Context in Asian Games

Abstrak

Tujuan dari penelitian ini adalah menghasilkan soal matematika tipe PISA menggunakan konteks cabang olahraga taekwondo pada Asian Games yang valid, praktis serta mengetahui efek potensial soal tersebut terhadap kemampuan matematis siswa. Metode penelitian yang digunakan adalah *Design research* tipe *Development studies* yang terdiri dari *preliminary* dan *formative evaluation*. Alur desain *formative evaluation* meliputi: *self evaluation*, *one to one* dan *expert review*, *small group*, dan *field test*. Peneliti menggunakan konteks taekwondo untuk meminta siswa mengestimasi jumlah maksimal atlet yang dapat latihan dalam aula dengan ukuran yang tentukan. Hasil penelitian ini menghasilkan soal yang telah dinyatakan valid, sesuai berdasarkan *framework* PISA yang divalidasi 3 *expert review* secara kualitatif; praktis, siswa mudah dalam memahami soal tersebut. Berdasarkan analisis hasil jawaban siswa, soal yang dikembangkan ini memiliki efek potensial terhadap kemampuan dasar matematis siswa yang beragam pada proses penyelesainnya. Kemampuan dasar matematis yang muncul pada permasalahan ini diantaranya kemampuan penalaran dan argumen, terlihat siswa dapat mengembangkan dan menyelesaikan masalah dengan *modelling* menggunakan asumsi sendiri. Selain itu, kemampuan merancang strategi untuk memecahkan masalah, terlihat siswa menggunakan berbagai prosedur dalam memecahkan masalah dengan menggiring pada satu penarikan kesimpulan.

Kata Kunci: Penelitian Pengembangan, PISA, Konteks Taekwondo pada Asian Games

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PISA or Programme for International Student Assesment is an International study organized by OECD (Organization for Economic Cooperation and Development) which assessment students' literacy skills (Edo, Putri, Hartono, 2014). PISA is held every 3 years to see academic ability both in literacy reading, mathematic literacy, science literacy and financial literacy (OECD, 2015). Based on Indonesia's participation in PISA 2015, Indonesian students earn an average of 386 and rank 63 out of

the 70 participating countries (OECD, 2015). The involvement of Indonesia in PISA is an effort to see the position of literacy ability of students in Indonesia when compared with student literacy achievement in other countries and the things that influence it (Khairuddin, 2017).

The low PISA result of Indonesian students is caused by students' failure to work on the PISA problem lies in their difficulty in formulating everyday problems into formal mathematical forms, understanding mathematical structures and evaluating mathematical results to real-world contexts (Edo, Putri, Hartono, 2014, Jupri, Drijvers, 2016). Moreover, when they have obtained the mathematical solution of the problem then it is not followed by interpreting the solution back to the given context/situation of the problem (Jupri, Drijvers, & Heuvel-Panhuizen, 2014; Lutfianto, Zulkardi, & Hartono, 2013). Putri (2012) stated using a context the students would not learn directly to the formula. Classroom activities designed by the teachers also have engaged students in group and classroom discussions. One effort to familiarize students with PISA model problem is to provide the problem as early as possible or at the beginning of the student stepping on middle school level (Barczi, 2008). Based on the results of PISA showed that students who are able to answer the problem correctly on the subject of the geometry of 47.5%, 61.96% for statistics, and 53.7% of number(Wardani, 2011). The result of PISA Indonesian students is one of the reasons the government revises the curriculum of KTSP and then develops and implements the 2013 curriculum (Kemendikbud, 2014). Putri (2013) reveals that one approach that is in line with the 2013 curriculum is PMRI approach. Zulkardi and Putri (2006) said that PMRI is one approach that uses contextual.

The results of Aminuddin's research (2012) that developed the mathematical problem of PISA model on Space and Shape content to know the ability of mathematical connection of junior high school students stated that less than 50% of students are able to solve math problems model PISA level 4,5 and 6. Another research Purnomo (2015) said the ability of students to solve the problem of PISA content space and shape based on Rasch model analysis is still lacking.

Charmila (2016) said that it is important to integrate the context in the surrounding environment. In 2018, Indonesia will host the XVIII Asian Games. On this occasion will be held in Jakarta and Palembang. The Asian Games is a sports competition held every four years with athletes from all over Asia enrolled in the Olympic Council of Asia (OCA) membership (Wikipedia, 2017). From the sports that will be held at the Asian Games later, many contexts related to the space and shape that can be applied into the math either from the equipment used, the situation of sports events and even the place of sport. Rahayu, Ratu & Zulkardi (2017) stated context of atheletics hurdles which is an Asian Games sport is used as the starting point used as a helpul media to solve the problems associated with fractional multiplication operations with natural numbers. Roni's research (2017) states used the context of sprint sport at the Asian Games give impression of something new and different. Meanwhile Gunawan's research (2017) used the swimming context is chosen because it can represent fractions using measurements. The shape of the pool is one model that allows to represent parts of the whole.

Based on the previous description, in this paper will discuss the math problem of PISA type using only the context of taekwondo sport. So the purpose of this research is to produce a valid and practical PISA math problem with the context of taekwondo sport at Asian Games 2018 and to know the potential effect of Mathematics PISA type with the context of taekwondo sport at Asian Games 2018 on students' mathematical ability.

METHOD

This research method is design research type development studies which consist of 2 phases that is preliminary and formative evaluation which include: self-evaluation, one to one and expert review, small group, and field test. (Tessmer 1993, Zulkardi 2006). In accordance with the provisions of the PISA framework subjects in this study are 15-year-old students in the class MIA 3 SMA 10 Palembang.

Initially researchers evaluated and reviewed the initial prototype draft. The researcher also designed several instruments (lattice, question cards, scoring rubrics and PISA questions on Space and Shape content based on PISA questions criteria). This research begins by describing how the developed problem to be valid. Therefore, the subjects used in this stage are 3 students who have various capabilities such as high ability, moderate and low. The three students are subjects in the one-to-one stage given about Prototype 1. Prototype 1 is a matter that has been developed by researchers.In other, prototype 1 also given at the expert review step. In this case, expert review is a PISA expert. In this study, the expert who became expert review is Prof. Kaye Stacey, Dr. Ross Turner and Prof. Ahmad Fauzan. This validation test focuses on three characteristics (content, constructs, and languages). The revision of prototype 1 is called prototype II. Prototype II is given to a small group of non research subjects with six students with each low, moderate, high-ability student. At this stage also evaluated the appearance and use of questions to see the responses, assessments, and practicality of these questions and the results as input to revise the design question to the next stage. The revision result of small group is called prototype III. Then the next stage, prototype III is tested with the subject of research by analyzing the results of student answers. It aims to see the potential effects that arise on students' mathematical abilities.

Data collection technique used in this research is walkthrough; used to know the validation of the problem both in terms of content, constructs and language according to the PISA framework. Function of documentation as physical data in the form of related documents. The test is performed to see comments from students on clarity, legibility, results of student answers to basic mathematical skills that arise. Interviews serve to gather information about what students think when they complete the given problem.

RESULT AND DISCUSSION

This study has produce 9 problems of PISA type using the context of game sports and taekwondo. There are 7 problems that use the context of the game (6 problems using the context of the small soccer field, 1 problems using the context of the big soccer field) and there are 2 problems using the context of the taekwondo sport. Of the 9 problems that consists of each two problems are level 3, level 4 and level 5 and one problems are level 1, level 2 and level 6. In this paper, researchers discuss one of the problems of the branch sport taekwondo. Researchers interested in discussing the problem using the context taekwondo because there are various ways of completion that students use so there are many assumptions that students use in solving problems given. The following stages in the development of PISA problems using the context of taekwondo sport at the 2018 Asian Games.

Preliminary

At this stage, the researcher determines the place and subject of the research, analyzes and designs the PISA (prototype 1), creates a grid containing the appropriate indicators of the curriculum, designs the cards problem, scoring rubrics according to the PISA framework. In addition, the researcher contacts the subject teachers to be used as research sites and prepares other needs such as scheduling and working procedures with classroom teachers.

Formative Evaluation

Self-evaluation

On self evaluation step, the researcher reviewed the prototype design by checking the conformity of the problem design with the PISA 2015 framework both in terms of content, context, language and level prediction in PISA. This stage aims to check the error in the process of resolving the problem before the prototype is used in the next stage. The results of the this prototype will be given to experts at the expert review stage and one-to-one. Furthermore, researchers also designed several instruments such as lattices, cards problem, scoring of rubrics and PISA problems based on the PISA framework. From this stage**,** nothing changes or nothing to repair, because according to the researchers the instrument is made in accordance with the PISA framework. The result of this prototype is called prototype 1. Researchers are motivated to develop problems from the PISA problem about a rock concert. In this case, researchers change the context using taekwondo sport. Researchers want to estimate the maximum number of taekwondo players who can practice in a hall with a given size. Researchers also want whether students who solve these problems have determined reasonable, relevant and accountable assumptions given their assumptions. The content used in this issue is space and shape. Predicted levels on this issue include level 5 predictions. Here is a comparison between the original PISA problem with the developed problem.

Table 1. Comparison between the original PISA problem with the developed problem

PISA problem	Developed problem
M552: Rock Concert **Question 1: ROCK CONCERT** M552Q01 For a rock concert a rectangular field of size 100 m by 50 m was reserved for the audience. The concert was completely sold out and the field was full with all the fans standing. Which one of the following is likely to be the best estimate of the total number of people attending the concert? A 2 000 B 5 000 C 20 000 D 50 000 E 100 000 **(PISA, 2009)**	 **Picture 1.** Taekwondo training hall Pelatnas (national training camp) taekwondo will undergo a series of warm-up before plunging in the 2017 Asian Games Kuala Lumpur. This exercise will be held in a rectangular hall measuring 150 meters in length and 75 meters wide. What is the maximum number of taekwondo athletes who can exercise in the hall?

Expert Review and One to one

Prototype 1 then validated by experts at the expert review stage and by students at the one-to-one stage. Both of these stages are carried out simultaneously. This stage is to look at the validity of PISA math type instruments using the context of the sport that has been developed. Expert review is a qualitative stage of validation. Experts who act as validators through via mails reviews are Prof. Kaye Stacey, Dr. Ross Turner and Prof. Dr. Ahmad Fauzan. The expert act as a validator on the review panel item is Prof. Zulkardi, M.I.Komp., M.Sc. (Sriwijaya University Lecturer), Dr.Somakim M.Pd. (Sriwijaya University Lecturer) and Ika Pratiwi, S.Pd. (University of Sriwijaya University graduate students).

The following inputs provided by the three experts, Ross Turner said that this problem can be said as a modeling problem. So in the assessment rubric will involve whether the student has been able to determine assumptions that are reasonable, relevant or accountable considering the assumptions made by each student. Kaye Stacey added that the matter can match the number of athletes that actually exist in taekwondo at the Asian Games 2018, so the estimated number of athletes who are training does not exceed the capacity of athletes that actually exist in the Asian Games 2018. While Ahmad Fauzan no comments on this problem so that this matter can be forwarded. While the advice given from the panel item results is to add a goal or reason why you want to develop a problem that uses the context of the sport. So that the students aim to be motivated to solve the problem.

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In one-to-one step, the problem of prototype I was tested also to three students who have various abilities which consist of each student has low ability, student has medium ability, and student has high ability. The focus of this stage is to get students'comments on the clarity of the question intent, propose changes or alternatives, investigate why students are confused or have difficulty or even other interesting things from some aspect of the problem device. The three students at this one to one stage initials CAR, MFR and NA. NA said that in the matter there is a narrow meaning of the maximum. So the student is confused interpreted in the word maximum. While CAR confused because he do not know how many movements are done in the exercise.

Based on the comments and suggestions from the validator and students at the one-to-one stage, the researcher made improvements to the prototype 1. So that the revision decision taken by the researcher is the researchers adjust the length and width of the hall given in accordance with the measure of taekwondo athletes in the Asian Games 2018 So the estimate to accommodate the total of athletes who exercise does not exceed the capacity of the real athlete. Then the problem solving strategy has been added to the scoring rubric.

Based on the revision of suggestions and comments from expert review and one to one conducted in parallel, then obtained a second prototype.

Small Group

On small group step, prototype 2 is tested to 6 students. Students involved at this stage are students which consist of each student has 2 low ability, 2 student has medium ability, and 2 student has high ability. The six students at the small group stage were given prototype 2 simultaneously. The students were given time to work on the problem individually, then after a few minutes, they were asked to work on the matter with their group members by way of discussion.

The researcher's focus on this small group stage is to see if students can understand the purpose of the given questions, whether information such as tables, figures, numbers can be seen and understood well. As long as the students solve that problem, the researcher goes around to see if there are any problems that the students encounter in the process of solving the given problem. Then after

the students completed the given problem, one of the group representatives was interviewed to ask how the problem had been worked out.

On this stage, all students can solve the problem without difficulty. So the matter is retained without revision. The result of the revision of the question based on the student's suggestion/comment on the small group stage, then called the third prototype. The third prototype is shown in Figure 1.

Figure 1. Taekwondo Hall

Pelatnas (national training camp) taekwondo will undergo a series of warm-up before plunging in the 2017 Asian Games Kuala Lumpur. This exercise will be held in a hall measuring 16 meters long and 5 meters wide. What is the maximum approximately the number of taekwondo athletes who can exercise in the hall?

Figure 1. *Prototype* 3

Field Test

In Field test phase, the stage that is tested on the subject of research that is grade X MIA 3 SMA Negeri 10 Palembang, 33 students worked on the third prototype. Researchers also observe students in working on the problem, so it can be known what difficulties that students experience. One of the goal of the field test step is to know the potential effect of the problem on the students' mathematical literacy ability which can be seen from the result of the student's answer. Here is the discussion of the results of student answers in the field test stage in solving problems with their respective strategies.

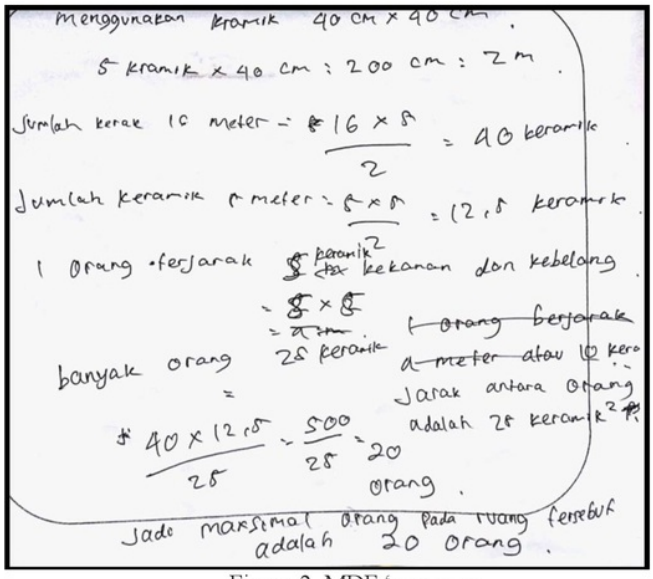
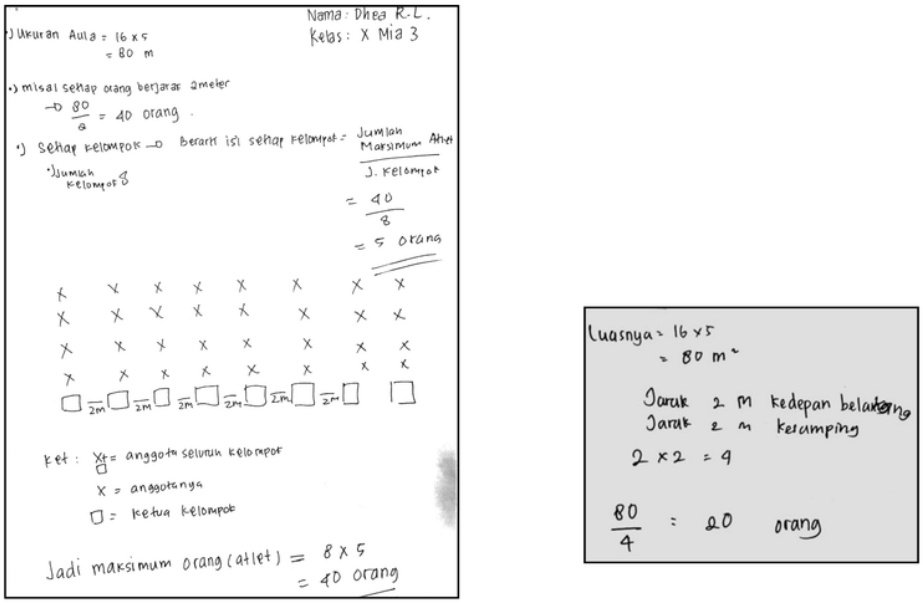


Figure 2. MDF 's answer

From the analysis of student answer, it appears that the MDF estimates the maximum number of taekwondo athletes who can exercise in the hall using ceramic measuring 40 cm x 40 cm as a benchmark in the distance between athletes. Although it is seen in the picture that the hall's floor is made of parquet wood, the MDF tries to use ceramics as a strategy to answer this problem. In this case, students are able to use representational skills. Also visible students make explanations and reasoning that support to qualify a mathematical solution to a contextual problem. In this case, the student is able to use reasoning and argument ability.

Initially, the MDF estimates the distance required for one athlete. By applying for 5 ceramics x 40 cm = 200 cm = 2 m. Here, the MDF estimates the space required between athletes to avoid touching each other. Furthermore, the MDF calculates the area of the hall by adjusting to the width and length of the hall using ceramics. After that, it was produced that one athlete requires a breadth of 25 ceramics, with 5 ceramic extending sideways and 5 ceramics extending backward. So the MDF concluded that the total maximum of athletes who can exercise in the hall is 20 people. The student answers by using another strategies to prove that their answer (Figure 3).



(a) (b)

Figure 3. DRL's answer (a) and N's answer (b)

It appears that a student with the initials DRL uses an answer strategy that simultaneously shows the sketch assumed himself. DRL assumes that everyone have space 2 meters with 8 groups. So with the size of the hall that is 80 m^2 and everybody get 2 meters, can be concluded there are 40 athletes who can exercise in the hall. With each group totaling 5 athletes.

While the student initials N estimates the total maximum of athletes who can practice in the hall is 20 people. Similar to the strategy undertaken by MDF and DRL, N also estimates that there is a distance between athletes. N estimates the required distance 2 meters to the front and 2 meters to the side (right and left). so one person has a $4m^2$ area for arena. It can be concluded that the estimated total maximum of athletes who can practice in the hall is 20 people.

Based on field test results, 17 from 33 students can use reasoning and arguments ability. It appears that students can make the explanation and reasoning from the mathematical solution to the contextual problem completely. We can see when students argue that situations are assumed to be reasonable, for example the assumption of distance size between students. There are also 6 from 33 students can define the complete range of mathematical solutions. Here students state the reasons for limiting the distance required from each athlete. So in this case, students are able to use the ability of mathematization.

In addition, there are 14 of 33 students can communicate explanations and arguments in the context of the problem completely. In this case, students are able to use communication ability. There are also 15 from 33 students can use representational ability. It appears that students can interpret mathematical results in a form of representation completely. Based on students' answers, the potential

basic mathematical ability that arise in this problem include: communication ability, viewed from the ability of students to read, interpret questions, images are given. It also shows that students are capable of reasoning and argumentation, mathematical ability and representational ability, can be seen from students' ability to represent real-world situation problems into math problems. Hapizah (2014) said the ability of reasoning is the ability to direct the mind to produce a statement in reaching conclusions when solving a problem.

In general, the achievement of students in the field test stage in working on the problem of prototype 3 has shown a potential effect. This issue has the potential to bring up various basic mathematical skills in the process of completion. Based on the results of the interview, the students stated that the tested tools provide a new experience for the students, the questions given are interesting because they use various sports contexts and vary according to their level so they can imagine more in answering the problem so that in solving this problem imagine using assumptions and logic. The context is a main point for students in developing mathematics and the context it self should be meaningful for them and real for their's mind (Putri, Dolk, Zulkardi ,2015). Same like Nasution (2018) stated the use of the rowing sport can be a bridge of students' thinking and help students in understanding the operation of addition and subtraction of fractions. Gunawan (2017) added with the support of context and learning media, students learn will be more antuasias. In addition, many students reveal that in solving this problem requires sufficient reasoning and to solve problems ability. This is in line with Putri (2015) saying that learning mathematics through sports can make students prefer mathematics, this is because they will adapt faster because it concerns daily activities. The concept of learning will be effective and minimize the level of difficulty of students in mathematics. As stated by Zulkardi and Jurnaidi (2013) in their research which concluded that the results of interviews with 5 students of the field test field is illustrated that in general the problems of mathematical reasoning PISA model can provoke students to think reason in solving the problem even though some students still have problems in understanding and resolving it. This means that the PISA model of sports content content developed is able to explore students' mathematical ability, and give positive effects to the students so it can be concluded that the problem has potential effect for the students.

CONCLUSION

This research produces a product of a PISA mathematical problem using the context of the Taekwondo sport at the 2018 Asian Games. In the preliminary, reseachers develop about 9 item using sports context in Asian Games 2018. All the item in the design, at the expert review stage and one-to-one have some revised. In small group, all the problems fill the practical characteristics. So that, in prototype 3 produced 9 items. This developed prototype generated about PISA model using the context of taekwondo sport that valid and practical. Student achievement in the field test stage in working on the problem of prototype 3 can develop students'mathematical literacy skills and explore

students' potentials. Based on the analysis of the results of tested on 33 students appear potential effects that appear basic mathematical abilities including the ability of reasoning and argument, it appears that students can develop and solve problems with modeling using their own assumptions. In addition, the ability to design strategies to solve problems, it appears that students use various procedures in solving problems by leading to the conclusion. Thus, this study is one of a positive contribution to develop Pisa-like mathematics problem in the context of taekwondo.

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REFERENCES

Aminudin. (2012). Pengembangan Soal Matematika Model PISA Pada Konten Shape And Space Untuk Mengethaui Kemampuan Koneksi Matematis Siswa SMP). Unpublished Thesis. Palembang: Sriwijaya University.

Barczi, K. (2008). A Study on how Hungarian Students solve problems that are unusual for them. Handbook of Mathematics Teaching Improvement: Professional Practices that address PISA.

Charmila, N.,Zulkardi., Darmawijoyo. (2016). Pengembangan soal matematika model PISA menggunakan konteks JAMBI. Jurnal Penelitian dan Evaluasi Pendidikan, 20 (2). 198-207.

Edo, S. I., Putri, RII, Hartono, Y. (2014). Investigating Secondary School Student's Difficulties in Modelling Problem PISA-Model level 5 and 6. Journal on Mathematics Education (IndoMS-JME), 4(1). 41-58.

Gunawan, M. S., Putri, RII, & Zulkardi. (2017). Learning Fractions through Swimming Context fo Elementry School Students. Proceedings of the 5th SEA-DR (South East Asia Development Research) International Conference 2017 (SEADRIC 2017), Atlantis Press.

Hapizah (2014). Pengembangan Instrumen kemampuan penalaran matematis mahasiswa pada mata kuliah persamaan diferensial. Jurnal Kreano,5(1),73-81.

Jupri, A. Drijvers, P. (2016). Student difficulties in mathematizing word problem in Algebra. Eurasia Journal of Mathematics, Science & Technology Education, 12(9): 2481-2502.

Jupri, A., Drijvers, P., & van den Heuvel-Panhuizen, M. (2014). Difficulties in initial algebra learning in Indonesia. Mathematics Education Research Journal, 26: 683-710.

Kemendikbud (2014). Kerangka dasar dan struktur kurikulum SMA/MA dalam lampiran Permendikbud NO.69 Tahun 2013. Jakarta: Kemendikbud.

Khairuddin (2017). PISA, uji coba soal PISA dan strategi siswa menjawab soal. Semnastika UNIMED, 9(6).

Lutfianto, M., Zulkardi, & Hartono, Y (2013). Unfinished Student answer in PISA mathematics contextual problem. Journal on mathematics education (IndoMS-JME), 4 (2), 188- 193.

Nasution, M. F.,Putrii, RII, & Zulkardi (2018). Rowing Sport in Learning Fractions of the Fourth Grade Students. Journal on mathematics education (IndoMS-JME), 9 (1), 69-80.

OECD (2015). PISA 2015 Assessment and Analytical Framework Science, Reading Mathematic and Financial Literacy. Diunduh dari http://www.oecd.org/dataoecd/61/15/46241909.pdf pada tanggal 28 Juni 2017.

Putri, RIII (2012). Developing Learning Trajectory Using Traditional Games In Supporting Students Learning Greatest Commom Divisor In Indonesia Primary School. *Proceeding ICME-12,* Seoul, Korea.

Putri, RII (2013). Pengembangan soal tipe PISA siswa sekolah menengah pertama dan implementasinya pada konteks literasi matematika (KLM) 2011. Prosiding seminar nasional matematika dan terapan. 28- 29 November. Aceh, Indonesia.

Putri, RII (2015). Penilaian dalam pendidikan matematika di Indonesia: Lokal, Nasional, dan Internasional. Makalah disampaikan pada rapat senat Khusus terbuka Universitas Sriwijaya, Senin 20 April 2015. http://fkip.unsri.ac.id/index.php/posting/90.

Putri, RII., Dolk, M., Zulkardi (2015). Professional Development of PMRI Teachers for Introducing Sosial Norms. Journal on mathematics education (IndoMS-JME), 6(1), 11-19.

Purnomo, S & Dafik (2015). Analisis Respon Siswa terhadap Soal PISA Konten Space and Shape dengan Rasch Model. Seminar Nasional Universitas Jember.

Rahayu., Putri RII, & Zulkardi (2017). Multiplication of Fraction With Natural Number by Using Hurdles. Proceedings of the the 5th SEA-DR(South East Asia Development Research) International Conference 2017 (SEADRIC 2017). Atlantis Press.

Roni A., Zulkardi& Putri, RII (2017). Sprint Context of Asian Games in Divison of Fractions. Proceedings of the the 5th SEA-DR(South East Asia Development Research) International Conference 2017 (SEADRIC 2017). Atlantis Press.

Tessmer, M (1993). Planning and Conducting Formative Evaluations. London: Kogan Page.

Wardani, K. (2011). Pengembangan soal metematika model PISA untuk program pengayaan kelas VII SMP. Unpublished Thesis. Palembang: Sriwijaya University.

Zulkardi (2002). Development a Learning Environment on Realistic Mathematics Education for Indonesian Student Teachers. Dissertation. Netherlands: University of Twente.

Zulkardi & Putri, RII (2006). Mendesain Sendiri Soal Kontekstual Matematika. Prosiding Konferensi Nasional Matematika XIII. Semarang.

Zulkardi & Jurnaidi (2013). Pengembangan Soal PISA Pada Konten Change and Relationship untuk Mengetahui Kemampuan Penalaran Matematis Siswa Sekolah Menengah Pertama. Jurnal Pendidikan Matematika, 7 (2), 25-42.

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