[JME] Editor Decision

Kotak Masuk

Rully Charitas Indra Prah... 15/5/2019
kepada saya, Ratu, Yusuf

Dear Levana Maharani,

We have reached a decision regarding your submission to Journal on
Mathematics Education, "PISA-LIKE MATHEMATICS PROBLEMS USING AQUATIC CONTEXT
IN ASIAN GAMES".

Our decision is to: Revisions Required

Please revise and re-submit your revised paper based on reviewers' comments
before May 19, 2019.

Regards,

Rully Charitas Indra Prahmana
(SCOPUS ID: 57192302745), Universitas Ahmad Dahlan, Yogyakarta
rully.jme@gmail.com

Journal on Mathematics Educatioh (p:2087-8885 e:2407-0610)
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Levana Maharani 2/6/2019
kepada Rully, ratu.ilma, Yusuf

Thank you for informing me.

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PISA-LIKE MATHEMATICS PROBLEMS USING AQUATIC CONTEXT IN ASIAN GAMES

Abstract

This study aimed to create mathematical problems of uncertainty and data contents in PISA using aquatic context that were valid, practical and had the potential effect. This study was designed to the research of development study. The subjects in this study were tenth-grade students of senior high school Palembang consisting of 20 students. Data were gathered by means of interviews, observation, and tests. The results of data analysis showed that there were 8 valid and practical items of PISA type of uncertainty and data contents obtained using aquatic contexts in Asian Games. It was concluded that 11 out of 20 students showed reasoning skills and good arguments and 9 out of 20 students showed reasoning skills and arguments but incomplete, this was because they were not used to solving PISA type problems in learning.

Keywords: Task design, PISA, Aquatic Context

Abstrak

Tujuan dari penelitian ini adalah menghasilkan soal matematika tipe PISA dengan konteks cabang olahraga akuatik yang valid, praktis, serta memiliki efek potensial. Penelitian ini merupakan penelitian pengembangan *design research* tipe *development study*. Subjek dalam penelitian ini adalah siswa kelas X IPA 1 yang berjumlah 20 siswa. Pengambilan data dilakukan dengan cara wawancara, observasi dan tes. Dari hasil analisis data penelitian ini menghasilkan 8 soal tipe PISA konten *uncertainty and* data menggunakan konteks sepedan dan akuatik yang valid dan praktis dan dapat disimpulkan bahwa 11 dari 20 siswa menunjukkan kemampuan penalaran dan argumen yang baik dan 9 dari 20 siswa menunjukkan kemampuan penalaran dan argumen tetapi kurang lengkap, hal ini dikarenakan tidak terbiasanya siswa dengan soal-soal tipe PISA dalam pembelajaran.

Kata kunci: *Task design*, Soal matematika tipe PISA, Konteks cabang olahraga akuatik

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Statistics is part of the mathematical material consisting of ways of data collection, data processing and drawing conclusions based on data collection and data analysis performed (Sudjana, 1975). Statistics is very important to learn because they are widely applied in various disciplines like in natural sciences, business, and industry, where almost every decision made in the field uses statistical reasons (Bakker, 2004).

In fact, many students face difficulties in solving mathematical problems that result in low mathematical achievement. This occurs because students have not been accustomed to solving problems with the characteristics of a real context, and only do question exemplified by teachers without knowing its usefulness in daily life (Wati, 2016). This is in line with the results of PISA for uncertainty and data content where in2003 PISA results, Indonesia was ranked 38 out of 40 countries with the score of 385 (OECD, 2004). While the results of 2012 PISA, Indonesia was ranked 63 out of 65 countries because the score of Indonesian students, 384, was far below the average OECD score of 493 for uncertainty and data content. In addition, the Indonesian students were only able to resolve the matter of uncertainty and data up to level 5 of about 0.3% of students, far below the OECD average of 9.2% of students able to solve level 5 problems, even 3.2% students were able to complete up to

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Commented [A2]: 1. The soundness of English used in the abstract is partially acceptable, but please mind the structure of each sentence as it disturbs the reader's understanding.
E.g. instead of saying ambiguous sentence "20 students showed reasoning skills and and argument BUT INCOMPLETE", you can write " 20 students performed incomplete reasoning ...."

2. Using simpler structure of sentences would be more understandable for reader. Please avoid long-combined sentence and try to make it into 2 simpler sentences.
E.g. This study aimed to create mathematical problems of uncertainty and data contents in PISA using aquatic context that were valid, practical and had the potential effect.
It is better to write, " This study aims to develop PISA-like mathematics problems using the content of uncertainty and data and the context of aquatic in Asian Games. The problems are supposed to be valid and practical and have a potential effect.

3. The results section should contain as much detail about the findings as the journal word count permits, while the conclusion may constitutes of the most important answer of the research questions. This abstract unfortunately only provides conclusion with lack details of findings.

Commented [A3]: There are many up to date sources can be refer to, author may selects the newest one.

Commented [A4]: It is OK to explain the time to time progress of Indonesian PISA as long as it constructs strong message, however, addressing the latest result of Indonesian PISA will be better to get the most up to date data.

level 6 (OECD, 2014). It showed that Indonesian students' mathematical literacy was still very low in resolving problems of PISA type.

The low ability of Indonesian students in PISA is because Indonesian students are not familiar with the contextual problems such as in the PISA problem, especially about the high level both in the process of learning and evaluation (Novita, Zulkardi, and Hartono, 2012; Ahyan, Zulkardi, Darmawijoyo, 2014). In addition, it is difficult to find contextual problems designed to hone student problem-solving skills and have PISA characteristics and frameworks on mathematics textbooks used by Indonesian students, even in mathematics textbooks that have passed BSNP (Ward & Rumiati, 2011; Fatmawati & Ekawati, 2016). This is the basis for the development of the 2013 curriculum, adjusting the learning in Indonesia with the questions tested on PISA so that the problems used must be adapted to the characteristics of PISA (Kemendikbud, 2014). Therefore, non-routine questions with PISA characteristics are required to familiarize students with the procedures required to solve the PISA problems.

In uncertainty and data content, researchers are more centered on its data content, where the content of this data is a statistical matter. Statistics learning in Indonesia is generally teacher-centered without the effort to develop students' math ideas through interaction or discussion (Widjaja, Julie, and Suryandari, 2010). In addition, Groth (2006) also revealed that the learning was carried out by giving the formula directly without first learning about meaningful basic concepts and procedures for students. Shi, He, and Tao (2009) added one of the causes of students less interested in statistics is because statistics are taught theoretically and less connected to the real world. Thus the students do not know the application on each of these materials. This has an impact on the decrease of students' motivation and achievement in learning statistics. Therefore, non-routine questions with PISA characteristics are required to make students accustomed to solving problems of PISA type.

Statistics are very important in the field of sports. According to Jim Albert of Bowling State University and Ruud H. Sembiring from the University of Groningen, sports and statistics have a close relationship. Not only measuring performance, in fact, statistics can also be used to make fantasy games (Kompasiana, 2013). Asian Games is an interstate competition among Asian countries organized by the Olympic Council of Asia every 4 years (OCA, 2016). This competency event was held for the first time in New Delhi, India in 1951 and followed by countries in Asia including Indonesia. The 18th Asian Games will be held in Palembang and Jakarta, Indonesia in 2018.

Commented [A5]: From this paragraph, it seems that PISA becomes the main indicator in the success of Indonesian education. But before that, author can elaborate a stronger message about what PISA promises to measure and how significant it is to become the indicator of success reached by the students.
E.g. author may say that PISA measures the ability to solve real life problems which in the end it could provide skills for the students to survive in the future, or etc.

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METHODS

This study was designed to research of development study (Akker, 2006) aiming to produce valid and practical PISA mathematics problems for tenth-grade and to examine the potential effects of problems developed on mathematical literacy skills of high school students. This study was conducted in two stages: Preliminary evaluation and Formative evaluation (Zulkardi, 2006).

Preliminary evaluation stage consists of preparation where at this stage it becomes the first step

of the researchers in developing the problem of PISA type. At this stage, the researchers analyzed the characteristics of the PISA problem and the basic competencies of the questions to be developed based on the PISA framework, then designing where at this stage researchers designed the problem device including the question grids and the question card according to the characteristics of PISA problems.

Formative evaluation stage consists of self-evaluation where in this stage the assessment of the designing problem of PISA type was done by the researchers themselves then it was revised and prototype 1 problem obtained. Then proceed to expert review stage where at this stage, prototype 1 made by researchers was consulted to experts to validate and evaluate based on the validation criteria of content, constructs, and language. Simultaneously the researcher performed one to one stage. At this stage, they asked three students who were not the subjects of study as testers and were asked to work on, observe, comment and respond freely to the question of prototype 1. After the one to one stage, the researchers entered the small-group stage where at this stage they tested prototype 2, the revision of prototype 1, to a group of students who were not the subject of study so that prototype 3 was obtained.

Then the researchers reached the final stage of the field test where in the last stage of this experiment, they tested the problem of prototype 3 to the realistic field where the testing performed on the subject of the study. The subject in this study were tenth-grade students of Indo Global Mandiri senior high school Palembang consisting of 20 students aged 15 years old. The data were gathered by means of walkthrough, observation, and interview and analyzed qualitatively.

RESULTS AND DISCUSSION

Analysis Stage

One activity conducted at the stage of student analysis was to visit the place of research implementation at SMA LTI Indo Global Mandiri (IGM) Palembang. Furthermore, researchers discussed the subject of study with Siti Marfuah, S.Pd., the classroom teacher. The purpose of this discussion was to explain the research procedure, to determine the subject of research on stage one to one, small-group, and field test with 20 students of tenth-grade science 1 LTI-IGM senior high school Palembang.

The subject matter was identified based on the curriculum used in the school where the study was conducted. The curriculum used in LTI-IGM senior high school Palembang is the 2013 curriculum. In this curriculum, the standard content of mathematics learning includes numbers, algebra, geometry and data management.

After analyzing the students and the curriculum, the researcher analyzed the PISA problem based on the PISA framework, then they also studied various things about the Asian Games that could be used as contexts in developing the math problem of PISA type and 3 contexts were obtained namely bicycle, swimming, and synchronized swimming.

Commented [A8]: The characteristics of PISA problems need to be introduced as well.

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The same questions for construct and language criteria.

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E.g. Among various branches of the games, why the three branches come up and the others not?

Dsign Stage

At this stage, researchers began designing and compiling the PISA math problems using the cycling road and aquatic context. These questions were designed for tenth-grade senior high school students. Below is the result obtained from designing in the form of instrument consisting of:

a. Question grids of PISA type mathematics using the bicycle and aquatic context.
b. PISA type cards using the bicycle and aquatic context for senior high school level.
c. Rubric assessment of PISA mathematics problems using the bicycle and aquatic context for senior high school level
d. Lesson plan

5 items were generated in this designing stage, namely bicycle (2 items), Swimming (1 item), and synchronized swimming (2 items).

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Evaluation Stage

a. Self Evaluation

At this stage, the PISA mathematical problems using a bicycle and aquatic context had been designed and then reexamined by the researchers. It aimed to find and correct errors or deficiencies in the design process. Supervisors also assisted in the examination of questions that researchers had designed during the consultation prior to conducting the research.

b. Expert Riviews

The validity of a PISA mathematical problem using a bicycle and aquatic context was carried out in terms of content, constructs, and language. Prior to giving to the expert, these questions were discussed previously with the supervisors. The experts who reviewed the problems were: 1) Hongki Julie, professor of mathematics education Sanata Darma University Yogyakarta; 2) Zulkardi, professor of mathematics education Sriwijaya University Palembang; 3) Somakim, professor of mathematics education Sriwijaya University Palembang; 4) Rani Permatasari, Magister student of mathematics education of Sriwijaya University of Palembang ; 5) Siti Marfuah, high school math teacher in LTI-IGM Senior High School Palembang

The validation process by Hongki Julie was carried out via email. While the process of validation by Zulkardi, Somakim, dan Ranni Permatasari. was executed through the item panel then validation with the model teacher was done by face to face in the library LTI-IGM Senior High School Palembang. Here is a recapitulation of expert suggestions and comments.

Tabel 1. Recapitulation of Expert Suggestions and Comments

Unit	Suggestions and Comments

Item	
1	**Honki Julie** Item 1 1: Clarify again the words “grafik” Item 2: Is the answer only on the track only?.
	Ranni Permatasari Item 1: the picture needs to be clarified because the description in the image does not exist so it make the students difficult to draw the possibility of the graph. Item 2: The meaning of the question is still unclear. Can be slightly changed to “Berdasarkan gambar diatas, kapan pemain akan melaju dengan kecepatan tinggi? Berikan alasanmu. (Based on the picture above, when will the players go at high speed? Give me your reasons)”
	Siti Marfuah In general: Provide a description of the boundary on the picture, so that students can comprehend the meaning of the problem. Item 1: correct the word "litasan" to "lintasan"
2	**Ranni Permatasari** In general: if it can be made into two problems. Problem 3 completing the table and Problem 4 about the question.
3	**Zulkardi** In general: Do not camouflage if you can find the original data. Then avoid using the exclamation mark (!) in the problems. Item 4: a jury in a big game is never absent. Although unable to attend, certainly replace people. So there's no way there's no value at all.
4	**Ranni Permatasari** In general: Add captions when scoring is viewed from the highest point, and if there are similar points, then scoring is seen from goal difference. Then it's Asean Games data. If possible, because we use the Asian Games context so the data used is the Asian Games data
5	**Zulkardi** In generally: The numbers and letters in the picture must be the same as the letters in the question, because they are illustrations, so it should be clear.
	Somakim In general: Later there must be fooled students who think that the high bar diagram wins.
	Ranni Permatasari Secara umum: The correct one is 4 x 100 m or 4 x 10 m, because in the title of relay swimming 4 x 100m but in explanation 4x10m relay swimming. Item 8: this can be added in question “Berdasarkan grafik di atas…..(Based on the graph above …..)” Item 9 questions can be changed to “berdasarkan grafik di atas, pemain manakah yang mempunyai pengaruh lebih besar agar negaranya menjadi emenang dalam perlombaan? (based on the graph above, which player has greater influence to make his country win in the race?)”
	Siti Marfuah Item 8: correct the word "berdasarkna" to be word "berdasarkan"

c. One-to-One

The one to one stage was done in parallel with the expert review stage. Here students also functioned as validators for prototype 1. This stage was held on November 6, 2017, where the researchers tested the questions on prototype 1 to 3 students of 10th grade Science 1 LTI-IGM Senior Hugh School Palembang.

In this one to one stage, the researcher used 3 levels of student ability, high-ability students (S.R), medium-skilled students (O.V.W) and low-ability students (J.C.T). The students were then asked to read the questions on prototype 1 with 10 items and solve the problems. It aimed to observe students' responses and difficulties while working on each question, whether the student understood the intent of each item developed. Researchers here only act as facilitators who oversee and assist students if they have difficulty in answering questions.

d. Small Group

At this stage, researchers tested the revision of prototype 1 called prototype to 6 students of 10th grade Science 1 LTI-IGM Senior Hugh School Palembang consisting of 2 high-ability students (IF and RH), 2 medium-skilled students (TW and DR), and 2 students low-performing (NF and APW).

At this stage, researchers began learning by providing an apperception of the Asian Games, sports at the Asian Games, statistical materials and links to sports at the Asian Games. Then the researchers distributed the activities of prototype 2 units 1 and 2 to students and students were required to understand in advance the activities that had been distributed. Then the students did the questions individually for 5 minutes, then discussed in groups where one group consisted of 3 high-ability students, moderate, and low. After the discussion, the researchers asked representatives of each group to present their work.

e. Field Test

The field test was conducted on November 20, 2018. At this stage, the prototype 3 questions were tested to the research subjects, ie students of class X IPA 1 SMA LTI-IGM which in 1 class consisted of 20 students.

Figure 1. Teacher guiding student discussion during field test

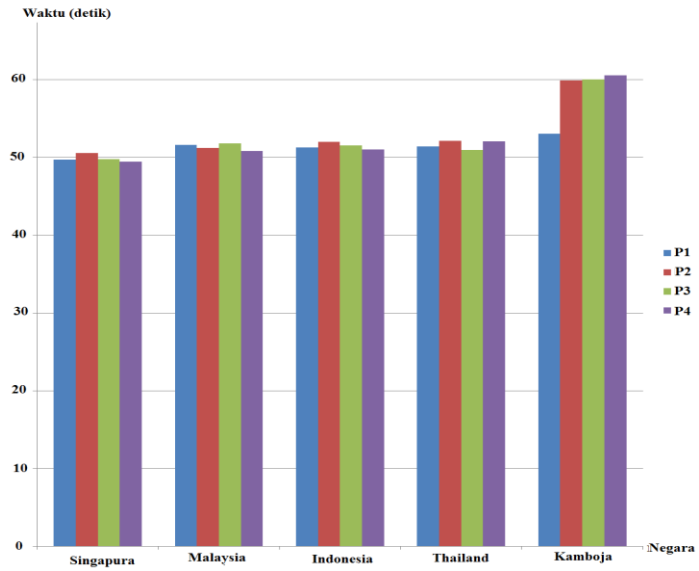
At the first meeting, model teachers began learning by giving apperception on the Asian Games, sports at the Asian Games, statistical materials and links to sports at the Asian Games. Then the teacher distributed the activity in the form of prototype 3 unit 1 and 2 to the students and the students were asked to understand first the activities that had been distributed. Then the teacher asked students to do the questions on the individual activities for 5 minutes, then discussed in groups where one group consists of 3-4 students. There were 4 groups in this class. After the discussion, the teacher asked representatives from each group to present their work. Here is one of the students work on the activities of prototype 3 units 1 and 2. At the second meeting on November 21, 2017, the teacher held a test, where the test questions are prototype 3 units 3 and 4. Here is a description of the students when conducting the test.

The test for IPA 1 class X was monitored by the model teacher, so no students were allowed to discuss something. Students were given 90 minutes. Here is one of the student answers.

Here is one of the problems that has been developed by researchers

Renang Estafet 4 x 100 m

Diagram di bawah ini menunjukkan hasil perlombaan renang estafet 4 × 100 m untuk 5 besar Negara pemenang. Negara dengan pencetak waktu tercepat itulah yang mendapatkan medali emas.



Soal 7

Berdasarkan grafik di atas negara manakah yang menjadi pemenang dalam perlombaan? Berikan alasanmu**.**

Soal 8

Berdasarkan grafik di atas, pemain manakah yang mempunyai pengaruh lebih besar agar negaranya menjadi pemenang dalam perlombaan? Berikan alasanmu.

Based on field test results, from 20 students, only one student answered correctly and completely, 13 students answered incompletely and 6 students answered wrongly. Here is some students' answer on 1 unit about running relay.

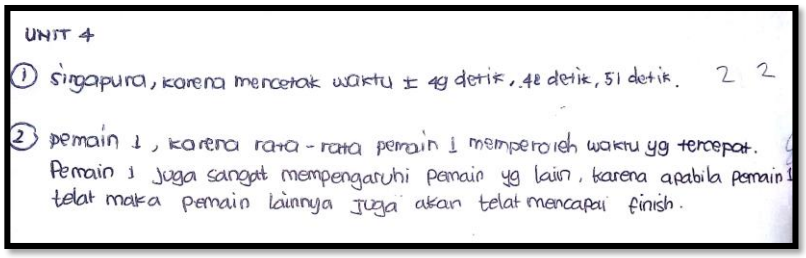


Figure 2. Student's Answer (H.A.)

In Figure 2 the student responded to player 1, a player who was very influential on the win of the relay swimming race. This was because player 1 was a player who started the start so players must start the race with high speed to win swimming relay race.

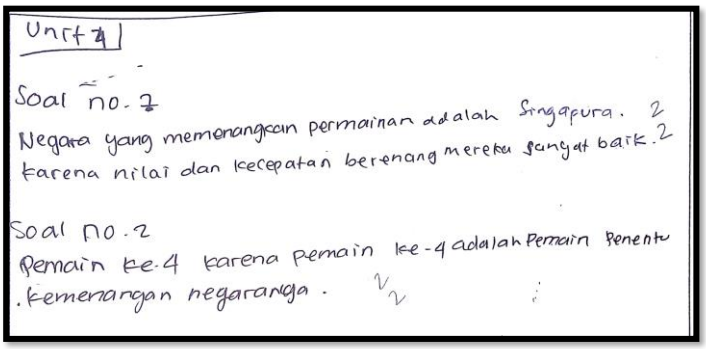


Figure 3. Student's Answer (S.A.D)

In Figure 3, S.A.D replied that the most decisive player of victory was player 4. This was because the 4th player was the last player to reach the finish. Then the 4th player was the winner of every country.

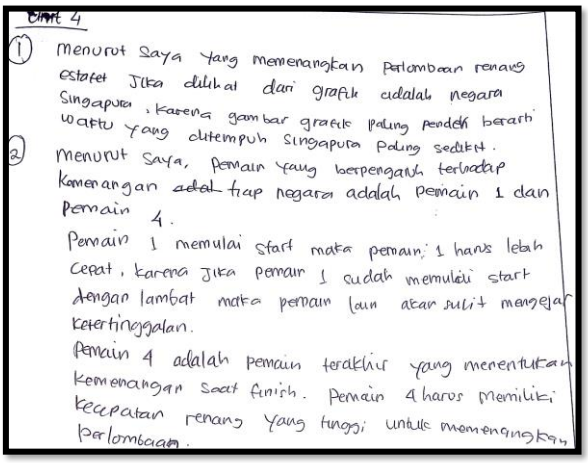


Figure 4. Student's Answer (B.P)

In figure 4, B.P responded that the influential players were payer 1 and player 4. This was because player 1 was a player who started the start while player 4 was a player who reached the finish line. Then the speed of player 1 should be superior so that other players especially player 4 do not have difficulty to reach the finish. If player 1 starts to start slowly, then player 4 will be difficult to catch up. In addition, 4 players must also be faster, it is because 4 players are the winner of each country.

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CONCLUSION

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The results of data analysis showed that there were 8 valid and practical items of PISA type of uncertainty and data contents obtained using bicycles and aquatic contexts in Asian Games. Characteristics constructed in the development of this problem were PISA characteristic and used the context within the scope of Asian Games, a personal context consisting of 1 problem of application ability and 7 problems of interpretation. The validity of the questionnaire could be seen in terms of the content whether the question was compatible with the dominant PISA literacy for context, content and process capability. Construct, whether the question was in line with the characteristics of PISA and the ability of the students of class X, and language, was it a matter of using a language compatible with EYD and understood by students. This was done in expert reviews and one to one phase. The practicality criteria of the problem revealed from the results of small-group where this type of PISA math problems used contexts known, understood, and applied in learning. Potential effects on PISA math problems can be obtained from the analysis of student responses in the field test phase in order to see the ability of mathematical literacy that appears in the student's answer. Judging from the issues discussed, it showed students' reasoning and argumentation abilities, where 11 out of 20 students demonstrated reasoning skills and good arguments and 9 out of 20 students showed reasoning skills and arguments but incomplete.

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Commented [A16]: Please be consistent with terminology

ACKNOWLEDGMENTS

The researchers would like to express gratitude to the Direktorat Jendral Pendidikan Tinggi Indonesia who has funded 'Hibah Pasca' research in 2018, and to Ms. Siti Marfuah and her students in Senior Hight School LTI-Indo Global Mandiri Palembang for participating in this research. As well as those who have helped the researchers in developing the research and writing this article.

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Keywords: Task design, PISA, Aquatic Context

Abstrak

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Kata kunci: *Task design*, Soal matematika tipe PISA, Konteks cabang olahraga akuatik

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Statistics is part of the mathematical material consisting of ways of data collection, data processing and drawing conclusions based on data collection and data analysis performed (Sudjana, 1975). Statistics is very important to learn, because they are widely applied in various disciplines like in natural sciences, business, and industry, where almost every decision made in the field uses statistical reasons (Bakker, 2004).

In fact, many students face difficulties in solving mathematical problems that result in low mathematical achievement. This occurs because students have not been accustomed to solve problems with the characteristics of a real context, and only do question exemplified by teachers without knowing its usefulness in daily life (Wati, 2016). This is in line with the results of PISA for uncertainty and data content where in2003 PISA results, Indonesia was ranked 38 out of 40 countries with the score of 385 (OECD, 2004). While the results of 2012 PISA, Indonesia was ranked 63 out of 65 countries because the score of Indonesian students, 384, was far below the average OECD score of 493 for uncertainty and data content. In addition, the Indonesian students were only able to resolve the matter of uncertainty and data up to level 5 of about 0.3% of students, far below the OECD average

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of 9.2% of students able to solve level 5 problems, even 3.2% students were able to complete up to level 6 (OECD, 2014). It showed that Indonesian students' mathematical literacy was still very low in resolving problems of PISA type. In fact, many students face difficulties in solving mathematical problems that result in low mathematical achievement. This occurs because students have not been accustomed to solve problems with the characteristics of a real context, and only do question exemplified by teachers without knowing its usefulness in daily life (Wati, 2016). This is in line with the results of PISA for uncertainty and data content where in2003 PISA results, Indonesia was ranked 38 out of 40 countries with the score of 385 (OECD, 2004). While the results of 2012 PISA, Indonesia was ranked 63 out of 65 countries because the score of Indonesian students, 384, was far below the average OECD score of 493 for uncertainty and data content. In addition, the Indonesian students were only able to resolve the matter of uncertainty and data up to level 5 of about 0.3% of students, far below the OECD average of 9.2% of students able to solve level 5 problems, even 3.2% students were able to complete up to level 6 (OECD, 2014). It showed that Indonesian students' mathematical literacy was still very low in resolving problems of PISA type.

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The low ability of Indonesian students in PISA is because Indonesian students are not familiar with the contextual problems such as in the PISA problem, especially about the high level both in the process of learning and evaluation (Novita, Zulkardi, and Hartono, 2012; Ahyan, Zulkardi, Darmawijoyo, 2014). In addition, it is difficult to find contextual problems designed to hone student problem-solving skills and have PISA characteristics and frameworks on mathematics textbooks used by Indonesian students, even in mathematics textbooks that have passed BSNP (Ward & Rumiati, 2011; Fatmawati & Ekawati, 2016). This is the basis for the development of the 2013 curriculum, adjusting the learning in Indonesia with the questions tested on PISA so that the problems used must be adapted to the characteristics of PISA (Kemendikbud, 2014). Therefore, non-routine questions with PISA characteristics are required to familiarize students with the procedures required to solve the PISA problems.

In uncertainty and data content, researchers are more centered on its data content, where the content of this data is a statistical matter. Statistics learning in Indonesia is generally teacher-centered without the effort to develop students' math ideas through interaction or discussion (Widjaja, Julie, and Suryandari, 2010). In addition, Groth (2006) also revealed that the learning was carried out by giving the formula directly without first learning about meaningful basic concepts and procedures for students. Shi, He, and Tao (2009) added one of the causes of students less interested in statistics is because statistics are taught theoretically and less connected to the real world. Thus the students do not know the application on each of these materials. This has an impact on the decrease of students' motivation and achievement in learning statistics. Therefore, non-routine questions with PISA characteristics are required to make students accustomed to solving problems of PISA type.

Statistics are very important in the field of sports. According to Jim Albert of Bowling State University and Ruud H. Sembing from the University of Groningen, sports and statistics have a close

relationship. Not only measuring performance, in fact, statistics can also be used to make fantasy games (Kompasiana, 2013). Asian Games is an interstate competition among Asian countries organized by the Olympic Council of Asia every 4 years (OCA, 2016). This competency event was held for the first time in New Delhi, India in 1951 and followed by countries in Asia including Indonesia. The 18th Asian Games will be held in Palembang and Jakarta, Indonesia in 2018.

METHOD

This study was design research of development study (Akker, 2006) aiming to produce valid and practical PISA mathematics problems for class X and to examine the potential effects of problems developed on mathematical literacy skills of high school students. This study was conducted in two stages: Preliminary evaluation and Formative evaluation (Zulkardi, 2006).

Preliminary evaluation stage consists of preparation where at this stage it becomes the first step of the researchers in developing the problem of PISA type. At this stage, the researchers analyzed the characteristics of the PISA problem and the basic competencies of the questions to be developed based on the PISA framework, then designing where at this stage researchers designed the problem device including the question grids and the question card according to the characteristics of PISA problems.

Formative evaluation stage consists of self-evaluation where in this stage the assessment of the designing problem of PISA type was done by the researchers themselves then it was revised and prototype 1 problem obtained. Then proceed to expert review stage where at this stage, prototype 1 made by researchers was consulted to experts to validate and evaluate based on the validation criteria of content, constructs, and language. Simultaneously the researcher performed one to one stage. At this stage, they asked three students who were not the subjects of study as testers and were asked to work on, observe, comment and respond freely to the question of prototype 1. After the one to one stage, the researchers entered the small group stage where at this stage they tested prototype 2, the revision of prototype 1, to a group of students who were not the subject of study so that prototype 3 was obtained.

Then the researchers reached the final stage of the field test where in the last stage of this experiment, they tested the problem of prototype 3 to the realistic field where the testing performed on the subject of the study. The subject in this study were 10th grade students of Indo Global Mandiri senior high school Palembang consisting of 20 students aged 15 years old. The data were gathered by means of walkthrough, observation, and interview and analyzed qualitatively.

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RESULT AND DISCUSSION

Analysis Stage

One activity conducted at the stage of student analysis was to visit the place of research implementation at SMA LTI Indo Global Mandiri (IGM) Palembang. Furthermore, researchers discussed the

subject of study with Siti Marfuah, S.Pd., the classroom teacher. The purpose of this discussion was to explain the research procedure, to determine the subject of research on stage one to one, small group, and field test with 20 students of 10th grade science 1 LTI-IGM senior high school Palembang.

The subject matter was identified based on the curriculum used in the school where the study was conducted. The curriculum used in LTI-IGM senior high school Palembang is the 2013 curriculum. In this curriculum, the standard content of mathematics learning includes numbers, algebra, geometry and data management.

After analyzing the students and the curriculum, the researcher analyzed the PISA problem based on the PISA framework, then they also studied various things about the Asian Games that could be used as contexts in developing the math problem of PISA type and 3 contexts were obtained namely bicycle, swimming and synchronized swimming.

Dsign Stage

At this stage, researchers began designing and compiling the PISA math problems using the cycling road and aquatic context. These questions were designed for 10th grade senior high school students. Below is the result obtained from designing in the form of instrument consisting of:

a. Question grids of PISA type mathematics using bicycle and aquatic context.
b. PISA type cards using bicycle and aquatic context for senior high school level.
c. Rubric assessment of PISA mathematics problems using bike and aquatic context for senior high school level
d. Lesson plan

5 items were generated in this designing stage, namely bicycle (2 items), Swimming (1 item), and synchronized swimming (2 items).

Evaluation Stage

a. Self Evaluation

At this stage, the PISA mathematical problems using a bicycle and aquatic context had been designed and then reexamined by the researchers. It aimed to find and correct errors or deficiencies in the design process. Supervisors also assisted in the examination of questions that researchers had designed during the consultation prior to conducting the research.

b. Expert Riviews

The validity of a PISA mathematical problem using a bicycle and aquatic context was carried out in terms of content, constructs, and language. Prior to giving to the expert, these questions were discussed previously with the supervisors. The experts who reviewed the problems were: 1) Dr. Hongki Julie, M.Si., professor of mathematics education Sanata Darma University Yogyakarta; 2) Pof. Dr. Zulkardi, M.I.Komp., M,Sc., professor of mathematics education Sriwijaya University Palembang; 3) Dr. Somakim, M.Pd., professor of mathematics education Sriwijaya University Palembang; 4) Rani Permatasari, S.Pd., Magister student of mathematics education of Sriwijaya

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University of Palembang ; 5) Siti Marfuah, S.Pd., high school math teacher in LTI-IGM Senior High School Palembang

The validation process by Dr. Hongki Julie, M.Si. was carried out via email. While the process of validation by Dr. Zulkardi, M.I.Komp., M.Sc., Dr Somakim, M.Pd., dan Ranni Permatasari, S.Pd. was executed through the item panel then validation with the model teacher was done by face to face in the library LTI-IGM Senior High School Palembang. Here is a recapitulation of expert suggestions and comments.

Tabel 1. Recapitulation of Expert Suggestions and Comments

Unit Item	Suggestions and Comments
1	**Dr. Honki Julie, M.Si.** Item 1 1: Clarify again the words “grafik” Item 2: Is the answer only on the track only?.
	Ranni Permatasari, S.Pd. Item 1: the picture needs to be clarified because the description in the image does not exist so it make the students difficult to draw the possibility of the graph. Item 2: The meaning of the question is still unclear. Can be slightly changed to “Berdasarkan gambar diatas, kapan pemain akan melaju dengan kecepatan tinggi? Berikan alasanmu. (Based on the picture above, when will the players go at high speed? Give me your reasons)”
	Siti Marfuah, S.Pd. In general: Provide a description of the boundary on the picture, so that students can comprehend the meaning of the problem. Item 1: correct the word "litasan" to "lintasan"
2	**Ranni Permatasari, S.Pd.** In general: if it can be made into two problems. Problem 3 completing the table and Problem 4 about the question.
3	**Prof. Dr. Zulkardi,M.I.Komp., M.Sc.** In general: Do not camouflage if you can find the original data. Then avoid using the exclamation mark (!) in the problems. Item 4: a jury in a big game is never absent. Although unable to attend, certainly replace people. So there's no way there's no value at all.
4	**Ranni Permatasari, S.Pd.** In general: Add captions when scoring is viewed from the highest point, and if there are similar points, then scoring is seen from goal difference. Then it's Asean Games data. If possible, because we use the Asian Games context so the data used is the Asian Games data
5	**Prof. Dr. Zulkardi,M.I.Komp., M.Sc.** In generally: The numbers and letters in the picture must be the same as the letters in the question, because they are illustrations, so it should be clear.
	Dr. Somakim, M.Pd. In general: Later there must be fooled students who think that the high bar diagram wins.
	Ranni Permatasari,S.Pd.

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Which sentence is suggestion from experts?

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Secara umum:
The correct one is 4 x 100 m or 4 x 10 m, because in the title of relay swimming 4 x 100m but in explanation 4x10m relay swimming.
Item 8: this can be added in question “Berdasarkan grafik di atas…..(Based on the graph above …..)”
Item 9 questions can be changed to “berdasarkan grafik di atas, pemain manakah yang mempunyai pengaruh lebih besar agar negaranya menjadi emenang dalam perlombaan? (based on the graph above, which player has greater influence to make his country win in the race?)”

Siti Marfuah, S.Pd
Item 8: correct the word "berdasarkna" to be word "berdasarkan"

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c. One-to-One

In this one to one stage, the researcher used 3 levels of student ability, high-ability students (S.R), medium-skilled students (O.V.W) and low-ability students (J.C.T). The students were then asked to read the questions on prototype 1 with 10 items and solve the problems. It aimed to observe students' responses and difficulties while working on each question, whether the student understood the intent of each item developed. Researchers here only act as facilitators who oversee and assist students if they have difficulty in answering questions.

d. Small Group

At this stage researchers tested the revision of prototype 1 called prototype to 6 students of 10th grade Science 1 LTI-IGM Senior Hugh School Palembang consisting of 2 high-ability students (IF and RH), 2 medium-skilled students (TW and DR), and 2 students low-performing (NF and APW).

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At this stage, researchers began learning by providing an apperception of the Asian Games, sports at the Asian Games, statistical materials and links to sports at the Asian Games. Then the researchers distributed the activities of prototype 2 units 1 and 2 to students and students were required to understand in advance the activities that had been distributed. Then the students did the questions individually for 5 minutes, then discussed in groups where one group consisted of 3 high-ability students, moderate, and low. After the discussion, the researchers asked representatives of each group to present their work.

e. Field Test

Field test was conducted on November 20, 2018. At this stage, the prototype 3 questions were tested to the research subjects, ie students of class X IPA 1 SMA LTI-IGM which in 1 class consisted of 20 students.

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Figure 1. Teacher guiding student discussion during field test

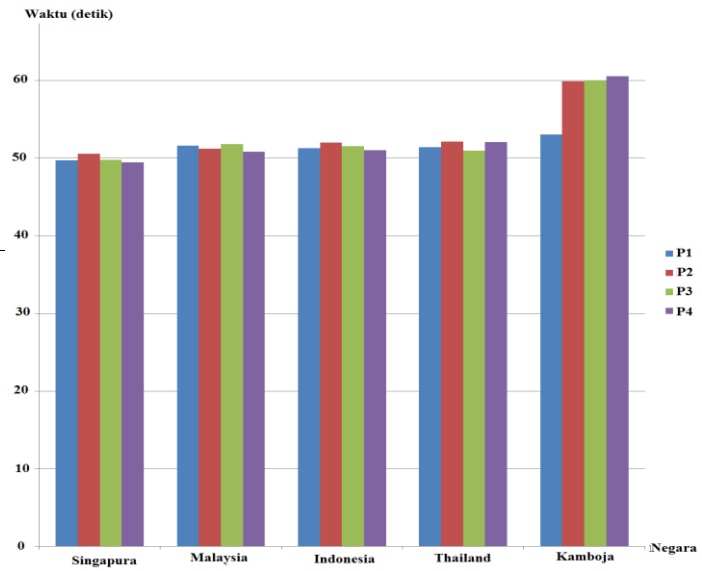
At the first meeting, model teachers began learning by giving apperception on the Asian Games, sports at the Asian Games, statistical materials and links to sports at the Asian Games. Then the teacher distributed the activity in the form of prototype 3 unit 1 and 2 to the students and the students were asked to understand first the activities that had been distributed. Then the teacher asked students to do the questions on the individual activities for 5 minutes, then discussed in groups where one group consists of 3-4 students. There were 4 groups in this class. After the discussion, the teacher asked representatives from each group to present their work. Here is one of the students work on the activities of prototype 3 units 1 and 2. At the second meeting on November 21, 2017 the teacher held a test, where the test questions are prototype 3 units 3 and 4. Here is a description of the students when conducting the test.

The test for IPA 1 class X was monitored by the model teacher, so no students were allowed to discuss something. Students were given 90 minutes. Here is one of the student answers.

Here is one of the problems that has been developed by researchers

Renang Estafet 4 x 100 m

Diagram di bawah ini menunjukkan hasil perlombaan renang estafet 4×100 m untuk 5 besar Negara pemenang. Negara dengan pencetak waktu tercepat itulah yang mendapatkan medali emas.



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Soal 7

Berdasarkan grafik di atas negara manakah yang menjadi pemenang dalam perlombaan? Berikan alasanmu.

Soal 8

Berdasarkan grafik di atas, pemain manakah yang mempunyai pengaruh lebih besar agar negaranya menjadi pemenang dalam perlombaan? Berikan alasanmu.

Based on field test results, from 20 students, only one student answered correctly and completely, 13 students answered incompletely and 6 students answered wrongly. Here are some students' answer on 1 unit about running relay.

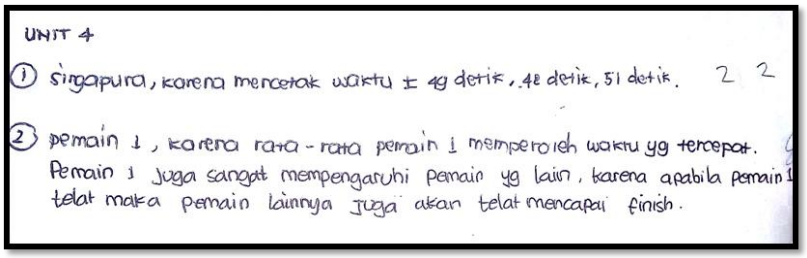

Figure 2. Student's Answer (H.A.)

In Figure 2 the student responded to player 1, a player who was very influential on the win of the relay swimming race. This was because player 1 was a player who started the start so players must start the race with high speed to win swimming relay race.

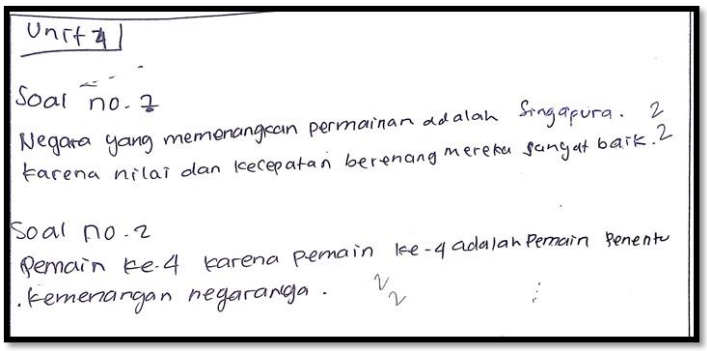

Figure 3. Student's Answer (S.A.D)

In Figure 3, S.A.D replied that the most decisive player of victory was player 4. This was because the 4th player was the last player to reach the finish. Then the 4th player was the winner of every country

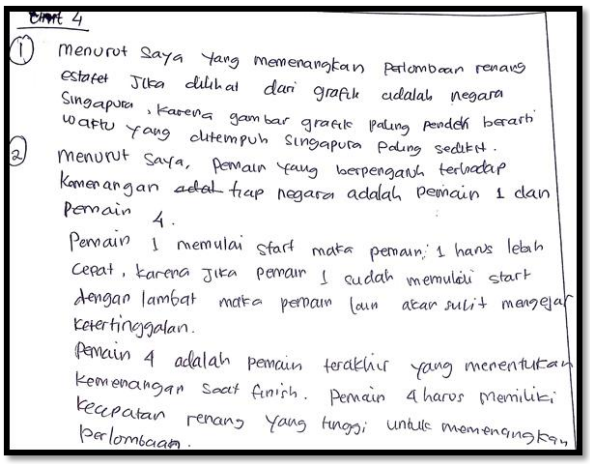

Figure 4. Student's Answer (B.P)

In figure 4, B.P responded that the influential players were payer 1 and player 4. This was because player 1 was a player who started the start while player 4 was a player who reached the finish line. Then the speed of player 1 should be superior so that other players especially player 4 do not have difficulty to reach the finish. If player 1 starts to start slowly, then player 4 will be difficult to catch up. In addition 4 players must also be faster, it is because 4 players is the winner of each country.

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Urgent:
- This is international journal indexed by scopus. Please describe the contribution of fild test to mathematics education. Cite some references. Information about
-
-The results of Validity and practicality are not significant findings for this research. The important think is about the potential effect of PISA like problems. Please elaborate

CONCLUSION

The results of data analysis showed that there were 8 valid and practical items of PISA type of uncertainty and data contents obtained using bicycles and aquatic contexts in Asian Games. Characteristics constructed in the development of this problem were PISA characteristic and used the context within the scope of Asian Games, a personal context consisting of 1 problem of application ability, and 7 problems of interpretation. The validity of the questionnaire could be seen in terms of the content whether the question was compatible with the dominant PISA literacy for context, content and process capability. Construct, whether the question was in line with the characteristics of PISA and the ability of the students of class X, and language, was it a matter of using a language compatible with EYD and understood by students. This was done in expert reviews and one to one phase. The practicality criteria of the problem revealed from the results of small group where this type of PISA math problems used contexts known, understood, and applied in learning. Potential effects on PISA math problems can be obtained from the analysis of student responses in the field test phase in order to see the ability of mathematical literacy that appears in the student's answer. Judging from the issues discussed, it showed students' reasoning and argumentation abilities, where 11 out of 20 students demonstrated reasoning skills and good arguments and 9 out of 20 students showed reasoning skills and arguments but incomplete.

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What is the passages and contributions of this finding?

ACKNOWLEDGMENTS

The researchers would like to express their gratitude to those who have helped and given support in this study, Dr. Hongki Julie, M.Si., Prof. Dr. Zulkardi, M.I.Komp., M.Sc., Dr. Somakim, M.Pd., Elika Kurniadi, S.Pd., M.Sc., and Ranni Permatasari, S.Pd. as the validators in expert reviews; Siti Marfuah, S.Pd., as the model teacher; Students of LTI-IGM Senior High School Palembang for participating in this study.

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