The PISA result of Indonesian students on uncertainty and data content were still lacking. It is important to give problems with PISA characteristics in students’ learning. This study aimed to produce a set of valid and practical PISA-like mathematics problems using the context of athletics in Asian Games. It used a design research method with the type of development studies consisting of two stages namely preliminary and formative evaluation. The result of this research was valid and practical of six items PISA-like mathematics problems for the content of uncertainty and data using the context of athletics in Asian Games at level 3, 4, 5, and 6. Valid criteria can be identified based on the content, construct, and language. While practical criteria consist of easy to understand, contexts that students recognize, and can be used in learning. Also, the result of this study showed that athletics contexts used made students more active in the discussion and could express the various reason.

1. Introduction

In the development of the 2013 curriculum, learning and assessment in Indonesia have been adapted to the material tested in international issues such as PISA (Program for International Student Assessment) as one of the government's efforts to improve the results of PISA Indonesian students in the 2013 curriculum, teachers are required to be able to design learning that begins from real problems to the abstract problem and requires students to think algorithmically and critically in solving the problems [1]. One approach consistent with the development of the 2013 curriculum is the Pendekatan Matematika Realistik Indonesia (PMRI) [2, 3]. Since it was developed from 2001, PMRI which emphasizes the context as the starting point of learning for the formation of concepts and motivation toward mathematics has been widely used in improving students’ interest, attitude, and learning outcomes [4, 5]. The use of real problems context that students recognize and real in the students’ minds can build explicit relationships between context and mathematical ideas that support student development for mathematical thinking [6,7].

One of interesting context to use is the sport at the Asian Games, especially athletics. The socialization of the Asian Games that will be held in Indonesia on 2018 is done by using the Asian Games as a learning situation as the presidential instruction [8]. Also, previous researchers who had designed a learning activities using Asian Games [9, 10], found that the Asian Games context used can help students to understand the material and make the learning process more meaningful and fun.
of the subjects that related to sports is uncertainty and data so that sports can be used as a situation in the learning of the material [11, 12].

Uncertainty and data content is one of the PISA content in the mathematical domain. In uncertainty and data content, Indonesia is only ranked 63 out of 65 countries with a score of 384, while the OECD average score for uncertainty and data is 493 in PISA 2012 [13]. This is because of Indonesian students are not accustomed to solving the problem of PISA especially high level both in learning and evaluation so that the results of PISA Indonesian students are always at the lower level of other countries [14-16]. Also, the cause of low PISA results is the limited availability of context-based questions that have characteristics of PISA problems to improve the students’ literacy skills, even in books that have passed BNSP [17, 18].

Whereas the students’ understanding and literacy skills on the uncertainty and data content are very important, so that students can use and solve problems related to uncertainty and data content in various fields of life especially in sports, politics, demography, business, etc. [11, 12, 19]. To that end, Indonesian teachers and students are required to improve their ability in designing mathematics problems using a context that closes to students’ life and according to PISA characteristics for the process and evaluation of PISA based learning [4, 20]. This to improve the literacy skills of Indonesian students are in line with the goals of the 2013 curriculum development [1]. Therefore, the researchers are interested to develop a set of PISA-like mathematics problems on uncertainty and data content using the context of athletics in Asian Games. Based on the description before, the objective of this research is to produce a set of valid and practical PISA-like mathematics problems using the context of athletics in Asian Games.

2. Method
This study involved the tenth-grade students of Senior High School. This study used a design research method type of development studies consisting of two stages, preliminary and formative evaluation. Preliminary consisting of analysis and design, and formative evaluation consisting of self-evaluation, expert reviews, one-to-one, small group, and field test [21, 22]. However, this study only showed the result at the preliminary to the small group stage to get prototype III which were valid and practical.

In the preliminary stages, the researchers analyzed the characteristics of PISA problems, the curriculum, and the students. Then, the researchers designed the initial prototype including the question grid, question cards, and assessment rubric to be used. Also, the researchers designed the lesson plans that will be used in the learning process of small groups.

In the formative evaluation, self-evaluation was the first stage where the researchers evaluated the initial prototype by themselves. The result of the revision from this stage was called prototype I. Then, prototype I was evaluated by the validators at the expert reviews stage based on the content, construct, and language. Simultaneously, the one-to-one was undertaken where prototype I was tested to three students with high, medium and low ability at this stage. The result of the expert reviews stage and one-to-one stage was used to revise prototype I, and it obtained prototype II. Then, prototype II that has been valid was tested to six students with high, medium and low ability in small group stage. The video recording while students’ discussion and interview during the learning process and the student’s answer were analyzed to know the practicality of prototype II. The result of small group stage was used to revise prototype II, and it obtained prototype III.

Prototype III was the final prototype which were valid and practical. The data collection techniques used were walk through, observation of the video recording of students’ discussion and interview during the learning process, and students’ answer. It obtained the qualitative data. Then the data are analyzed by qualitative descriptive method to describe the result of each step of development.

3. Result and discussion
In this study, there were six items of PISA-like mathematics problems on uncertainty and data content using the context of athletics in Asian Games. The result of this study on each stages of the preliminary evaluation and formative evaluation are shown below.
3.1. Preliminary

In the first stage of preliminary stage, from the analysis of the characteristics of PISA problems in PISA 2015 Assessment Analytical Framework and PISA Results, it was found that PISA problems were identified in three mathematical processes (including formulating, employing, and interpreting), four mathematical contents (including change and relationship, space and shape, quantity, uncertainty and data), and four contexts (including personal, occupational, societal, and scientific). The main characteristics of PISA problems that the problems were designed using the context of real-life problems to enhance the ability of the students’ mathematical literacy to solving problems in variety situations [23]. Also, from the analysis of PISA Released Items, the researchers were interested on some of PISA problems content uncertainty and data as the basic of development problems.

From the analysis of the 2013 curriculum used in Senior High School, it was found that uncertainty and data content was studied by students in class X on the material of probability and statistics. While the results of student analysis with the help of teachers in each school obtained each of the three students, who will be involved in the stage one-to-one and six students at the small group's stage.

Then, the researchers did the design phase by designing the question grid, question cards, and assessment rubric to be used. Also, the researchers also designed the lesson plans that will be used in small groups. One of the problems in this stage was Indonesian medal achievement at the Asian Games unit. It designed from M179 PISA items that using context of robberies. In this units, the researchers asked students to give some arguments of the given interpretation of the bar graph.

3.2. Formative evaluation

In this study, the formative evaluation phase will only be discussed until small group stage. At self-evaluation stage, the researchers decided to revise the whole problems. The revision at this stage was obtained prototype I. Prototype I contained three units consisting of six items on uncertainty and data content using the context of athletics in Asian Games. At the prediction level, three problems are predicted at level 3, and each one is at a level of 4.5 and 6. While in the processing ability, one problem required the ability of formulation, two problems required the ability of employ, and three problems in the ability of interpretation.

One of the problems in prototype I was marathon unit. In this unit, the researchers decided to change the context of Indonesian medal achievement at the Asian Games into the context of time record data from two Bahraini marathon athletes. Also, the researchers made it into one question from two question before. This was done so that the problem fits the athletic context.

Hereafter prototype I was evaluated in parallel at expert reviews and one-to-one to see the validity of the problem. In expert review stage, prototype I was consulted to the experts through email validation with an PISA expert from Brunei, panel validation with the lecturer of mathematics education of Sriwijaya University and colleagues whose research on the development of PISA-like mathematics problems, and face-to-face validation with a mathematics teacher.

From the results of expert reviews found that the whole question was accepted, but with some revisions according to the comments and suggestions that were given. The comments and suggestions contained in adding information of the marathon distance information, providing interesting information about the reason for choosing the Bahrain results as the data in context, adding the word of ‘country’ to Bahrain because Bahrain was a country that is not well known to the students, and improving the statement on the problems to be more focused for the change of graph or the drastically of the changes.

While in the one-to-one stage, the researchers asked each student to solve prototype I. From the results of student answers analysis, it found that most students only focused to assess the truth of the statement by looking at the decline alone. Though the focus of the problem was the understanding and arguments of students in declaring a change of graphs can be said drastically or not.

Based on the results of expert reviews and one-to-one, the researchers decided to change the information about Mubarak Hassan Shami’s time-lapse record which could win in all of his participation in the two Asian Games events. The researchers also decided to add marathon
information and change the problem statements based on the new data. The revised result of prototype I produced a valid prototype II.

After obtaining a valid prototype in content, construct, and language, prototype II was tested at the small group stage of each of the six students to see the practicality of the problem. The small group stage was done in two lessons and one final test. In the learning process, it found that students were very enthusiastic in solving problems and active during the discussion. Also, the context used had been known to students and could help students to think critically to see the difference of regular time charts that have different meanings with time charts in marathon competition. This was in line with previous research [2, 24, 25] which found that the sports contexts in Asian Games could help students to enlarge students’ thinking in understanding the material and make students more motivated in a fun and meaningful learning process.

From the analysis of student answers found that most students had been able to understand the problem even though there were some students who still focused on the reduction of time records alone without seeing the drastically of the changes. Also, there were several reasons that could be expressed by students. The Figure 1 showed one of the student's arguments. It was no drastic reduction in Mubarak Hassan Shami’s achievements from 2006 to 2010.

As for the analysis of time difference, the student did not give a complete reason although it was true that Mubarak Hassan Shami's record time decline was not drastic because it was only 9 seconds apart. In addition to the difference in time records, the student was also able to examine the drastically of the change from the chart correctly.

From the results of student answers analysis, it was found that students were difficult to give reasons and arguments that supported the answer clearly and completely, especially about this marathon unit was a PISA-like mathematics problem on level 6. Only one out of six students that could describe the truncated bar graph as the argument for the interpretation graph, whereas it was the main argument for this level 6 item [26]. Incomplete reasons indicated that most students were only able to solve the problem of partial credit. It was in line with previous research which stated that most students did not write an explanation of the solution they made because students were not accustomed to solving PISA type math problems that required students to communicated their answers in writing along with the reasons, especially on level 6 [27-30].

Based on the results of small groups, researchers decided to thicken the word "drastically" on prototype II revision. The revised result of prototype II was prototype III. Figure 2 showed the PISA-like mathematics problem on uncertainty and data content using the context of athletics in Asian Games that had been valid and practical.
Marathon

Mubarak Hassan Shami is a marathon athlete from Qatar. At the 42.4 km Men’s marathon event in the Asian Games, Mubarak Hassan Shami won consecutive medals in 2006 and 2010. The time records achieved by Mubarak Hassan Shami can be illustrated in the following chart:

Based on the chart above, is the following statement true?
“The time achievement of Mubarak Hassan Shami at the marathon event has decreased drastically from 2006 to 2010.”

Give a reason to support your answer.

Figure 2. The valid and practical of PISA-like mathematics problem on uncertainty and data content using the context of athletics in Asian Games

At the marathon unit in Figure 2, it could be seen that it had the characteristics of a PISA-like problems. In mathematical process, it was included in interpreting processes ability because students should be able to reflect upon mathematical solutions, results, or conclusions and interpret it in the context of real-life problems [31, 32]. In mathematical content, it was included in uncertainty and data content because it contained a data representation problems. In context, it was included in personal context because the context of sports that used was in personal context [23]. Also, it had the characteristics of level 6 problems. It could be seen from the problems that required students to use their knowledge in relatively non standard context and be capable of advanced mathematical thinking and reasoning [33]. The context of marathon unit that contained interpretation of a truncated bar graph was non-standard context [23, 26].

4. Conclusion
The PISA mathematics problem on uncertainty and data contents using the athletic context had fulfilled the valid and practical criteria. Valid criteria can be seen in terms of content that matched the PISA mathematical literacy domain for content, constructs, and process capabilities, in terms of constructs that matched the characteristics of the PISA level and the ability of the tenth grade students, and in terms of the language corresponding to the enhanced spelling and could be understood by students. Practical criteria were seen from the context of questions that students recognized and could be used in learning. Also, the athletic context in the Asian Games used could make students to express the different reasons and be more active in discussions during the learning process. Therefore, researchers suggest teachers and other researchers to develop and use PISA-type math problems using
a context that closed to students, especially a context that relates to Indonesia. It is to make the learning process to be more interesting, fun and meaningful.

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