MGMP optimization in developing teacher professionalism in developing HOTS problems based on RME approach

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Abstract. The results from the Program International Student Assessment in 2018 placed Indonesia at number 74 out of 79 countries, it shows low student ability in Higher Order Thinking Skills (HOTS). One of them is caused low competence of teachers in applying HOTS in the subject. Therefore, we need a method to improve teacher competency. One method used is to optimize training HOTS development in the Subject Teacher Forum or called MGMP using the Realistic Mathematics Education approach. This research includes preliminary, prototype, and field tests. This research is on high school mathematics teachers in East OKU Regency. Analysis of this research data using a walkthrough, documents, and tests. The results of this study prove the increase in teacher competence in generating valid HOTS questions. Valid is when all validators said HOTS problems that are generated both in content and construct, practical (questions used for student learning, easy to read, do not attract diverse interpretations, and can be given to all students). Also, research has the potential for student learning outcomes with an average value of 70.16 student abilities. This research also improvement of student learning activities, as seen from the results of the analysis of activities students that are 3.09.

1. Introduction

The Program International Student Assessment (PISA) 2018 survey results showed Indonesia ranked 74th out of 79 countries, ranking sixth from the bottom. These results indicate that the thinking ability of Indonesian students is still in low order thinking (LOT) [1–4]. Because the problem raised in PISA are high order thinking skills (HOTS) problems [5–8]. HOTS questions stimulate students to interpret, analyze, or even be able to manipulate previous information so that it is not monotonous. This is needed learning process that increase students' ability in solve HOTS questions. This mathematics learning process must be fun, smart, and involve students by paying attention to the relationship between mathematical concepts with students' experiences in daily life to increase students' learning interest, that is namely Realistic Mathematics Education (RME) learning [9].

RME is an approach to learning mathematics developed to bring mathematics closer to students, real problems from daily life that are raised as a starting point for learning mathematics. The use of this realistic problem aims to show that mathematics is close to the daily lives of students [10]. Some research on RME learning has been carried out at either the elementary or secondary school level. These studies show how positive changes in mathematics learning use the RME Approach [11-14]. However, based on the results of the distributed questionnaire, only 70% of the teachers...
were familiar with HOTS and RME learning while 30% were not familiar at all. It is therefore important to improve teacher competency and professionalism in developing HOTS problems with the RME Approach.

The development of teacher professionalism can be done with the training method [15]. While Castetter said that there are five models of teacher professional development one of which is training [16]. Training is a method that provides the techniques training needed to improve professionalism. Based on the previous research, training is very helpful for teachers in increasing their knowledge and skills [17].

One of the government's efforts to improve the competence and professionalism of teachers is by forming the Subject Teachers' Conference or called MGMP in Indonesian [18]. MGMP is a forum for professional activities of subject teachers in junior high school and senior high school which are located in one region or city school cluster used as a means to communicate with each other, learn, and exchange ideas and experiences to improve performance as a teacher. The MGMP organization is under the auspices of the District/City Level Education Office throughout Indonesia. Through MGMP teachers can discuss various problems and alternative solutions related to the learning process and the teacher's tasks, such as the preparation process, training, and evaluation of student learning outcomes [19]. The role and performance of the MGMP have obtained legality from the government contained in the Law on Teachers and Teachers Number 14 of 2005 article 20 paragraph (b) [20]. But in reality, the role of MGMP as an organization is not going well because there are limited resources and funds [21]. Therefore this research aims to develop the professionalism and competence of teachers in developing HOTS questions with the RME Learning Approach through training in MGMP.

2. Method

Research subjects are objects or people to which the research variables [22]. The research subjects were 60 high school mathematics teachers in the East OKU region, consisting of 24 male and 36 female teachers that incorporated in the MGMP East OKU region. The study was conducted in January 2019/2020 school year. This research is development research by providing knowledge and insight to teachers by conducting workshops with the topic "Professionalism Development in developing HOTS questions with a Realistic Mathematics Education Approach".

In this study, researchers used training from experts as a technique for developing teacher professionalism and competencies. In this study, researchers used a method of developing or developing a formative evaluation type. The procedure of this research consists of several steps, namely preliminary & formative evaluation and field tests the following steps of development are presented in the form of flowcharts (Figure 1) [23-24].

Figure 1. Formative evaluation design flow
2.1. Preliminary
At this stage, the researchers conducted an analysis of the results of the Teacher Competency Test, determined the place and subject of research, arranged a research schedule, and established collaboration with the Chairman of Mathematics MGMP at East OKU Regency and Chairperson of the High School at East OKU regency, as well as Mathematics Education experts.

2.2. Training
At the design stage (prototyping), the researcher made a research plan to implement the Teacher Professionalism Development Workshop in developing HOTS problems based RME approach [23-24]. Then create a Workshop Implementation guidelines fit of expert guidelines. In this workshop, experts explain HOTS Learning materials and RME Learning. Participants on the first day designed the HOTS problems in groups with each group consisting of 4 (four) or 5 (five) people to design the HOTS problems and on the second day, each participant redesigned the HOTS problems by appropriated the guide. The design of this product as prototype 1, each prototype produced in three characteristics, namely: content, construct, and language.

2.3. Formative evaluation
The formative evaluation stage includes self-evaluation, expert review, one-to-one, small group, and field tests.

a. Self-evaluation
Self-evaluation is a self-assessment by themselves of HOTS problem prototype that has been developed by participants [23-24].

b. Expert review and one-to-one.
In this study, the prototype consisted of three cycles, namely the prototype, the second prototype, and the third prototype as the final prototype (product). With triangulation techniques, teaching materials are validated by experts based on characteristics (content, construct and language) [25-29]. Validation also uses one-to-one evaluation techniques, which is a technique that utilizes several people as a tester, usually carried out on two to four people alternately. Their suggestions are used to revise and declare the teaching material produced is valid and practical. If the learning kit is considered invalid then it must be revised again on the advice of an expert. The results of this validated design are called the prototype [23-24].

c. Small group
At this stage, HOTS problems that were developed were tested on students who were not research subjects in small groups to study and see the practicality of the second prototype [23-24].

d. Field test
The revision results were tested on research subjects in this case as a field test. At this stage, the revised product is tested on High School (SMA) students in East OKU District who are the subjects of the research. The products that are tested in the field tests must be products that have requested qualified. Akker suggests three quality criteria that are validity, practicality, and benefits [23-24].

2.4. Data analysis technique
Descriptive analysis is used to analyze valid data from experts by revising based the walkthrough or validator records and checking the teaching material documents by the validator and the teacher. The results of this analysis are used to revise HOTS problems made by participants. This descriptive analysis is also used to analyze the practicality of HOTS problems that are developed about the assessment and findings of small groups of students doing the activities and working on the questions [23-24].

2.5. Analysis of student activity observation data
Student’s activity during the learning process can be known by observation. The aspects learned are must following the Learning Implementation Plan that has been made by the teacher and is carried out by two observers [23-24].
3. Result and Discussion

The result of this research shows that teacher professionalism and competency development can be done with training. Training that held on East OKU MGMP at this research can development teacher competency in the development HOTS problem with the RME learning approach. It's showed by data analysis and expert opinion that HOTS problem that is resulted from this research is categorized as valid and practical also has a potential effect. It can be showed by HOTS problems created by the participant (Figure 2) and the answer from a student (Figure 3) that showed validity, practical and has a potential effect. This is suitable for previous research that showed training is very helpful for teachers in increasing their knowledge and skills [17].

![Figure 2. HOTS problem that resulted in participant](image)

The following is a description of the validity, constructs, potential effects, and data analysis that resulted from this research.

3.1. Validity
The prototype was validated by experts and was tried at one to one step that results in suggestions for revising the prototype into a second prototype. The second prototype was revalidated by experts and tested on a small group, then was revised into a second prototype. The second prototype was validated by experts based on three criteria, namely, content, construct, and language validity [25-29]. HOTS problems developed by workshop participants can already be categorized to have validity in content because can determine specific objectives that are in line with the material or lesson content listed in the curriculum. HOTS problems that are developed already have construct validity because the contents of the HOTS problems can measure every aspect of thinking mentioned in the learning

![Figure 3. The answer from a student](image)
objectives. HOTS problems can already be categorized to have the validity of the language because following EYD and not to cause multiple interpretations.

3.2. Practical

The practicality of HOTS problem measured by easy students in using teaching materials [17-18]. The HOTS problem can already be said practically by experts on the second prototype conducted in small groups. Besides, observations made by researchers on the second prototype showed that students were enthusiastic about working on each activity and the questions given. This is supported by the students' comments on the prototype which students happy using the prototype given because it is equipped with interesting drawings or controversial things.

3.3. Potential

Table 1. Statement of workshop participants

| Statement                      | Percentage |
|--------------------------------|------------|
| Useful                         | 97         |
| Has developed HOTS in test     | 88.2       |
| Difficulties in developing HOTS| 94.1       |

The potential effect of developing teacher professionalism in developing HOTS problems done on 34 participants who filled out the questionnaire, 97.0% said of the workshops useful and 3.0% not useful, and 88.2% of participants had developed HOTS problems and 11.8% had not yet developed. 94.1% of the participants still had difficulties in HOTS problems and 5.9% had no difficulties. This can be seen in Table 1.

In the field test, the problems that have been developed are tested in 5 (five) schools in class X (ten) with the material adjusted when the teacher teaches. At SMA N 1 Martapura Class X Science 2, with a total of 30 students, At SMAN 2 Maratapura Class X Science 2 with 36 students, At SMAN 3 Martapura Class XI with 32 students, At SMA Muhamadiyah Martapura Class X Science with 16 students, and SMA YIS Martapura Class X with 11 Students. This Fields test resulted in student average value is based on a category of learning outcomes is 70,16 that means enough category. For the comprehensive data, this can be seen in Table 2.

Table 3. Percentage of Observational Results in Student Activities

| Observer | Observation Aspects | Total | average |
|----------|---------------------|-------|---------|
| 1 and 2  | A                   | 3,00  |         |
|          | B                   | 3,50  |         |
|          | C                   | 3,05  |         |
|          | D                   | 3,03  |         |
|          | E                   | 2,89  |         |
|          | Total               | 15,47 | 3,09    |

At the last meeting, students carry out written tests. Each student solves the problem individually. There were eight questions given. The results of this analysis test are used to determine the categories of learning outcomes. Recapitulation of student learning outcomes showed significant results (real differences due to $t_{test} > t_{table}$) after being statistically tested using the SPSS program with paired t-
test. Based on the results of the data analysis, the potential effect on 124 students in 5 (five) upper schools is that 87 students out of 124 students scored more than enough while 37 students rated less that means more than 70% student have enough value so this research can behave potential effect. During the trial process, the research was conducted by two teachers as observers of the activity. This learning takes place in five activities and resulted in activity observational analysis average student participating in learning is 3.09. Observer observations can be seen in Table 3.

4. Conclusion
The result of this research shows that teacher professionalism and competency development can be done with training. Training that held on East OKU MGMP at this research can development teacher competency in the development HOTS problem with the RME learning approach. The HOTS problems developed in this study can be categorized as valid and practical. Based on the development process it was found that the HOTS problems developed had a potential effect on student learning outcomes. This can be seen from the average value of students' ability is 70.16 which is included in enough category based in KKM. The development of HOTS problems is also effective in increasing teacher creativity and innovation in learning that has an impact on student learning outcomes, seen from the results of the observation analysis of each activity during the learning process using the RME approach, the average is 3.09 indicators that appear in each activity.

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