TRAINING AND ASSISTANCE IN THE DEVELOPMENT OF LEARNING OUTCOME ASSESSMENT MATERIALS HIGH-ORDER THINKING SKILLS FOR HIGH SCHOOL MATHEMATICS TEACHERS IN SOUTH TANGERANG

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Abstract: *High Order Thinking Skill (HOTS) is students' ability to process knowledge and ideas in a certain way to give them new knowledge and implications. The general perception regarding HOTS questions is that they are high-level questions. Most teachers adopt olympic questions as HOTS questions due to a misperception that HOTS questions are difficult, even though HOTS questions can be made in various difficulty levels: low, medium, and high. In addition, the substantive aspect of Mathematics, especially the application of Mathematics in life, is also one of the problems in developing HOTS questions. The method of implementing community service (PkM) is by training and assisting in preparing SMA-level Mathematics HOTS questions. The results of this PkM activity are: (1) Increased knowledge and understanding of teachers in the technique of developing HOTS questions which can be seen in an increase in the average pre-test and post-test results by 9%, (2) Improved mathematical skills in the use of concepts and applied Mathematics on HOTS questions. This can be seen from the questions made by the teachers in this PkM activity, and (3) the participants' satisfaction with this PkM activity is shown by the questionnaire results with a satisfaction range of 85.71% - 96.43%.*

Keyword: *Development; High school teacher; HOTS; Mathematics; Thinking Skills.*

INTRODUCTION

Mathematics is a subject given to all students starting from elementary school to equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as work together[1]. In other words, Mathematics is the foundation for all fields of science. Therefore, Mathematics is used as a subject tested in the Program for International Student Assessment (PISA).

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[1] Menteri Pendidikan Nasional RI, *Peraturan Menteri Pendidikan Nasional Republik Indonesia Nomor 22 Tahun 2006 Tentang Standar Isi Untuk Satuan Pendidikan Dasar Dan Menengah*, 2006.

PISA, initiated by the Organization for Economic Co-operation and Development (OECD), is a study to evaluate the education system that is participated in by more than 70 countries around the world[2]. PISA aims to improve the quality of education that focuses on reading, Mathematical, and scientific literacy in line with the Minister of Education and Culture's policy regarding the Minimum Competency Assessment (AKM), which covers these three fields. AKM is one part of the replacement for the National Examination (UN), which will be implemented in 2021.
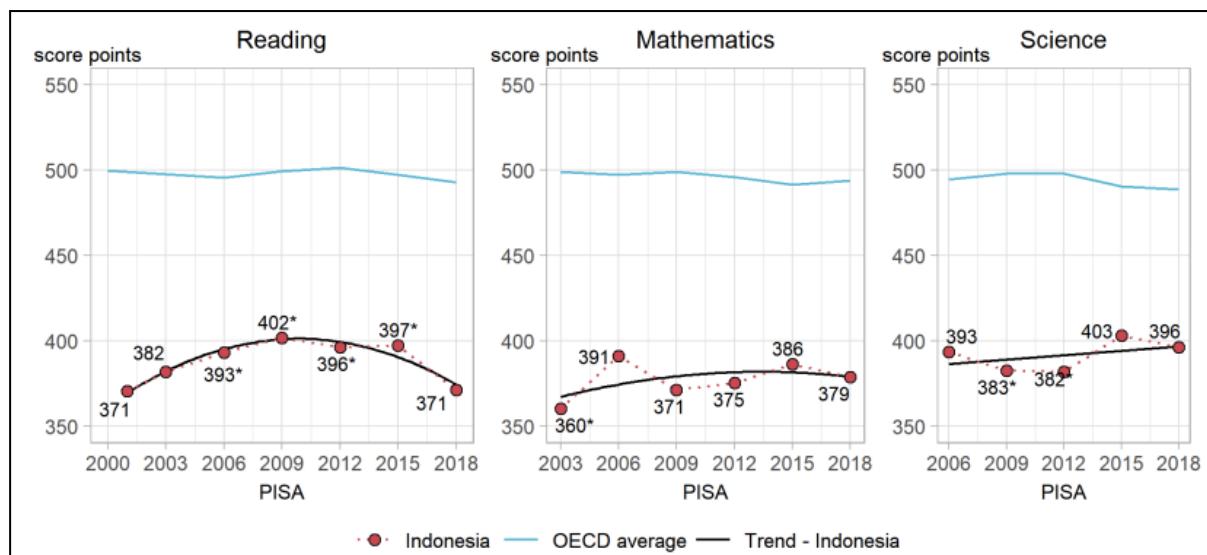
Picture 1. PISA scores for Indonesia[3]

Based on Picture 1, the PISA score for Indonesia is still below the OECD average and has decreased in 2018, including in Mathematical literacy skills. Therefore, training is needed to improve students' thinking skills by using non-routine questions oriented towards higher-order thinking levels in the evaluation of learning in schools, such as daily tests, midterm exams, and final semester exams, as well as other forms of assessment of learning outcomes.

HOTS is students' ability to think to process knowledge and ideas in a certain way so that it can give them new understanding and implications[4]. The cognitive dimensions of HOTS include analysis, generalization, integration, evaluation, and correctly solving non-routine questions[5]. In other words, HOTS-oriented learning can train students to think at a higher level. The teacher's

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[2] PISA OECD, *How Does PISA for Development Measure Mathematical Literacy* (Paris: OECD Publisher, 2018).

[3] OECD.

[4] A.W Gunawan, *Genius Learning Strategy: Petunjuk Praktis Untuk Menerapkan Accelerated Learning* (Jakarta: PT Gramedia Pustaka Utama, 2012).

[5] Zakkina Gais and Ekasatya Afriansyah, 'Analisis Kemampuan Siswa Dalam Menyelesaikan Soal High Order Thinking Ditinjau Dari Kemampuan Awal Matematis Siswa', *Mosharafa: Jurnal Pendidikan Matematika*, 6 (2018), 255–66.

role is to improve students' thinking skills to support this. Therefore training is needed to improve teacher competence.

Subject Teacher Consultation (MGMP) is an association or association of teachers who strategically improve and strengthen teacher competence through discussion and training. The High School Mathematics MGMP of South Tangerang City, Banten Province, consists of around 150 to 200 high school Mathematics teachers spread across all high schools in South Tangerang, both public and private.

Table 1. High school data in South Tangerang, Banten[6]

No.	Subdistrict	Number of high schools		Total
		Public High School	Private High School	
1	Ciputat	4	11	15
2	Ciputat Timur	2	7	9
3	Pamulang	2	12	14
4	Pondok Aren	1	17	18
5	Serpong	1	22	23
6	Serpong Utara	1	7	8
7	Setu	1	1	2
	Total	12	77	89

The vision of the South Tangerang City High School Mathematics MGMP is to familiarize mathematics learning in a fun and exciting class. The missions of the Mathematics MGMP include (1) enabling students to learn mathematics quickly, (2) enabling students to learn mathematics in a fun way, (3) enabling students to learn mathematics properly, and (4) assisting students in understanding mathematical problems.

Furthermore, based on the results of discussions with the Chair of the MGMP and the Head of the MGMP Mathematics Development and Training Section for High School Mathematics in South Tangerang City, in line with the results of the PISA study, the development of HOTS questions is still a problem for high school Mathematics teachers in South Tangerang. Some teachers think that HOTS questions are a type of question with a high level of difficulty, so they use Olympic questions or college entrance examination questions to be used as HOTS questions, but this is not the case. According to needs, HOTS questions can be developed in various difficulty levels: low, medium, and high. In addition, the competence of teachers in the scientific field of

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[6] Pusdatin Kemendikbudristek, 'Data Referensi Pendidikan, Kebudayaan, Riset, Dan Teknologi', 2023, P. 2. Https://Referensi.Data.Kemdikbud.Go.Id/.

Mathematics also needs to be improved because the SMA Mathematics Teacher Competency Test (UKG) results in South Tangerang still need to be higher. Many still scores below 70, while the minimum completeness criteria (KKM) given by the school to students can reach 80.
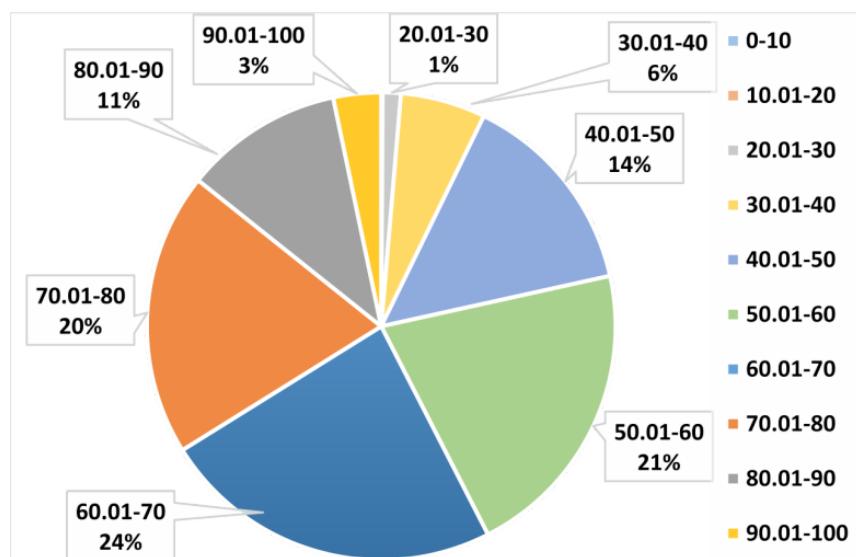

Figure 2. Percentage of UKG scores for high school teachers in 2015[7]

In line with the information provided by the head of the South Tangerang High School Mathematics MGMP regarding UKG results, Figure 2 also show data that the percentage of teachers who have UKG scores above 80 is 14%, scores 70.01-80 are 20%, while others (as many as 66%) get scores below 60[8].

Based on the discussion results, increasing the abilities, skills, and competencies of high school teachers in South Tangerang, especially in developing HOTS-oriented learning outcomes assessment materials in learning Mathematics, is the main focus of this community service (PkM). There are several partner problems related to learning Mathematics in high school level in South Tangerang, namely (1) teachers still need training and assistance in making HOTS-oriented Mathematics, and (2) increasing competence in the field of Mathematics science so that students teachers can quickly apply mathematical theories and concepts in the development of HOTS questions as well as in classroom learning.

Community service activities related to training on creating and answering HOTS questions have been carried out for students and teachers in several regions. Some community service related

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[7] S. Hidayati and others, *Peran Musyawarah Guru Mata Pelajaran (MGMP) Dalam Meningkatkan Mutu Pembelajaran Di SMA* (Jakarta: Pusat Penelitian Kebijakan, Badan Penelitian dan Pengembangan dan Perbukuan, Kemendikbud, 2020).

[8] Hidayati and others.

to training to answer HOTS questions for students has also been carried out for junior high school students in Jakarta[9], SMA Dharma Karya UT in South Tangerang[10], while community service that focuses on increasing teacher competency includes preparation training or questions HOTS for elementary school teachers[11], Indonesian language teachers at junior high school levels in the same district[12], high school science teachers in Gresik district[13], Indonesian Languange high school teachers in East Aceh (Hariadi, 2021), Muhammadiyah Klaten Middle School teachers[14], High School Mathematics teachers in Malang Regency[15], Padang Pariaman Regency[16], Riau Province[17], and Jember Regency[18], and High School History teachers in Karanganyar Regency[19].

Based on that activities, community service for preparing SMA Mathematics HOTS questions still needs to be improved. These activities align with the problems experienced by partners in the city of South Tangerang. The fundamental difference in the training conducted at this PkM is the focus of the assessments made and the trick to modifying HOTS questions that appear regularly to remain HOTS questions. Besides that, in this PkM activity, participants can not only compose HOTS questions. However, they can also compose HOTS questions with difficulty levels (easy, medium, and difficult) and various test instruments (multiple choices and essays).

Therefore, this PkM activity aims to increase teachers' knowledge, skills, and competence in developing HOTS-based assessment Mathematics learning outcomes at the high school level in

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[9] Windia Hadi and others, 'Pelatihan Pemahaman Soal Matematika Bertipe Hots Bagi Siswa Sekolah Menengah Pertama Di Jakarta', *Jurnal SOLMA*, 10.01s (2021), 2021.

[10] Selly Anastassia and others, 'Pengembangan Kemampuan Berpikir Kritis Siswa Melalui Soal-Soal Higher Order Thinking Skills (HOTS) Di SMA Dharma Karya UT Tangerang Selatan', 3.1 (2023), 103–12.

[11] A. P Cahyaningtyas and others, 'Pelatihan Penyusunan Soal-Soal Berbasis Hots Dan Aplikasinya Dalam Pembelajaran Daring Di Sekolah Dasar', *Indonesian Journal of Community Services*, 2.2 (2020), 162–71; M. F Rafli, 'Pelatihan Penyusunan Soal Berbasis HOTS (Higher Order Thinking Skills) Untuk Guru SDN 050718 Cempa', *Jurnal Pengabdian Kepada Masyarakat (Jpkm)*, 2.2 (2021), 110–17.

[12] R.M Ismayani, A Permana, and S Sukawati, 'Pelatihan Penyusunan Soal Berbasis Hots Bagi Guru Bahasa Indonesia Tingkat Smp Se-Kabupaten Subang', *Abdimas Siliwangi*, 3.1 (2020), 173–85.

[13] Suyatno Suyatno and others, 'Pelatihan Penyusunan Soal Berbasis Hots Untuk Guru IPA SMA Di Kabupaten Gresik', *Jurnal Pemberdayaan Masyarakat Universitas Al Azhar Indonesia*, 5.1 (2022), 66 <https://doi.org/10.36722/jpm.v5i1.1770>.

[14] R. P Khotimah, 'Pelatihan Penyusunan Soal Matematika Berbasis Higher Order Thinking Skills (HOTS) Bagi Guru-Guru SMP Muhammadiyah Klaten', *Warta LPM*, 24.4 (2021), 646–55.

[15] Ucik Fitri Handayani and Wildan Hakim, 'Pelatihan Penyusunan Soal HOTS Matematika SMA Sederajat Di Kabupaten Malang', *Jurnal Anugerah*, 4.2 (2022), 135–44 <https://doi.org/10.31629/anugerah.v4i2.4384>.

[16] Khairudin and Niniwati, 'Pelatihan Menganalisis Dan Menyelesaikan Soal Matematika Berorientasi Higher Order Thingking Skills (HOTS) Bagi Guru SMA Kabupaten Padang Pariaman', *Jurnal Pengabdian Pada Masyarakat*, 5.2 (2020), 443–50.

[17] Rezi Ariawan and others, 'Pelatihan Penyusunan Soal Hots Bagi Guru Matematika', *Jurnal Altifani Penelitian Dan Pengabdian Kepada Masyarakat*, 2.1 (2022), 65–74 <https://doi.org/10.25008/altifani.v2i1.207>.

[18] Didik Sugeng Pambudi and others, 'Pelatihan Penyusunan Soal Berfikir Tingkat Tinggi Bagi Guru-Guru Matematika SMA Di Jember', *Dinamisia : Jurnal Pengabdian Kepada Masyarakat*, 6.6 (2022), 1413–19 <https://doi.org/10.31849/dinamisia.v6i6.5505>.

[19] D.A Kurniawan and others, 'Pelatihan Pembuatan Soal Berbasis HOTS Bagi Guru Mata Pelajaran Sejarah SMA Di Kabupaten Karanganyar', *DEDIKASI : Community Service Reports*, 5.1 (2023), 25–36.

South Tangerang City questions. In addition, this activity is also a form of implementing research results on community needs or related to problems faced by partners and potential for development.

RESEARCH METHODS

The method used by the PkM team is Participatory Action Research (PAR). PAR is an action research method that defines a problem and applies the information to act as a solution to that problem[20]. PAR focuses on the concept that the participant is the center or center of activity[21]. The steps in the PAR method are as follows[22]:

(1) Initial mapping

Initial mapping is a tool to understand the community/partners so that the PkM team quickly understands the reality of the problems that occur.

(2) Building humanitarian relations

The PkM team incurs and builds trust with the community/partners to establish equal and mutually supportive relationships. The PkM team and partners can carry out activities, learn to understand problems and solve problems together (participatory).

(3) Determine the social change research agenda

Together with partners, the PkM team plans programs to understand partner problems.

(4) Participatory mapping

Together with partners, map the problems experienced by partners.

(5) Formulate humanitarian problems

Partners formulate the fundamental problems they are experiencing.

(6) Develop a movement strategy

Partners and the PkM team develop strategies to solve the problems that have been formulated.

(7) Community organizing

Partners accompanied by the PkM team form a working group.

(8) Action for change

Problem-solving actions are carried out simultaneously and participatively.

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[20] Abdul Rahmat and Mira Mirnawati, 'Model Participation Action Research Dalam Pemberdayaan Masyarakat', *Jurnal Ilmu Pendidikan Nonformal*, 6.01 (2020), 62–71.

[21] S Sumarni and others, 'Pelatihan Penggunaan Aplikasi Referensi Untuk Menunjang Penulisan Akademis Bagi Mahasiswa Pendidikan Bahasa Inggris', *As-Sidanah : Jurnal Pengabdian Masyarakat*, 5.1 (2023), 77–93 <https://doi.org/https://doi.org/10.35316/assidanah.v5i1.77-93>.

[22] A Afandi and others, *Metodologi Pengabdian Masyarakat* (Jakarta: Direktorat Pendidikan Tinggi Keagamaan Islam, 2022).

(9) Reflection

  The PkM team, together with partners, reflect and evaluate PkM activities.

(10) Expanding the scale of movement and support

  The success of a program is not only measured by the results obtained during the process but also by the program's sustainability. Therefore, partners can expand the scale of movement by applying the knowledge and skills obtained during training at their respective schools. In addition, the PkM team can also extend its network by training with other partners at the same or different educational levels.
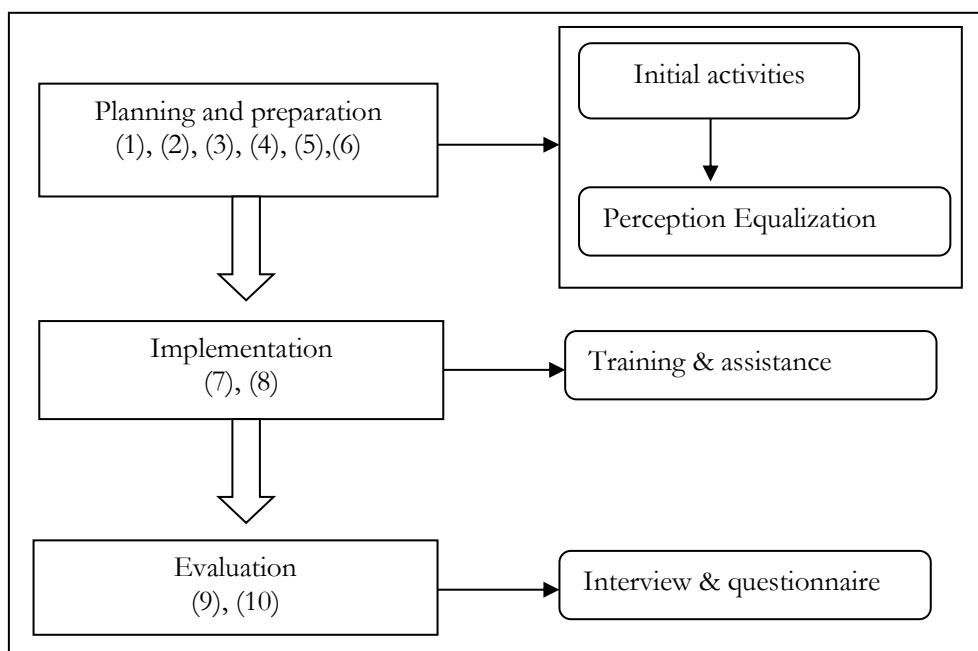
Picture 3. Diagram of implementation of the PAR method in PkM activities

     In this activity, PkM participants or partners were high school teachers from South Tangerang City, Banten Province who are members of the Mathematics MGMP for South Tangerang City. Participants were selected using a purposive sampling technique from 12 public and private high schools in South Tangerang City. This PkM activity began with conducting a needs analysis through interviews with the MGMP Mathematics of the City of South Tangerang to obtain information regarding the constraints of high school mathematics teachers in teaching mathematics. Furthermore, the PkM team prepared training materials on HOTS and techniques for developing HOTS-oriented assessment materials for high school mathematics subjects. Another intervention from the PkM team was training and assisting teachers in developing HOTS-based high school mathematics questions with various difficulty levels, namely medium, easy, and

difficult. The participants were given a pre-test before the training started and a post-test after the mentoring activities ended to determine the achievement of participants' competency improvement in developing HOTS questions.

The training was conducted online through the zoom meeting application in 3 meetings and one activity evaluation. This activity starts from October to November 2022. The training material at the first meeting was an introduction and criteria for HOTS questions, techniques for developing HOTS questions, and examples of HOTS Maths questions and discussions. The second meeting was continued with practice accompanied by HOTS question development assistance by the PkM team, and the material for the third meeting was the practice (continued) HOTS question development and providing feedback from resource persons to participants. At the end of the activity, the PkM team evaluated to find out the achievements of the PkM activities and the benefits of these activities with the needs of high school teachers in South Tangerang, as well as to find out the obstacles found during the activity as an effort to improve for the implementation of the next PkM. The evaluation will be carried out by taking into account several aspects, including:

a. evaluation of participants' understanding increased. The evaluation was carried out by pre-test and post-test given to participants.

b. evaluation of participants' skills increased. This can be seen from the work produced by the participants used in preparing high school Mathematics HOTS questions.

c. activity evaluation also be carried out on the implementation process at the end of a series of activities to obtain information regarding the benefits of implementing the training using interviews and questionnaires.

RESULTS AND DISCUSSION

Results

Results of PkM activities are carried out in several stages: initial activities, equalization of perceptions, implementation, and evaluation of activities.

Initial activities

The PkM team surveyed the South Tangerang City Mathematics MGMP as a partner to obtain information on the needs and problems faced by high school teachers, especially Mathematics teachers, in South Tangerang City. The Chairperson of the Mathematics MGMP as a representative of the partners, expressed a desire to increase the knowledge and skills of SMA Mathematics teachers by facilitating teachers to participate in various educational and training activities. Furthermore, the PkM team provided solutions to partners for training and assistance

assesment of higher-order thinking skill (HOTS) learning outcomes for high school mathematics teachers.

Picture 4. Analysis of Partner Needs

Perception Equalization

Before the implementation of the PkM, the PkM team and the training participants carried out an equalization of perceptions which was carried out online regarding the time of implementation, the mentoring strategy to be carried out, and the competencies that the participants would gain after participating in this PkM. The results obtained are (1) PkM activities are carried out online using the Zoom meeting application; (2) the implementation is carried out after the High School Mid Semester Examinations (UTS) in the South Tangerang area, Banten, which is around October 2022; (3) PkM activities were carried out in 3 meetings and one activity monitoring/evaluation, (3) PkM participants were Mathematics teachers from various high schools in South Tangerang, Banten.

Implementation of Activities

PkM activities were held in October-November 2022. This activity began with an opening attended by the head of the South Tangerang City Mathematics MGMP, high school Mathematics teachers from various regions in South Tangerang, the FST UT PkM team, and the Head of the FST UT Mathematics Study Program. The number of participants who attended was 20 from 12 SMA in South Tangerang City. Even though the activity was carried out boldly, the number of participants was limited to 20 people so that the class mentoring process would run more effectively.
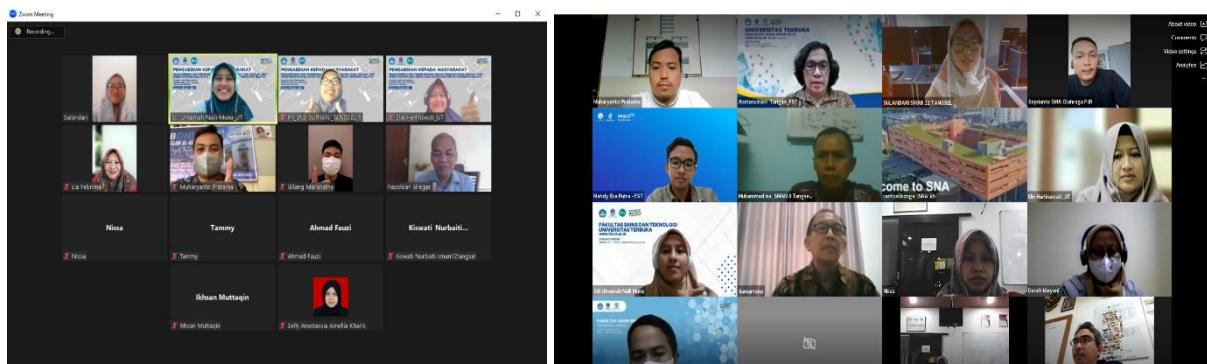
Picture 5. Participants

At the first meeting, before the presentation of the material, the participants gave pre-test questions to measure participants initial abilities related to HOTS and HOTS-based material assessment before conducting training and mentoring. Then it was followed by a presentation of material by the PkM team about HOTS and HOTS question preparation techniques. The steps for preparing HOTS questions were also explained, including how to develop grid questions and make HOTS questions according to the question grids. Finally, discussion activities were carried out regarding the material that had been explained and given independent assignments that the PkM team had prepared to measure the achievement of the participants' needs. In order to be more effective in the mentoring process, the participants also joined the WhatsApp group (WAG), so that outside of the scheduled meetings, the participants had the opportunity to discuss in the WAG with the PkM team. The findings in the WAG discussion were related to determining LOTS and HOTS questions and the cognitive level of the HOTS questions created.
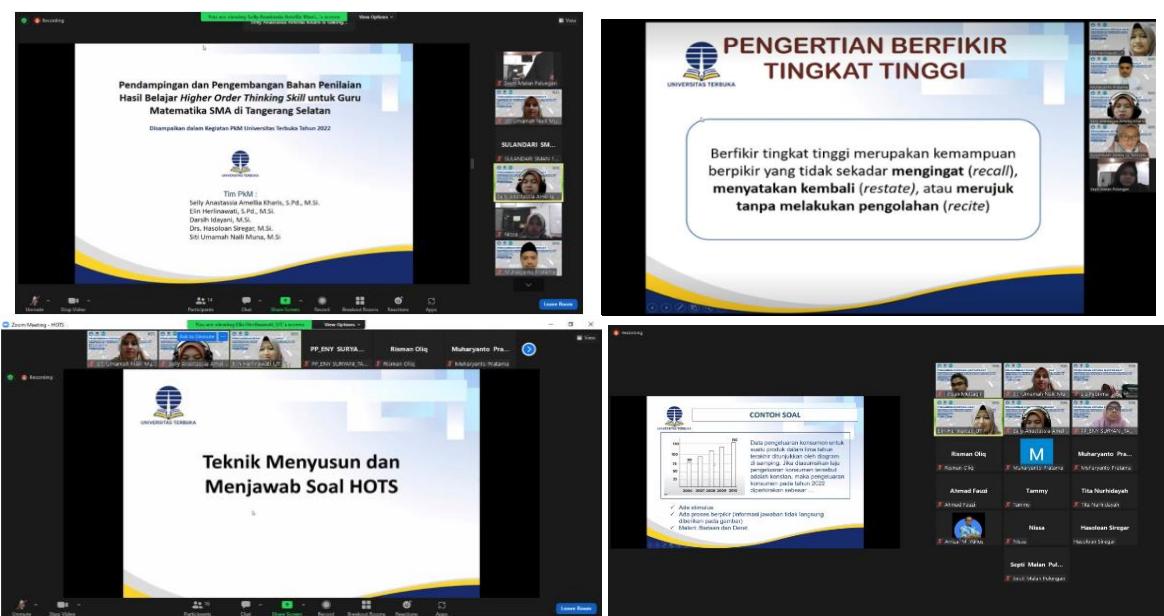

Picture 6. Material presentation by the PkM team

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The next meeting was assistance in developing HOTS-based learning outcomes assessment materials. This activity is stimulating by enriching examples of HOTS and LOTS questions with various levels of difficulty, followed by the process of assisting in developing questions by modifying the HOTS questions that are routinely given by the teacher to students so that they remain HOTS questions because routine HOTS questions will not be HOTS anymore. Then discuss the suitability of developing HOTS-based questions on questions and answers made by PkM participants on independent assignments.
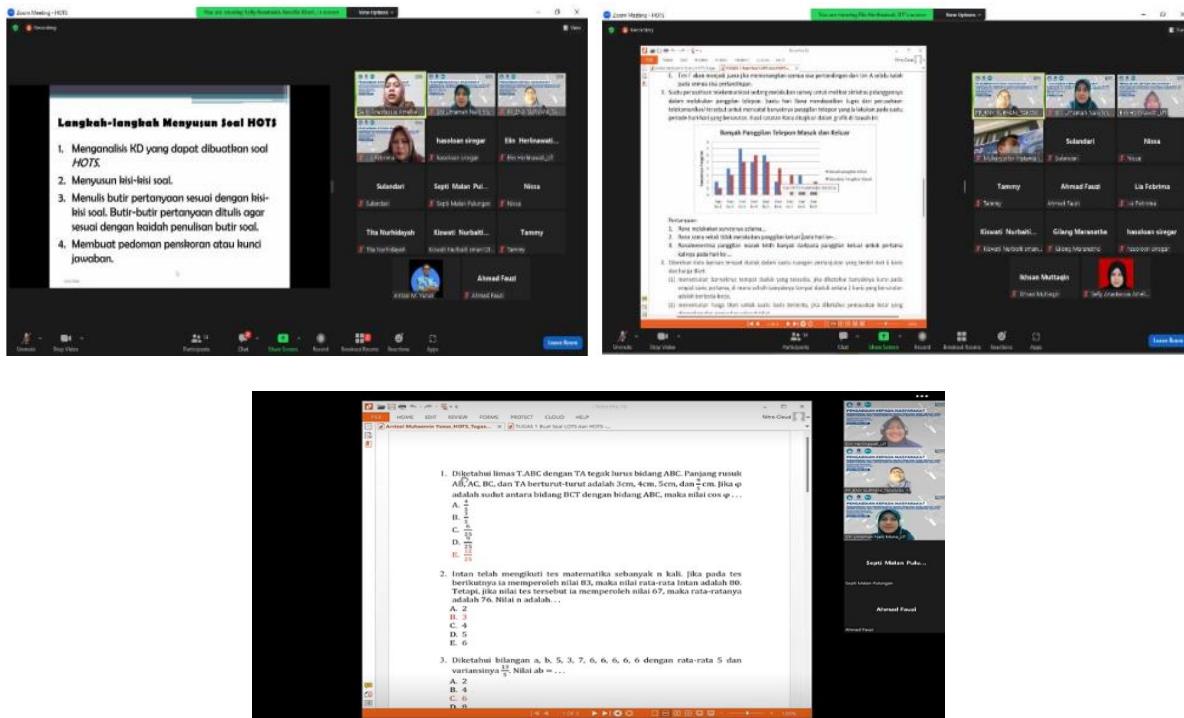
**Picture 7**. Assistance in developing HOTS questions

After completing the mentoring process at the last meeting, the PkM activities ended with filling out a post-test to measure achievement in developing HOTS questions after training and mentoring. Then it was followed by the handing over of the plaque symbolically by the head of the Mathematics Study Program to the head of the South Tangerang City Mathematics MGMP.
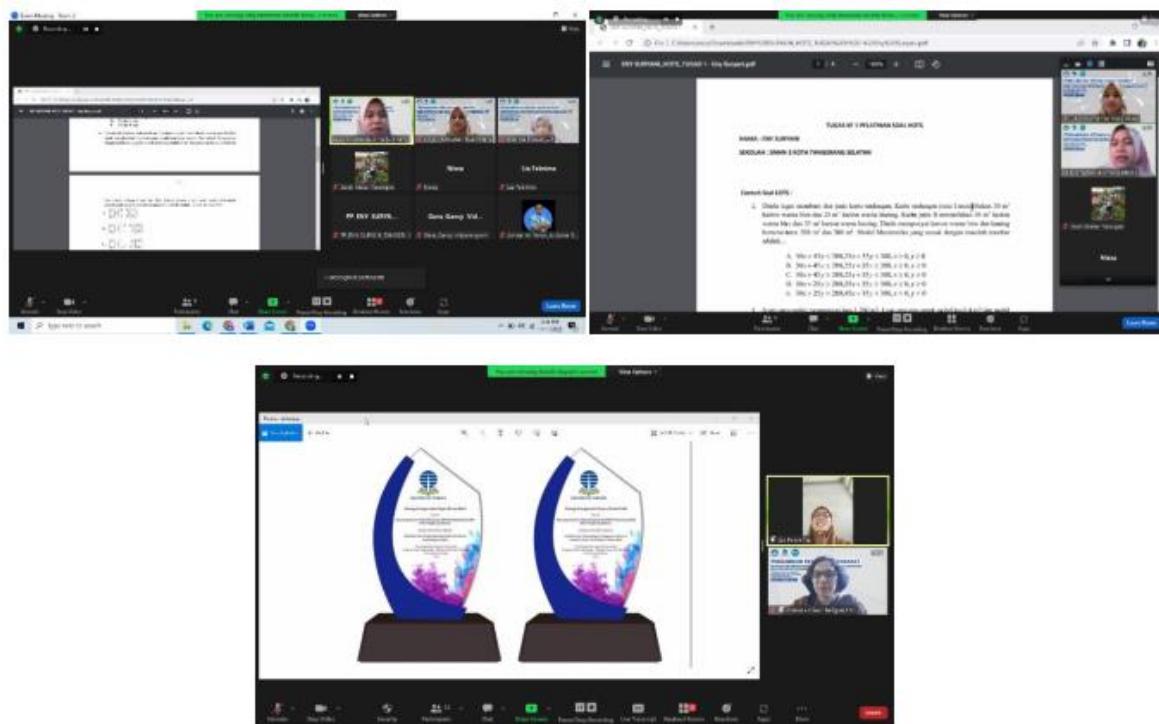
Picture 8. Assistance in developing HOTS questions and closing PkM activities

Output

This PkM activity resulted in the participant's understanding of HOTS and how to develop HOTS Mathematics questions. This can be seen from the comparison of the pre-test and post-test results of the trainees. The average pre-test score of participants was 60 while the post-test score was 69. This shows that there was an increase of 9% from the average initial score to the average final score.
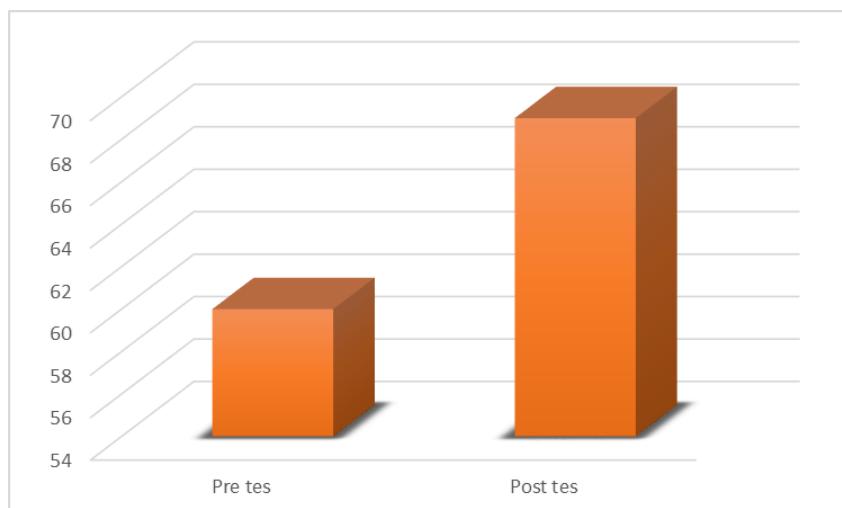
Picture 9. Comparison of the average pre-test and post-test scores

In addition, participants also gained skills in preparing HOTS questions, especially high-school-level Mathematics questions. This can be seen from the participants' questions during the mentoring process.

No Soal	1
Kompetensi Dasar	Menggeneralisasi pola bilangan dan jumlah pada barisan Aritmetika dan Geometri
Materi	Barisan dan Deret
Indikator Soal	Peserta didik diminta untuk mengingat rumus mencari jumlah dari barisan aritmatika
Level Kognitif	C1
Bentuk Soal	Pilihan Ganda
Soal	Rumus untuk mencari jumlah suku ke-n pada barisan aritmatika adalah… A. $a + (n-1) \cdot b$ B. ar^{n-1} C. $S_n - S_{n-1}$ D. $\frac{S_n}{n}$ E. $\frac{n}{2}[2a + (n-1) \cdot b]$
Kunci Jawaban	E.

(a)

No Soal	4
Kompetensi Dasar	Menggunakan pola barisan aritmetika atau geometri untuk menyajikan dan menyelesaikan masalah kontekstual (termasuk pertumbuhan, peluruhan, bunga majemuk, dan anuitas)
Materi	Barisan dan Deret
Indikator Soal	Diberikan masalah dalam kehidupan sehari-hari, peserta didik diminta menentukan Panjang busur.
Level Kognitif	C4
Bentuk Soal	Uraian
Soal	Diana sedang bermain ayunan di halaman belakang rumahnya. Dia mengayunkan ayunan tersebut dengan menggunakan tangan dan tubuhnya agar ayunan tersebut berayun sampai ketinggian maksimum, kemudian membiarkannya sampai ayunan yang dia tumpangi berhenti dengan sendirinya. Dalam setiap ayunan, Diana menempuh 75% dari panjang ayunan sebelumnya. Jika panjang busur pertama (atau ayunan pertama) 2 meter, tentukan panjang busur yang ditempuh Diana pada ayunan ke 8. Berapa meterkah total panjang busur yang ditempuh Diana sebelum dia berhenti berayun?
Kunci Jawaban	Diketahui : $a_1 = 2$ $r = 75\% = 0,75$

Ditanya : $S_\infty = ?$
Ayunan ke 8 adalah :
$a_n = a_1\, r^{n-1}$
$\leftrightarrow a_8 = a_1 r^{8-1}$
$\leftrightarrow a_8 = 2(0,75)^7$
$\approx 0,27$
Jadi panjang ayunan ke 8 adalah 0,27 meter atau 27 cm.

Menentukan panjang lintasan
$S_\infty = \frac{a_1}{1-r}$
$S_\infty = \frac{2}{1-0,75}$
$S_\infty = \frac{2}{0,25}$
$S_\infty = 8$

Jadi panjang lintasan yang ditempuh Diana sampai berhenti berayun adalah 8 meter.

(b)

Picture 10. Examples of LOTS question (a) and HOTS question (b) made by participants

Evaluation

The implementation was designed online because this activity occurred during the Covid-19 pandemic. The online meeting scheme requires a stable internet connection, so some participants experience network problems. As a result, some participants still need to get the material as a whole. To overcome this, the PkM team sends recordings of each online meeting to participants to review. In addition to providing material, mentoring is also carried out with independent worksheets/assignments prepared by the PkM team so that the mentoring process is more focused.

Furthermore, to find out the satisfaction and usefulness of PkM activities for participants,

the PkM team evaluated through interviews and filling out questionnaires by the participants. From the interviews, this PkM activity received a positive response. The main points of the interview include (1) the level of partner satisfaction, which includes the suitability of the program implemented by the PkM team to the needs of the participants, the resource person's skills in delivering the material, and the scope of the material according to the participants' expectations, as well as the results of the interview. PkM activities can solve problems related to the development of HOTS questions so that teachers can create and classify HOTS questions not only at cognitive levels C1-C3 but also on questions C4 – C6, (2) Changes in attitudes, knowledge, and skills of participants, and (3) usefulness of the results program for partners. The participants also provided input for holding a similar PkM by raising other issues that lead to the use of technology in learning Mathematics or assisting teachers in making Mathematics more enjoyable for students.

Furthermore, the results of the questionnaire filled out by the PkM activity participants are shown in Table 2.

Table 2. Questionnaire results

No.	Descriptions	Results
1	Satisfaction with the explanation of PkM activities carriedout by the PkM team	85.71%
2	Compatibility of PkM activities with needs	89.29%
3	Satisfaction with the PkM activities carried out	89.29%
4	Satisfaction with the knowledge and skills of the PkM team in implementing PkM activities	89.29%
5	Satisfaction with the way the PkM team teaches / trains / guides PkM activities	92.86%
6	Use of the knowledge gained after participating in PkM activities	89.29%
7	Use of skills obtained after participating in PkM activities	89.29%
8	Satisfaction with knowledge and skills obtained after participating in PkM activities	92.86%
9	Use of PkM activity materials in supporting daily work	85.71%
10	Satisfaction with the accuracy of choosing the type of activity to help solve partner group problems	85.71%
11	Satisfaction with the attitudes and behavior of the lecturers during the PkM activities	96.43%
12	Appearance of the PkM team when delivering PkM activity material	85.71%

DISCUSSION

The findings show that PkM activities have been carried out well. Participants participating in the training and mentoring can create HOTS High School Mathematics questions according to the rules for writing questions for teaching and learning activities. Participants can not only create questions but also pay attention to the rules for writing questions so that the aim of creating questions to convey learning outcomes and develop students' thinking abilities can be achieved[23]. Higher-order thinking skills in Mathematics cannot be obtained instantly but must be trained by teachers in mathematics learning[24]. Apart from creating questions, participants can modify questions that appear routinely into HOTS questions so that participants do not have to use Olympiad questions to evaluate learning outcomes. This also breaks the opinion of most participants who think HOTS questions are complicated. HOTS questions don't have to be difficult and difficult questions are not necessarily HOTS questions. This PkM activity is one of the solutions to overcome the problem of developing HOTS Mathematics questions at the high school level, especially in the city of South Tangerang, as expressed by the head of MGMP Mathematics for the city of South Tangerang.

Apart from that, this PkM activity provides other benefits to participants, such as how to create question grids, question cards, and guidelines for scoring question answers, as well as how to create questions based on cognitive level. The PkM team also invites participants to present the results of their work individually and in groups during this training. This PkM activity also allows participants to discuss and share experiences with other participants. Discussions between participants can help participants understand the formulation of HOTS questions from various perspectives and different approaches. This adds insight and new ideas for developing HOTS Mathematics questions at the high school level.

CONCLUSION

The PkM activities focus on training and mentoring in preparing assessment materials for high school students learning outcomes, with participants being high school Mathematics teachers in South Tangerang City, Banten. This activity has been carried out well by the PkM team. This activity was carried out from October to November 2022. This activity was carried out in 3 meetings and one activity evaluation. The achievement of training and mentoring objectives

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[23] Ahmad Rozaq Alfajri, Syafdi Maizora, and Ringki Agustinsa, 'Kepraktisan Soal-Soal Higher Order Thinking Untuk Menghasilkan Soal Yang Praktis Untuk Siswa Kelas XI MAN 1 Kota Bengkulu', *Jurnal Penelitian Pembelajaran Matematika Sekolah*, 3.2 (2019), 205–17.

[24] Alfajri, Maizora, and Agustinsa.

includes: (1) Increasing teachers' knowledge and understanding of HOTS question development techniques as seen from the increase in the average pre-test and post-test results by 9%, (2) Increasing mathematical abilities in the use of concepts and applied mathematics in HOTS questions. This can be seen from the questions asked by the teachers during this PkM activity, and (3) participant satisfaction with this PkM activity is shown in the questionnaire results with a satisfaction range of 85.71% - 96.43%. As a follow-up, similar junior and senior high school-level training activities could be included in the PkM team's agenda, considering the usefulness and enthusiasm of the participants who took part in these activities.

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