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The Minimum Competency Assessment Model Instrument Development Training for MTs Mathematics Teachers in Bandung

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Abstract

The Minimum Competency Assessment (AKM) is followed by students and is designed to measure reading and numeracy literacy as a cognitive learning outcome. In its development, AKM adopts the assessment system carried out by the OECD through PISA, so that it was first implemented and even now, in general, teachers still do not understand AKM which is based on numeracy literacy, and have not been able to develop measurement instruments according to standards. For the fulfillment of quality educational services for the community through improving the competence of teachers in AKM, community service is developed in the form of training. In order for the training to strengthen the understanding of numeracy literacy and the development of assessment instruments, this service is arranged in several stages. Seminar on strengthening numeracy literacy and its measurement, and the practice of developing AKM model instruments. Although the increase in participants' knowledge was not too high, the results of the evaluation of this service activity were responded to very well in service, responsiveness, and tangible evidence. The teacher's response to the implementation of service activities that have been carried out is generally considered very good. The seminars and workshops in the development of AKM model instruments have provided a lot of knowledge and experience in compiling standard instruments, so that not only for the needs of literacy measurement, but also for the needs of teachers in the development of learning outcome instruments. Therefore, it is important for the government (Ministry of Education and Ministry of Religion) or universities in the field of education to provide services for teachers in improving their numeracy understanding skills, and their skills in compiling AKM model instruments, so that they can be integrated into mathematics learning practices.

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INTRODUCTION

Mathematics learning in the 21st era emphasizes the importance of developing four aspects of skills, namely critical thinking, communication, collaboration, and creativity. One of the essential requirements for students in developing 21st century skills is to have literacy skills (Fajriyah, 2022; Hamdiah et al., 2025; Hasanah et al., 2025). As a result, the priority in developing students' multiliteracy skills which has a significant impact on the manifestation of character values, one of which is focused on numeracy (Wiratsiwi, 2020; Alam et al., 2024; Siregar et al., 2024). Numeracy is the skill

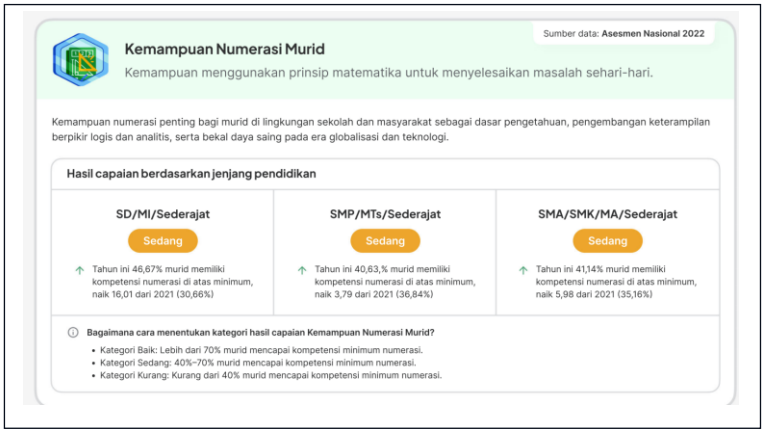
of using basic mathematical numbers and symbols to solve practical problems in various daily life situations (Pusmendik, 2023).

To measure students' numeracy skills at the global level, it is carried out through the Programme International Student Assessment (PISA) organized by the Organization for Economic Cooperation and Development (OECD) and attended by 70 countries in the world, including Indonesia. As for Indonesia itself, the numeracy literacy ability of students nationally is measured through the National Assessment (AN). The birth of the National Assessment (AN) was adopted from PISA which provides a comprehensive overview of the quality of learning achievement and the teaching process in educational institutions (Kemdikbud, 2022). AN is attended by students and is designed to measure reading and numeracy literacy as a cognitive learning outcome (Indahri, 2021), and also serves as a mirror or portrait of the services and performance of each school so that reflection can be carried out together to accelerate the improvement of the quality of Indonesian education (Indahri, 2021; Yudha et al., 2025; Arifin et al., 2025).

There are three parts in the measurement of AN, namely the Minimum Competency Assessment, Character Survey, and Learning Environment Survey (Indahri, 2021). The Minimum Competency Assessment (AKM) is a numeracy assessment conducted to measure the extent to which students are able to think using concepts, and/or procedures (Andiani et al., 2021). Thus, AN has a significant role in the educational context because of its function in measuring student development, evaluating teaching effectiveness, and providing a basis for decisions that affect educational improvement, especially in measuring students' numeracy skills.

Nationally, literacy measurement can be known from the AKM organized by the Ministry of Education and Culture and PISA organized by the OECD. The results of the AKM by the Ministry of Education and Culture in 2022 can be seen in Figure 1.

Figure 1. Numeracy Ability of Students 2022 National Assessment Results



The results for junior high school/MTs students showed an increase in the achievement of students' numeracy literacy skills from 36.84% (low category) in 2021, to 40.63% (lower limit for the medium category) in 2022. If the above results are compared to a survey conducted by PISA in 2022, the results are the opposite, namely the average numeracy literacy score of Indonesian students actually decreased by 13 points compared to 2018, from 379 to 366 (OECD, 2023). In particular, in West Java in three regions, namely the city of Bandung (Purwasih et al., 2018), West Bandung Regency (Nuurjannah et al., 2018), and Cirebon Regency (Widianti & Hidayati, 2021)

who believe that junior high school students are good at doing mathematical calculations but because students are not yet used to solving problems related to mathematical literacy, They have difficulty understanding the information in the problem and use it to create mathematical models and find solutions.

Especially in the city of Bandung, the literacy of elementary school students is said to be quite good, but there needs to be precision in the content of the text (Nurjanah et al., 2022), the need to improve skills in numeracy literacy, and the need to examine the causes of these difficulties because in learning students are not used to doing practice problems and PISA characteristic tasks that require mathematical literacy skills in solving them (Selan et al., 2020). Therefore, it is important for teachers to have the ability to develop numeracy literacy model test instruments.

The importance of teachers' ability to develop minimum competency assessment tests based on numeracy literacy is not supported by their competence. Teachers have not been able to produce assessment instruments that reach the expected quality standards (Gusti Ngurah Arya Surya Wangsa et al., 2021), teachers still have limited abilities in designing numeracy literacy tests (Aprilianti et al., 2022), and lack of ideas and understanding in designing numeracy-focused questions (Novita et al., 2022). The results of these studies are strengthened by the results of research conducted by the MGMP MTs team in March 2023. The research involved 61 junior high school/MTs mathematics teachers from two Cities in West Java. A total of 61 mathematics teachers were asked to prepare three AN type questions each with three different levels. As a result, out of a total of 183 questions made, only 27.87% of the questions met the indicators. Then of the 3 questions made by each teacher, only 9.8% of teachers with 2 questions according to the indicators, then 63.9% of teachers with 1 question according to the indicators, and 19.7% of teachers whose third questions did not follow the indicators, and 6.6% of teachers who did not work at all. This shows that teachers' ability to compile numeracy problems still needs to be improved.

Improving teacher competence in numeracy literacy has started with community service through training on the development of integrated learning tools for numeracy literacy (Dahlan et al., 2023). For further improvement in accordance with the community service roadmap that has been prepared, it is an increase in teacher competence in national assessments, as well as the development of National Assessment model instruments. For this reason, there needs to be direct treatment in the form of activities that integrate theories about numeracy literacy assessments in the form of Minimum Competency Assessments (AKM), practical training in the development of instruments, and the implementation of trials and analysis. The form of training activities for the preparation of AN type numeracy questions for teachers is designed by involving education experts in the field of numeracy, as well as practitioners (MGMP) as partners in the form of Community Service (PkM) activities. The implementation of PkM in the form of this training will be focused on teachers in one region.

Based on the results of observation and discussion with MGMP Mathematics MTs Bandung, training in the preparation of AKM-type numeracy problems has never been carried out before in the Bandung area. For this reason, the training in this PkM activity was carried out in Bandung in collaboration with the Mathematics Subject Teacher Conference (MGMP) of the Bandung MTs.

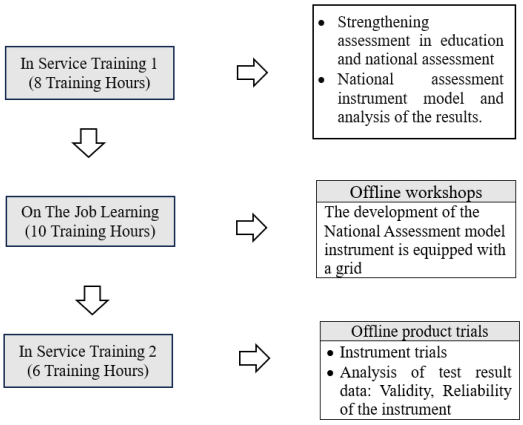
From this identification, it is important to carry out activities that can facilitate teachers in improving their understanding of numeracy literacy, as well as the

development of numeracy literacy assessment instruments that are integrated in learning.

METHOD

The service in the form of training on the development of national assessment model instruments for MTs mathematics teachers in the city of Bandung was carried out in three stages with a combination of online and offline. The stages of implementation can be seen in Figure 2.

Figure 2. Stages of PkM Activities



The first stage of PkM was carried out in the form of an online seminar with a Participatory Action Research (PAR) design. This design is seen as an approach to community service training whose process aims to learn in overcoming problems and meeting the practical needs of the community, as well as the production of science (Afandi, 2020). With PAR, theoretical material on numeracy literacy, as well as the development of the National Assessment model interface are presented by experts in the field of mathematics assessment and numeracy literacy, so that they can be well understood by participants.

The second stage of PkM is a workshop conducted face-to-face or offline. The workshop aims to train teachers in the development of grids and instruments for the measurement of numeracy of the national assessment model. The result of this workshop is a set of national assessment model instruments equipped with a grid. The development of Cement Grids and instruments is divided into four groups, namely Algebra, Numbers, Geometry, and Statistics. The division is carried out so that each group focuses on each field. The results of the group are presented in class discussions, then revised, and the results are combined into a set of instruments that are ready to be tested.

The third stage in this PkM is the trial of products resulting from the workshop. The trial was carried out in one of the schools of each group. The results of the trial were analyzed for validity and reliability.

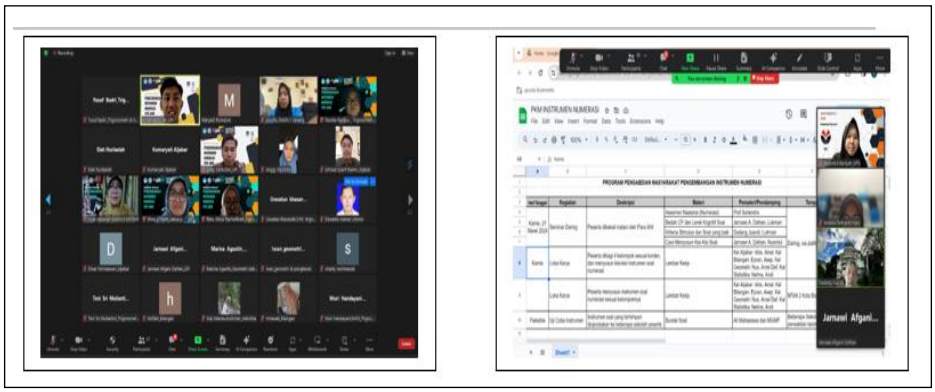
At the end of the training, participants were also given a questionnaire containing their responses about service, responsiveness, and tangible evidence. The instrument in the form of a questionnaire was sent to the participants through googleform.han and the method contained the main materials used in the research and the methods used in problem solving including the analysis method. The ingredients listed here are only the main ingredients and must be equipped with the brand and purity (e.g.: H2SO4 (Merck, 99%)). The equipment described in this section contains only the main equipment

equipped with a brand (e.g., electric furnace (Carbolite)). The components of the supporting equipment do not need to be written. The main set of tools should be presented in this section with image captions. The image caption is placed as part of the image title (figure caption) instead of being part of the image. The methods used in completing the research are described in this section.

RESULT AND DISCUSSION

The first step in this PkM is to increase participants' understanding of numeracy, as well as the concept of developing numeracy instruments that contain a study of cognitive levels, stimulus, and AKM instrument grids. The activity is carried out in the form of an online seminar, so teachers do not need to leave their assignments at school. The seminar was facilitated by several speakers who are experts in the field of numeracy, assessment in mathematics learning, and after practitioners, namely teachers who are experienced in the preparation of AKM instruments.

Figure 3. Seminar on Strengthening Participants' Numeracy Competencies (Stage-1)



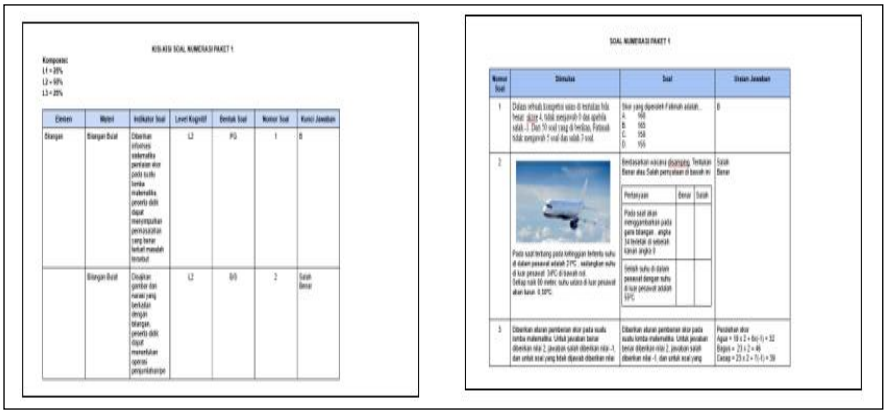
Strengthening teachers' knowledge in numeracy is an important aspect in the development of numeracy narrative instruments. This is as shown by research from (Rahmasari et al., 2022) that the ability to develop literacy and numeracy test questions is still low and requires special training, socialization, and habituation of application in schools.

The second stage of the training activity was a workshop on the development of AKM grids and instruments. The activity was carried out offline which took place in the hall of MTs N 2 Bandung City. For time efficiency, participants in the practice of developing AKM grids and instruments were divided into several groups, namely number groups, algebra, geometry and measurement, as well as statistics and chance. Each group develops one AKM instrument grid, and two AKM instruments of the same kind.

Figure 4. Workshop Implementation Activities (Stage-2)

From the results of this workshop, the Minimum Competency Assessment Instrument (AKM) of the National Assessment Model was obtained. The resulting products from this training can be seen in the following image.

Figure 5. Examples of Training Works



The resulting instruments were tested on 83 students of MTs N 1 and MTs N 2 in Bandung.

Figure 6. Trial of Training Instrument Products (Stage-3)

Before the training, participants were measured their initial abilities about numeracy literacy, cognitive taxonomy, and instrument development. Likewise, at the end of the training, students are given tests with equivalent instruments. Descriptively, the results are as follows.

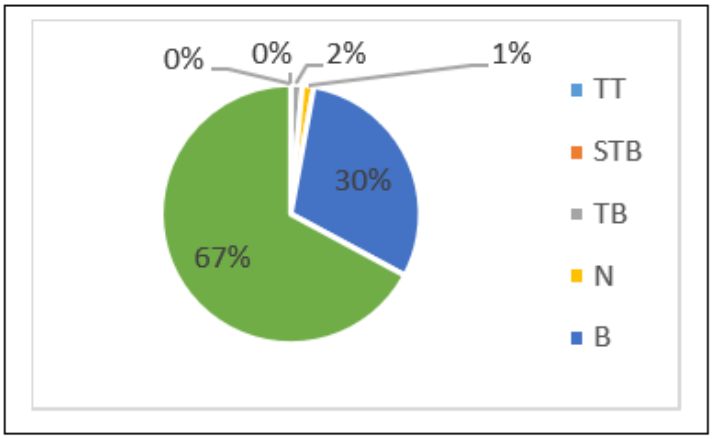
Table 1. Pre and Post Test Results of Trainees

Pre		***Pos***	
$\bar{X}$	49,27	$\bar{X}$	52,29
M_e	49	M_e	53
M_o	49	M_o	57
S	9,9497	S	9,61
Kurtosis	-0,06	Kurtosis	-0,26
Skewness	-0,16	Skewness	-0,23

The results above provide information that on average there is a slight increase in participants' comprehension ability from before and after participating in the workshop. With an ideal maximum score (SMI) of 100, the final test results are still far from expectations. However, there are results that support optimism, namely the skewness value of the distribution of the final test (postest) is smaller than before (pretest), meaning that the data of the final test results are more above average.

When viewed from the response of the trainees, generally the participants gave a very good response from the usefulness of the training activities that had been carried out. The response diagram is as follows.

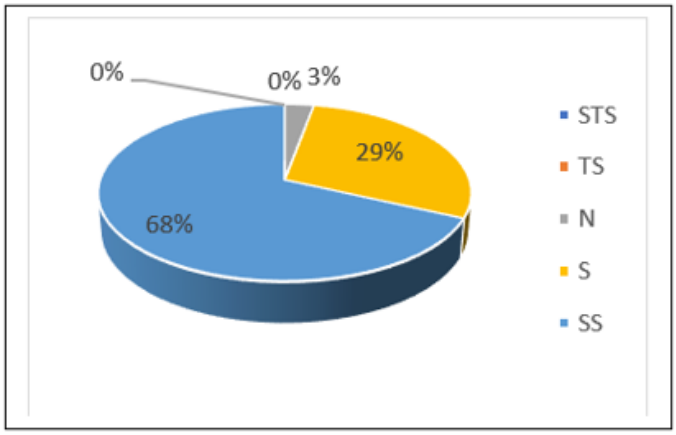
Figure 7. Response to the Benefits of Training Activities



From the data in the pie chart Figure 7, it can be seen that 67% of teachers stated that activities were very useful in learning mathematics, and 30% stated that they were useful. This positive response provides encouragement for teachers to improve their competence in the development of assessment instruments in accordance with the rules of learning evaluation, as well as specifically in the development of minimum competency assessments (AKM) which have become a reference in assessing the quality of education in Indonesia.

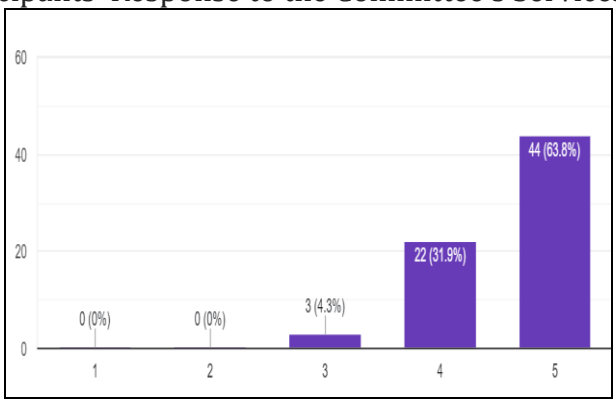
The usefulness of the activity is inseparable from the relevance of the material to the teacher's assignment, the service in the activity, as well as the proficiency of the resource persons in the material presented and the guidance process in the workshop. The opinions of the participants related to the suitability of the training theme with current education, especially in the practice of learning mathematics are as follows.

Figure 8. Suitability of the Seminar Theme with Mathematics Learning Practice



The service of the association committee was also seen as very good by the participants. This was obtained from the results of the participant's opinion questionnaire related to committee services during the training activities as follows.

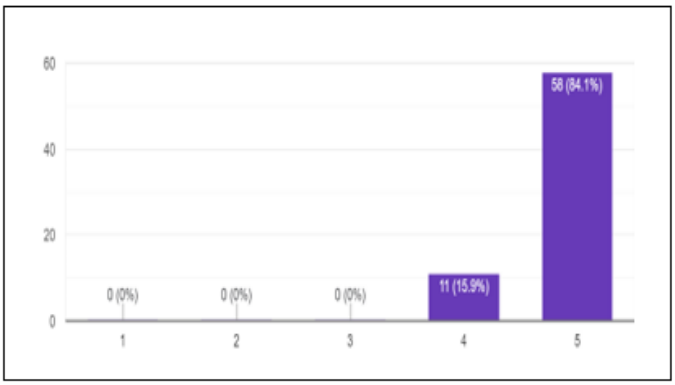
Figure 9. Participants' Response to the Committee's Services in Training



From Figure 9, it can be seen that the committee's services in service activities were well and very well responded to by some participants. The activity committee's good service to the participants will provide a sense of comfort for the participants during the workshop activities, as well as have an impact on the products produced by the participants from the workshop.

Another factor that is very decisive in this training is the competence of the resource persons. In the online seminar, there were four speakers, namely theoretical reinforcement of numeracy literacy, cognitive level analysis, stimulus development in numeracy literacy instruments, and the design of grids and questions in numeracy literacy instruments. In the workshop, the resource persons acted as companions for the participants, as well as a review of the results of the development of numeracy literacy grids and instruments. From these two activities, the participants' opinions about the resource persons were obtained as follows.

Figure 10. Competencies of resource persons



From figure 10, it can be seen that as many as 84% of participants gave very good ratings, and 15.9% rated them good. These results provide information that all resource persons have competencies related to numeracy literacy. The competence of resource persons is fundamental in training.

The Community Service activities that have been carried out aim to help improve teachers' understanding of numeracy literacy, as well as the development of numeracy grids and problems. The results of the activity showed that the participants had been able to develop AKM model grids and instruments. Participants who were divided into 4 groups (Numbers, Algebra, Geometry and Measurement, Statistics and Opportunities) were targeted to be able to complete 3 complete sets of AKM model literacy instruments (grids and instruments). From this target, each group can complete 1 set of instruments, while 2 sets of instruments are completed by each group after the activity. The non-fulfillment of the target of 3 sets of instruments was due to the time of the workshop, only 1 day (8 hours of training). Lack of time in training according to Surur & Kuswandi (2024); Aviyanto, Zumrotun & Muhaimin (2024) are crucial factors needed for assistance in training, there are times when some individuals need longer than others. One of the possible things to do in anticipation of it so that the teacher can complete the training task but not interfere with the main task, the training design can use *the In-On-In model.*

In terms of quality, grids and instruments generally meet the validity of the theory, the ABCD (*Audience, Behaviour, Condition, Degree*) principle in the development of question indicators has been applied, making it easier for participants to prepare the question items. It's just that there are some question indicators in the grid that are still weak in the development *of conditions* or stimulus, so that the stimulus in the form of context in the question is less realistic, or the relevance between the context and the question is still lacking. In fact, the context in the numeracy literacy instrument is a fundamental basis. As defined by numeracy literacy itself, knowledge and skills to (a) use a wide variety of numbers and symbols related to basic mathematics to solve practical problems in various contexts of daily life and (b) analyze the information displayed in various forms (graphs, tables, charts, etc.), and then use the interpretation of the results of the analysis to predict and make decisions (Ministry of Education and Culture, 2017; Kurniawan et al., 2023; Ariyanto et al., 2022) and mathematical literacy according to PISA is defined as an individual's capacity to formulate, use and interpret mathematics in a variety of contexts (Schleicher, 2022). Therefore, strengthening the

understanding of participants (teachers) in the development of stimulus needs to be a concern in training activities for the preparation of AKM instruments.

Results that are not optimal in the development of AKM model instruments that have been implemented in service can be caused by differences in individual competencies of trainees that are not optimally anticipated by the training resource persons. Resource persons need to know in advance the competencies of participants in the training material, so that they can anticipate problems that may arise during assistance in instrument development. This is as expressed by Mariska & Wiryanto (2023) that it is not easy to be a facilitator in teaching numeracy to students, because the characteristics of each student are very different. Therefore, hard work is needed to be able to see the characteristics of each participant, the goal is so that when given numeracy material, participants can follow well, enthusiastically, and understand the material taught.

Good assistance from resource persons will have an impact on the training participants. The direct impact can be seen from the results of the training evaluation given at the end of the activity. From the results of the trainee understanding test in numeracy literacy, it was found that in general it was not satisfactory with an average achievement score of 52.39 out of a scale of 100. However, in training with a short time, it is more important to have motivation for teachers to improve their competence, as obtained (Sukirman et al., 2024) in training to improve game-based *assessment (GBA) development skills obtained with an* average score ranging from 4.59 to 4.85, but there is a desire to further develop the material obtained from the training. Thus, although the training on the Development of the Minimum Competency Assessment Instrument (AKM) of the National Assessment Model for MTs Mathematics Teachers which has been carried out in the form of seminars and workshops has not been able to have a significant impact, the implementation of the activity has provided high motivation to the participants to integrate the numeracy literacy model instruments that they have developed in mathematics learning assessment. As the results of the questionnaire found that most of the participants stated that the training activities for the preparation of the AKM model numeracy literacy instrument are very useful in mathematics learning, so that the encouragement for teachers to improve their competence in the development of assessment instruments in accordance with the rules of learning evaluation, and especially in the development of the Minimum Competency Assessment (AKM) which has become a reference in assessing the quality of education in Indonesia. Therefore, assistance is needed for teachers who have a comprehensive understanding of the understanding and meaning of literacy and numeracy (Wulandari, et al., 2023).

The conduciveness of services in service is a factor that contributes to the success of training activities (Bahctiar, 2021), and the combination model of in-on-in can help teachers update their knowledge, expertise, skills and competencies in the teaching profession (Osamwonyi, 2016), thus giving them enough time and guidance that participants need. Therefore, the model developed in community service is seen as suitable for current conditions.

The above results show that the perception of participants is actually very good in the material they are taught, unfortunately it is not enough to help briefly understand the participants in numeracy literacy. This can be seen from the achievements and increase of participants from the tests given. It is very possible that there are other factors to consider in training. For example, from this sense, it can be seen that a

person's performance or achievement depends on the desire to achieve and the ability of the person concerned to do so (Fatimah et al., 2023).

From the service activities that have been carried out, it provides a new understanding for teachers of the importance of integrating numeracy literacy in mathematics learning. Because literacy skills are very important to be considered and possessed for the future needs of every student (Agustina, Vardani & Dewi, 2024). In addition, the training activity for the development of AKM model instruments provides teacher skills not only in the development of numeracy literacy instruments, but also in the process of preparing mid-semester instruments and end-of-semester exams.

CONCLUSIONS

The results of community service using three stages of activities, seminars, workshops, and trials of workshop products provide an increase in knowledge skills in numeracy literacy, as well as teachers' skills in developing Minimum Competency Assessment (AKM) model instruments. The teacher's response to the implementation of service activities that have been carried out is generally considered very good. The seminars and workshops in the development of AKM model instruments have provided a lot of knowledge and experience in compiling standard instruments, so that not only for the needs of literacy measurement, but also for the needs of teachers in the development of learning outcome instruments. Therefore, it is important for the government (Ministry of Education and Ministry of Religion) or universities in the field of education to provide services for teachers in improving their numeracy understanding skills, and their skills in compiling AKM model instruments, so that they can be integrated into mathematics learning practices.

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