

Three Training Strategies for Improving Mathematics Teacher Competences in Indonesia 2015-2019 based on Teacher Competency Test (TCT) 2012-2014

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Abstract. *In this paper we present three training strategies for improving mathematics teacher competences in Indonesia 2015-2019 based on Teacher Competency Test (TCT) 2012-2014. These three strategies are (1) Basic training, In-On-In, at MGMP with facilitators are instructors from PPPPTK in Mathematics and master teacher at MGMP in every district, (2) Basic training, face to face, at MGMP, and (3) Structured E-Training. The first two training strategies are intended to improve mathematics teacher competency and it must be done face to face at MGMPs. An E-Training is said to be Structured E-Training if equipped with a Hits record for each participant and Hits used strictly for graduation. Hits are defined as the sum total access to the E-Training Systems. Hits consists recording activities; login, logout, access the content, participation in the discussion, and task undertaken by the participants.*

In 2014, PPPPTK in Mathematics has successfully done a Structured E-Training during 21 days for hundreds of mathematics teachers from several islands in Indonesia, including Java, Sumatera, Kalimantan, Sulawesi, Papua, Bali and West Nusa Tenggara. We note that most of participants come from rural areas, mostly have high enthusiasm and fanaticism to participate, have their own initiative, and about 73 percents pass the E-Training. Hits were used strictly for graduation with the assessment formula: 35% of authentic assessment, 50% of judging assignments, and 15% of post-test, and if a participant in 5 consecutive days or accumulative 7 days does not logged in to the learning system then he or she will be considered fail.

1. Background

Indonesian diplomacy is established in order to serve the national interest; Indonesia continues its commitment to identity formation and strengthening of international and regional integration; and encourage international cooperation, inter-regional and bilateral, inter-group, and among institutions in various fields especially in the field of Education. Generally Indonesian Government has a Medium Term Development Plan Policy mentioned in the Law No. 17/ 2007 [1]. For more detailed and systematic, Indonesian Government Development Plan Policy 2005-2024 is given in Figure 1.1. Its is mentioned that the 3rd Development Plan (2015-2019) aims to consolidate the overall development in various fields by emphasizing the achievement of economic competitiveness on the basis of the competitiveness of natural resources and qualified human resources and the ability to improve science and technology continually. In addition, the 4th Development Plan (2020-2025) aimed at establishing an independent Indonesian society, progressive, just, and prosperous through the acceleration of development in various fields built on a solid economic structure based on competitive advantages in various fields supported by qualified and competitive human resources.

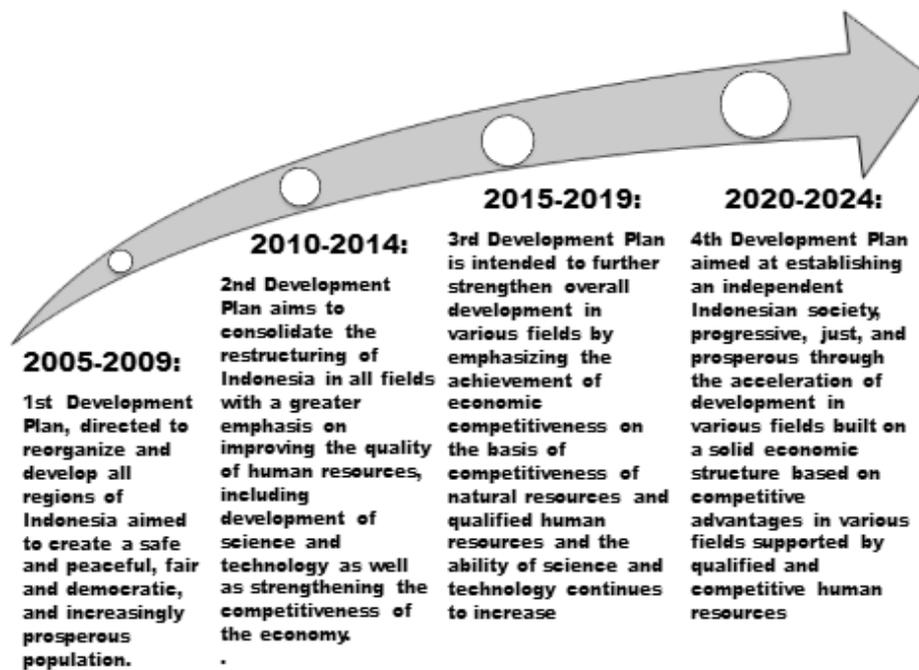


Figure 1.1. Indonesian Government Development Plan Policy 2005-2024.

Meanwhile, in the period of 2015-2019 Indonesia Development Plan in Education concentrates in the regional competitiveness [2].

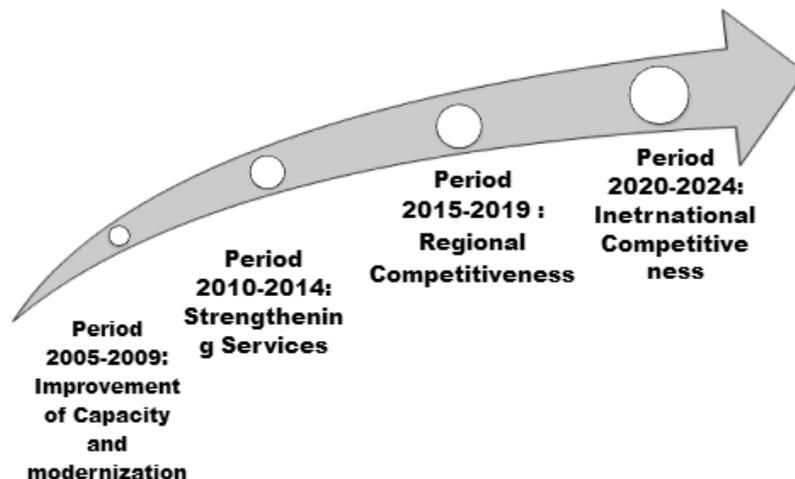


Figure 1.2. Indonesian Government Development Plan in Education 2015-2019.

Therefore Ministry of Education and Culture of Indonesia starting from 2015 has to prepare teachers to compete in regional as well as international level. In the long-term development plan 2005-2024, Ministry of National Education used four strategic themes of education development, namely: (1) increase in capacity and modernization, (2) strengthening the services, (3) regional competitiveness, (4) international competitiveness. Each strategic theme of long-term educational development above, will be deployed in the work program of the Ministry in accordance with medium-term development policy that emphasizes the 3 main challenges, namely: (1) equity and

accessibility; (2) improving the quality, relevance and competitiveness; and (3) improvement of governance, accountability and public image. One of the elements in the declaration of the national education vision 2025 is competitiveness on global level. Therefore, the development period in 2015-2020 focused on the quality of education that has regional competitiveness in the ASEAN level first. Sustainable quality standards during this period are expected to be relevant to the ASEAN regional market. Those standards should be based on objective and realistic. The work program based on the understanding of the development needs of the regional market becomes a very important factor in achieving the desired competitiveness. Failure in creating high quality of education in accordance with the needs or who do not have the competitive edge will only create the new unemployment figures. Management education programs through standardization, quality assurance, accreditation and education unit or program that has been started earlier will be focused in this period. Those are done without compromising previous programs related to the ease of access to education and public accountability in its implementation. Development goals that underlie strategic policy in this period include the form and operation of the service system with a standard level of ASEAN, which has been cross-MONE image of ASEAN countries, cooperation between ASEAN countries, especially in the field of education that are more stable, and other things relevant. Indonesian human hopes that at the end of this period could become the social center of gravity of ASEAN as a sociocultural entity [10].

2. Quality of Mathematics Teachers in Indonesia Based on Teacher Competency Test (TCT) or UKG (*Uji Kompetensi Guru*) 2012-2014

Based on NUPTK (unique identification number for teacher) data, the total numbers of Indonesian Mathematics Teacher in Junior High School, Senior High School, Vocational High School is 112.965.

Table 2.1. The total numbers of Indonesian Mathematics Teacher in Junior High School (JHS), Senior High School (SHS), Vocational High School (VHS).

No.	School level	Number
1	SHS	25.311
2	VHS	19.121
3	JHS	68.533
Total		112.965

Teacher standard competencies of Indonesian teachers. Since education reform in Indonesia, there are two significant legal foundation regarding teacher: Law No. 20/2003 on National Education System [3], and Law No. 14/2005 on Teacher and Lecturer [4]. Both of laws mandate a number of essential competencies required by teachers. The teacher law has placed such an emphasis on improving teaching competency. Teaching competency is defined as a set of knowledge, skills, and behaviors a teacher or lecturer must have. A Teacher must fully comprehend and master the competency to perform his/her professional task. The explanatory note to the Teacher and Lecturer Law, and generated by Regulation of Minister of National Education No. 16/2007 about Teacher Academic Qualification and Competency Standard [5] describes some detail of the four key competencies required from teachers. Four key competencies are as follows.

- a. *Professional competence*; This is the wide and comprehensive mastery of the subject to be taught to students using appropriate instructional methodology and learning strategy
- b. *Pedagogical competence*. This is teaching competency that involves: Understanding students; Designing and implementing learning methods; Evaluating study results; Developing professionalism

- c. *Personal competence*. This is the strength of teacher personality as a mature and outstanding person who sets model to be followed by students. Personal competency involves the following aspects: Having adult personality and character of worthy of imitation; Having leadership qualities and ability to nurture each individual student.
- d. *Social competence*. This is the ability of the teacher as part of a social group to communicate effectively and efficiently with students, fellow teachers, students' parents/guardian, and the nearby community. The competency involves the following aspects:
- Displaying good behavior with enlightened attitude and interesting personality in social intercourse at school and in the community
 - Having the ability to respect and appreciate the feeling of others, particularly students with their respective strength and weaknesses;
 - Having good moral values in accordance with his/her religion.

Based on this standard, we may judge the quality of a mathematics teacher. Mathematics teacher who acquires and implements more of the four indicators of mathematics teacher standard is considered as a more qualified teacher. Ministry of Education and Culture of Indonesia has done Teacher Competency Test (TCT) or in Indonesia called UKG (Uji Kompetensi Guru) 2012-2014. There were 52.178 mathematics teachers attended TCT in 2012, 18.056 mathematics teachers attended in 2013, and 6.647 mathematics teachers attended in 2014. All together there were 76.881 mathematics teachers attended TCT during the years 2012-2014 (see [10]). In TCT for mathematics teacher, we only measure *Professional competence* and *Pedagogical competence* consists of 100 items of mutiple choice problems. We do not measure *Personal competence* and *Social competence*. TCT has done by *online* and *semi-online* in 273 districts (*Kabupaten/ Kota*).

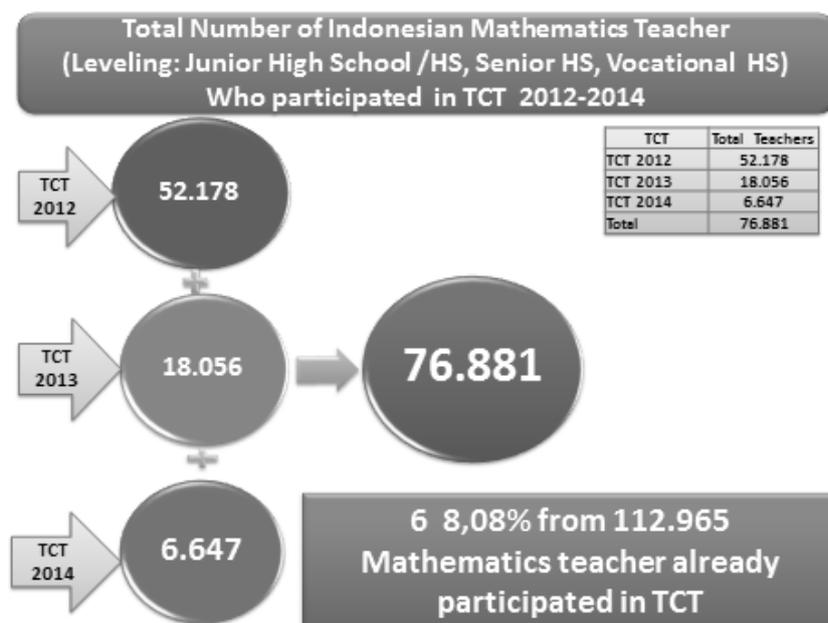


Figure 2.1. Mathematics teachers participation in TCT

After finishing the TCT, we have the following Mathematics Teachers Distribution for every province In Indonesia Based On TCT 2012-2014.

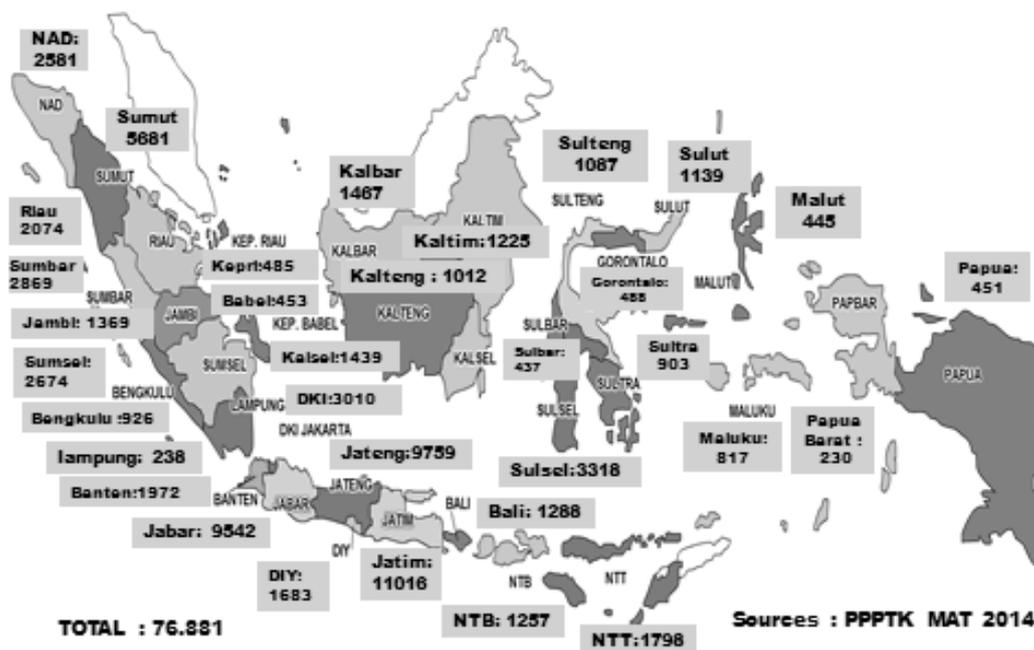


Figure 2.2. Mathematics Teachers Distribution for every province in Indonesia Based On TCT 2012-2014.

We also have the following statistics distribution of TCT scores of the Indonesian Mathematics Teachers 2012-2014 (See Figure 2.3 and Table 2.2).

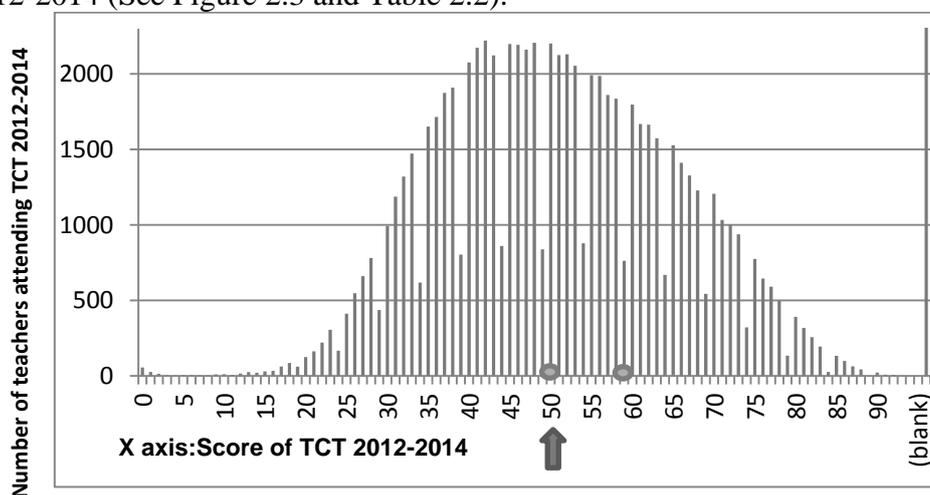


Figure 2.3. Distribution of TCT scores of the Indonesian Mathematics Teachers 2012-2014.

Table 2.2. TCT Score Distribution

Mean of TCT Score	50.86
Maximum Score	96.25
Minimum Score	00.00
Number of Teacher	76.881

3. Three Training Strategies for Improving Teacher Competences based on Teacher Competency Test (TCT) or *UKG (Uji Kompetensi Guru) 2012-2014*

Problems: What is best trainings that must be conducted to improve the competency of 76.881 mathematics teachers who has been doing TCT 2012-2014? Here, best training means a training that effectively increase teacher’s competences, and efficiently from the budget point of view. Usually face to face training is effective but not efficient. On the other hand, E-training is efficient but usually not as effective as face to face training. For simplification, then we make three categories of the TCT Score 2012-2014:

Table 3.1. Three categories of the TCT Score 2012-2014.

No	Categories	Total Teachers
1.	Cat I / Category I : TCT Score < 50	36.923
2.	Cat II / Category II : $50 \leq$ TCT Score < 60	17.829
3.	Cat III/ Category III : TCT Score \geq 60	22.129
Total Teachers		76.881

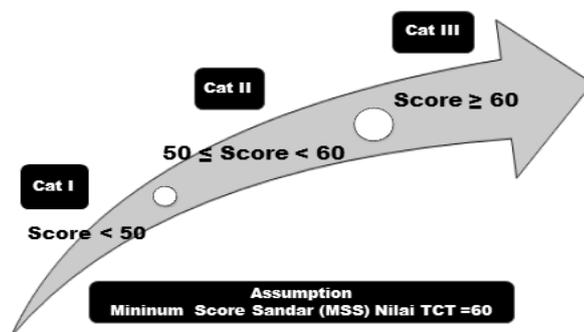


Figure 3.1. Three categories of the TCT Score 2012-2014.

Based on these three categories above then we make the following scheme:

Three Training Strategies 2015-2019 based on TCT 2012-2014

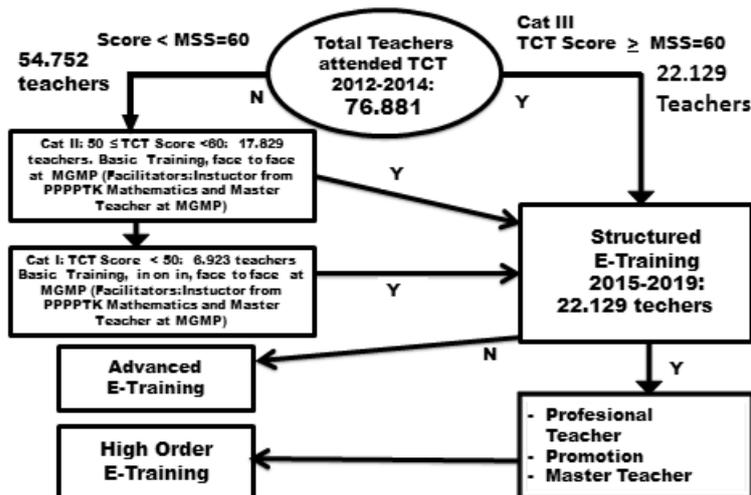


Figure 3.2. The training strategies 2015-2019 based on TCT 2012-2014

MGMP (*Musyawah Guru Mata Pelajaran*) is a Discussion Group of Subject Teachers in Every District in Indonesia. Usually MGMP Mathematics contains of more or less 20-60 mathematics teachers. In Indonesia there are 34 provinces and 473 districts. From the scheme above, in the next five years (2015-2019) PPPPTK in Mathematics are going to carry out the following three Training Strategies for Improving Mathematics Teacher Competences based on Teacher Competency Test (TCT) or UKG (*Uji Kompetensi Guru*) 2012-2014:

1. Basic Training, IN-ON-IN, at MGMP with the Facilitators are Instructor from PPPPTK in Mathematics and Master Teacher at MGMP (*Musyawah Guru Mata Pelajaran*) in every district (*Kabupaten/ Kota*)
2. Basic training, face-to-face, at MGMP with the Facilitators are Instructor from PPPPTK in Mathematics and Master Teacher at MGMP in every district
3. Structured E-Training for Improving the Competences of Mathematics Teachers in Indonesia.

The first two training strategies are intended to improve mathematics teacher competency and it must be done face to face at MGMPs in every district, with facilitators are Instructor from PPPPTK in Mathematics and Master Teacher at MGMPs. Master teachers at MGMPs can be teacher core or outstanding teachers from the local district. In this training the participants do not have to stay, except that the distance to the place of training (MGMPs) too far. If at any MGMPs number of teachers who qualify as participants of the training a bit, it is possible execution combined with teachers from other nearby MGMPs.

Next, we are ready to present Best Practices of Structured E-Training for Improving the Competences of Mathematics Teachers that has been done in PPPPTK in Mathematics in 2014.

4. Structured E-Training for Improving the Competences of Mathematics Teachers in Indonesia 2015-2019 with Best Practices in 2014

Definition of Structured E-Training: Speaking about E-Training can not be separated from E-Learning, and are sometimes used to refer to the same concept. The basic idea of both the e-training and e-learning is to deliver knowledge. However, In E-Training, the knowledge are intended more to the knowledge that related to work requirements. The definition of the term e-learning itself is quite diverse. One of the definitions of e-learning is quite common to mention that E-learning, or 'technology enhanced learning' describes the use of technology to support and enhance learning practice[6]. Meanwhile, E-training can best be defined as using some form of technology to deliver training and other educational materials [7], [8], [9],[11]. **In my opinion, an E-Training is said to be Structured E-Training** if equipped with a Hits record for each participant and Hits used strictly for graduation. Here, Hits are defined as the sum total access to the E-Training Systems. Hits consists of files recording the login, logout, read the content, active in the discussion, a task undertaken by the participants, and other online activities. In our best practices, Hits are used strictly for graduation, such as E-Training for 21 days with the assessment formula consist of some aspects: 35% of authentic assessment (as seen from the liveliness of the discussion), 50% of judging assignments, and 15% of post-test, and if 5 consecutive days are not logged in or not logged in accumulation of 7 days, will be immediately considered fail. Authentic assessment taken from the frequency of login, logout, read the content, active in the discussion.

Architecture of E-Training: The architecture of E-Training PPPPTK in Mathematics 2014 is given by the following scheme.

Implementation: This E-Training is guided by 6 facilitators from PPPPTK in Mathematics and 10 technical and administrative personnel/officers. The facilitators are responsible for matters related to academic activities of training; the pre test and post test items, preparing and uploading the learning materials, preparing discussion topics, monitoring and guiding the discussion, setting up and uploading assignments, assessment activities and tasks, as well as academic coaching to participants. Technical personnel responsible for the administration matter, monitoring the activities of the participants and the facilitators, and helping and guiding participants in the case of technical problems. Each officer handles 10 participants.

Participants: Training participants are selected based on the recruitment process conducted openly broadcasted over the web with the provisions and requirements of applicants as follows: Junior high school mathematics teacher, Permitted by the school superiors, Compose and assign commitment letter to attend training, Attach a work or learning media ever made.

Registrants: Registrants who enroll will be selected based on completeness and quality of the products. Applicants who meet the criteria would be declared eligible for the training and then would be sent complete online training guide via email.



Figure 4.2. Registration process.

In this best practice of the Structured E-training, there were 112 participants consisting of Junior High School Mathematics Teachers, with the following distributions.

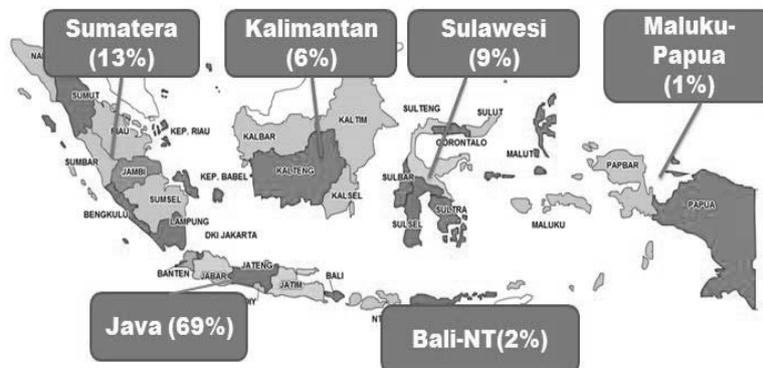


Figure 4.3. Geographic distribution of the participants.

Age and sex distribution of the participants is shown in Figure 4.4 and Figure 4.5.

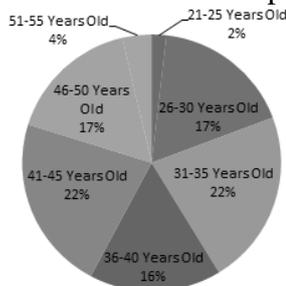


Figure 4.4. Age distribution of the participants.

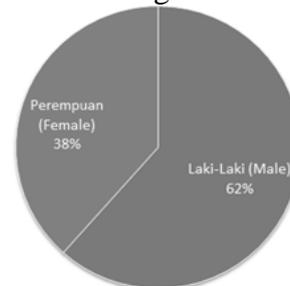


Figure 4.5. Sex distribution of the participants.

Learning Process: Learning activity of the E-Training is shown by the following scheme.

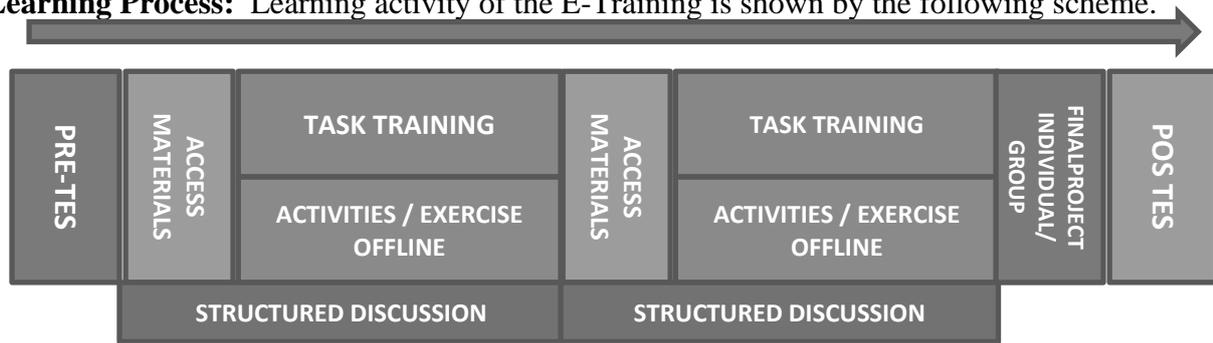


Figure 4.6. Learning activity scheme of the E-Training.

The participants, in training activities should do the several process, including: Pre-test, • Access to materials (modules/handouts, media, videos), Working on task/assignments (individual/group) and offline activities, participate in the forum discussions (both in class discussions and group discussions), work on final project, and post test.



Figure 4.7. Home page of the E-Training 2014.

Learning material is presented in text format and multimedia/video. The materials can be accessed online or downloaded for offline study. The materials aired as scheduled and participants are expected to access the materials in accordance with the schedule.



Figure 4.8. Learning materials are presented in text format and multimedia/videos.

Besides reading the material in the text and listen to the video, other activities that should be done is conducting a structured discussion. The facilitator prepared several discussion topics that are expected to be an inducement or stimulant to make the discussion interactive. The discussion topics are also designed to gain better understanding related to the subject. Discussion forums are asynchronous so that it can be done in a time flexible manner. Participants can respond to a topic that was brought up by the facilitators and post new topics that they think deserves to be highlighted. Other activities to be undertaken by participants were the assignment. Facilitator defined the tasks should be done by the participants. Assignment was adjusted to the type of task training and competence desired. Some of the tasks include observing a learning process videos, creating effective questions, reviewing lesson plans, writing articles on a blog, creating a screencast video, creating project-based product, and so on. As the final part of the training was held the final test/post-test that should be done in the duration of 1 hour. The final test was in the form of multiple-choice and short description. All participants of the training activity is recorded and monitored intensively. Participants were enthusiastic with the implementation of online training. It was evident by the presence of a high enough participants, the activities in the discussion and the completion of the task. The total log of participants is shown by the following graph:

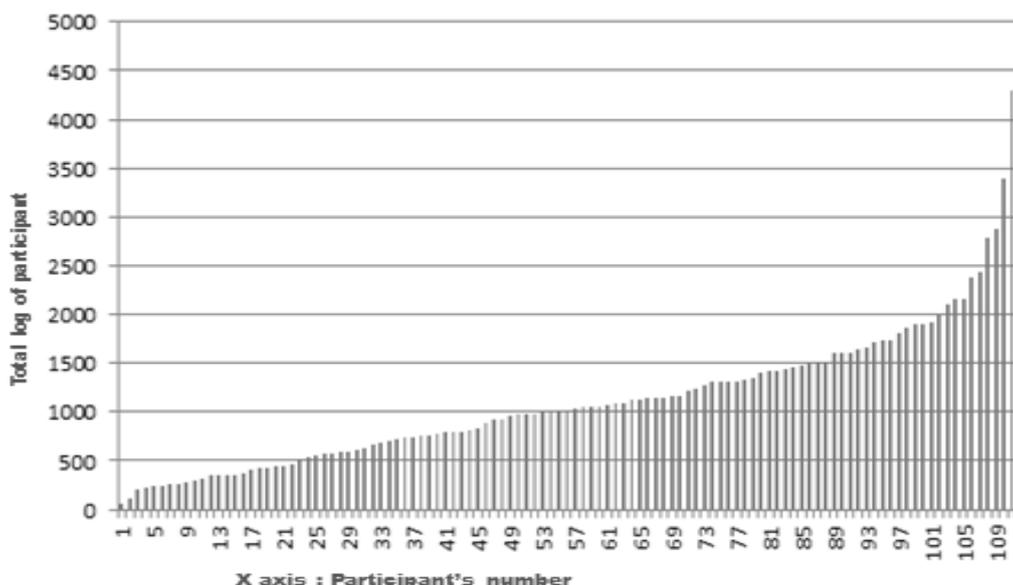


Figure 4.9. The total log of participants during training process.

This graph shows the distribution of the log of all participants. Calculations were performed by the system automatically. The number of hits is calculated from the activities of the participants either log in, open content, open discussion forums, ask questions discussions, respond to discussions, submit assignments, or others. Activity outside the online is not recorded here (e.g. reading modules that have been downloaded or offline tasks). Recorded log total participants are as follows:

Table 4.2. Total and average participant's log

Total number of log	127.118 hits
Total of the average log per day	6.053,23 hits
Average log per participant	1134,98 hits
Average log per participants per day	54,04 hits

Based on the data it can be shown that on average each participant access the online training system about 54 times each day. Another activity which is quite interesting from the online training is the discussion in online forums. The discussion is conducted in a flexible manner while still adjusting the time schedule. That is, every day of the scheduled particular material is being studied, however participants have the flexibility of time to access or participate in the discussion forums (within 24 hours). In one subject training can consist of more than one topic (thread) and one topic of discussion may consist of hundreds of responses. The next illustration is an example of one of the topics of discussion along with responses. Online activities of participants in the discussion are automatically recorded by the system including adding new topic/question or responding to an existing discussion.

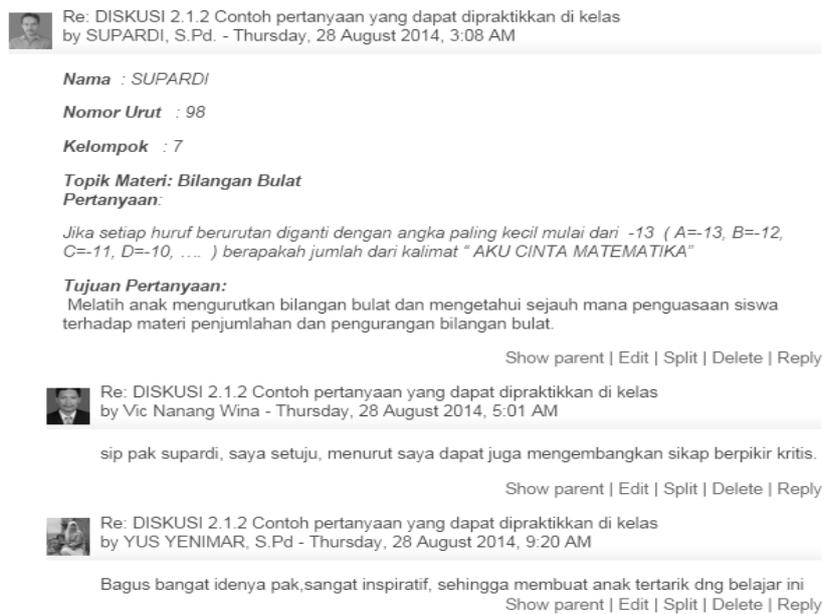


Figure 4.10. Screenshot of a discussion thread.

The graphics of messages discussion activity during training process is shown in Figure 4.11.

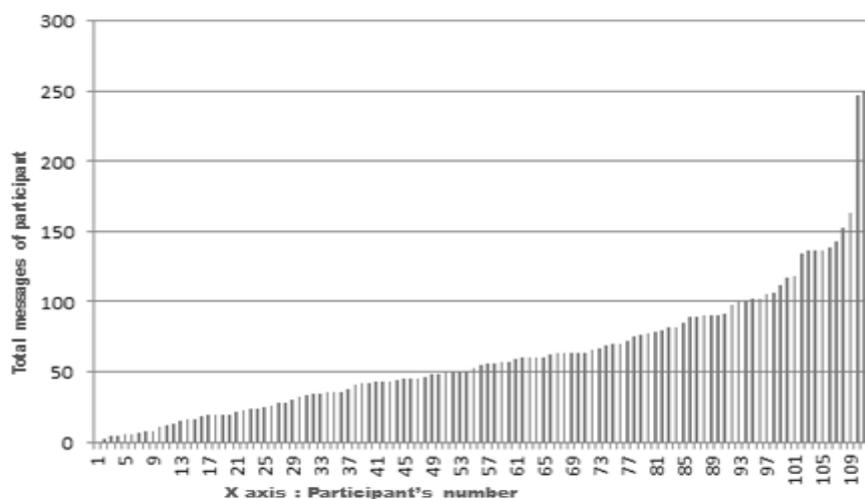


Figure 4.11. Number of messages in online discussion by participants.

Recorded data showing discussion forum activities are as shown in Table 4.3.

Table 4.3. Number of messages in discussion forums

Total Number of Messages	7.066 Messages
Average Messages Per Participant	63 Messages

Based on these data it can be seen that the average activity of the discussions during the training (either post a new discussion topic or respond to an existing discussion) was about 63 messages each participant.

Assessment: An assessment is consist of some aspects. 35% of authentic assessment (as seen from the liveliness of the discussion), 50% of judging assignments, and 15% of post-test. Participants are considered pass the training if the final value of at least 61 (on a scale of 100). In addition, there are special requirements, that the presence of participants must meet the minimum requirements, namely 66.66%. If the presence below the minimum limit for reasons that are unreasonable, the participant shall be considered fail even though its value is more than 60. In addition, if a participant did not access the system in 5 consecutive days or 7 accumulative days, then the participant will also be declared fail.

Results: The average value of the pre-test (on a scale of 100) is 53.68 and the average value of post-tes is 73.99 or the score is increased 20,31. In the end of training, the number of participants that passed the training is 82 participants, or about 73% of the 112 participants.

Feedbacks: For gaining the participant’s view to the training we conducted an online survey where each participant can give their rating score and his/her opinions about E-Training.

The participant’s perception of the content and delivery for each session is shown in Table 4.4.

Table 4.4. Participant’s rating scores of the content and delivery for each session.

SESSION	SCORE (SCALE 100)
Session 1: Curriculum 2013 And ELPSA	87,11
Session 2: Questioning	93,33
Session 3: Rich Mathematics Problems	91,33
Supporting Session (ICT)	92,44

The result of the satisfaction survey is shown in Figure 4.12.

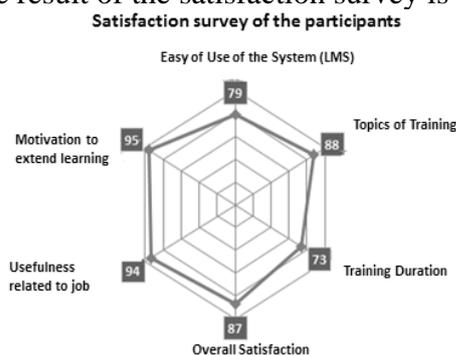
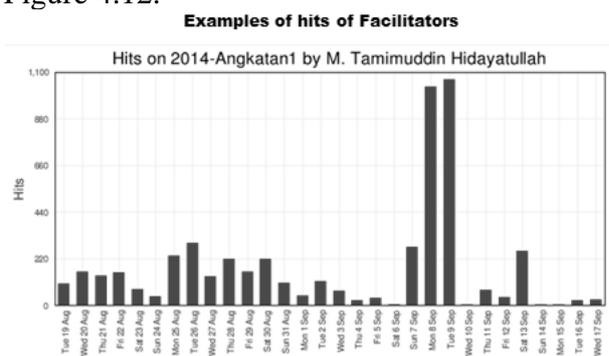


Figure 4.12. Satisfaction survey result.



M. Tamimuddin H, instructor of PPPPTK in Mathematics. Eventhough duration of E-Training is only 21 days, but he actives for 26 days, since sometimes he works on weekend. Total Hits is 4.553 consisting of 4.468 total log and 85 Total Posting Forum.

Figure 4.13. Example of hits of a facilitator.

Some examples of the recording hits of a facilitator and participants are shown in Figure 4.13 and Figure 4.14.

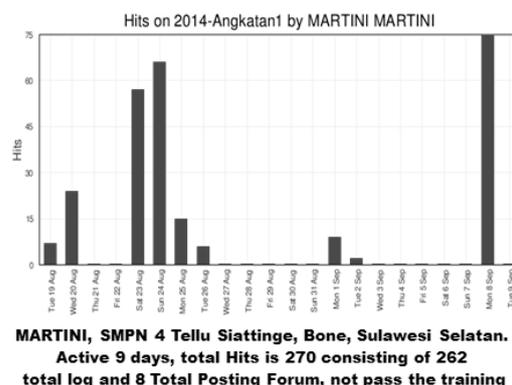
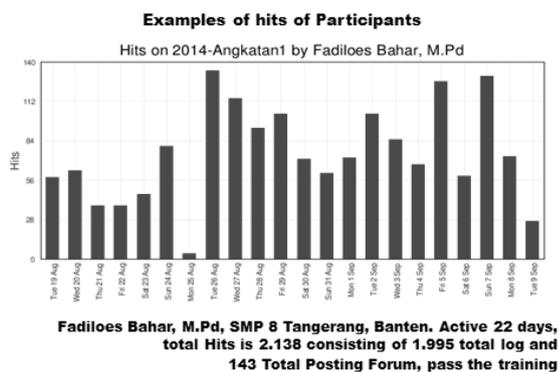


Figure 4.14. Examples of hits of participants.

In the following paragraphs we hereby show the chart of hits of technical personnel during the implementation of E-Training. The graph is taken per day and displayed on a graph with the X axis is the number of the access and the Y axis is the time of access.

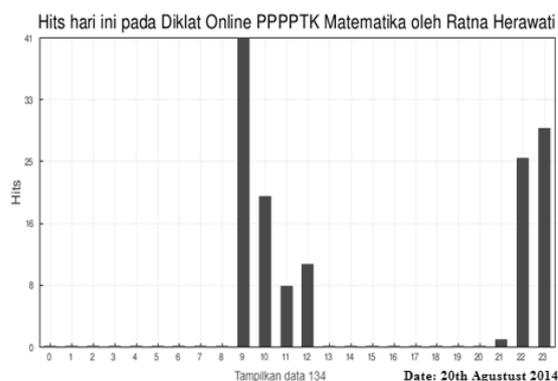
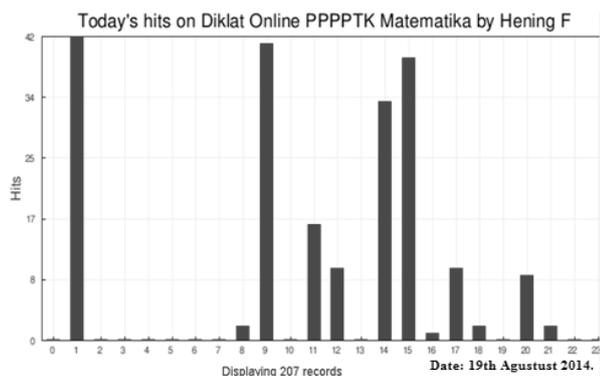


Figure 4.15. Examples of hits of technical officers.

In addition, most participants give positive feedbacks regarding to the training. Here are some of the written comments from the participants:

Very useful and better when compared to face-to-face (training) because participants have to fully intend to study independently. Competence of teachers will be developed by following this training because the materials are very supportive for teaching and learning in schools. Through this online training it will increase teachers' knowledge in effective questioning. In addition, teachers will be ICT literated and was very supportive in the implementation of the curriculum 2013 (Ahmad Zaini, SMP 11 Banjarbaru, Kalimantan Selatan).

Very amazing, for 30 years teaching math this training might be the best that gives a lasting impression for me even though I only do it in the virtual world (Fadiloes Bahar, S.Pd, SMP 8 Tangerang, Banten).

Very helpful as a teacher of mathematics who want professional, and many gave their repertoire of knowledge that previously have not been obtained in the educational and training that I have followed. I learned many things, for example about effective questioning techniques to students,

who turned out the types of questions I've asked so far it has not been effective, so in the event the E-Training here I understand how important effective questioning techniques to gain knowledge about their initial material that will be taught. (Sri Susilawati, S.Pd, M.Pd, SMP N 1 Peudawa Aceh Timur, NAD)

Overall, learning from our practices, the Structured E-Training has shown that technology can be embraced to improve the teachers' competencies. Most of the participants give positive feedbacks and found several benefits from the E-Training. Our practices also shown that the structured E-Training is feasible and have huge potentials to be developed and implemented in wider scale areas.

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