TÜRK FEN EĞİTİMİ DERGİSİ
Yıl 15, Özel Sayı, Aralık 2018

Journal of
TURKISH SCIENCE EDUCATION
Volume 15, Special Issue, December 2018

http://www.tused.org

The INNOMATTS: A Model of Mathematics Teacher Training Management

Mohammad ASIKIN[1], Iwan JUNAEDI[1], Adi Nur CAHYONO[1]

[1] Department of Mathematics, Faculty of Mathematics and Science, Semarang State University, Indonesia

Received: 20.06.2018 **Revised:** 20.09.18 **Accepted:** 15.12.2018

The original language of article is English (v.15, n. Special Issue, December 2018, pp.76-86, doi: 10.12973/tused.10259a)

ABSTRACT

The purpose of this paper is to analyze the impact of the INNOMATTS (Innovative Mathematics Teaching Study) Model on content knowledge and impact on pedagogical content knowledge related to the role of teacher. The research design is an adaptation of research and development research design. Data and information were obtained from Semarang Junior High School (JHS) Mathematics Teachers as trainees. Used data collection tool is questionnaire and test. The data were analyzed descriptively narrative and quantitative calculation. The results of the study and discussion are as follows: (i) In relation to the perception, only 27% of the teachers who think that the government training programs that have been followed so far there is a post-training follow-up program; 60% of the teachers found that they only participated in training if there were programs from the government; (ii) The effectiveness of the overall training model from before to after the model implementation of teacher competence has increased. the magnitude of the normalized average gain effectiveness before and after the model implementation is 0.62 (62%) in the moderate category; while the average effectiveness of the overall model characteristic is 75.35 is included in either category. Taking into account the effectiveness of the empirical model of both process and product as a whole, the overall effectiveness of pretest and posttest, as well as the results of the RPP assessment and its implementation, it can be concluded that the implementation of the model contributes to the improvement of professional competence of JHS Mathematics teachers in Semarang City.

Keywords: INNOMATTS, mathematics teacher professional competencies, professional development model, training model

INTRODUCTION

Many factors determine the quality of education. However, the quality of education is still in bounded with teachers' determination which identified by direct interactions from teachers straight to learners. Teachers who are in control of learning, determine the achievement direction of indicators and learning objectives. Good and superior education is highly dependent on quality, professionalism, performance and competence of the teacher. To produce qualified learners, require qualified teachers who have competence and high

dedication in carrying out their professional duties (Kunandar, 2007: 40). Podhorsky and Moore (2006) argued that educational reform should be interpreted as an effort to create programs that focus on improving teaching and learning practices rather than focusing solely on classroom design with teacher proof curriculum. Learning practices can only be changed through testing the teachers' ways in packing and carrying out learning. Therefore, coaching program of teacher profession is necessary. The teacher competence has been taken by the government in various ways. These efforts include education and training (in service training). However, the government's efforts to improve teacher competence through training do not give a significant impact on improving the quality of learning (Hendayana, (2007). There are two reasons why the training for teachers has not had an impact on improving the quality of learning: (a) the training is not based on real issues in the classroom, for example the same training materials are delivered to all educators without knowing their background (b) the training is only theoretical which is not able to be applied in the classroom learning (Hendayana, 2007). According to Suparlan (2006) and also Lie (2010), there is a little evidence of the impact of the teacher training on the quality of learning. In addition, the activities for teacher professions such as training, workshops, and seminars actually causes problems in schools because teachers leave their main task, namely teaching.

According to Burns (2011) professional development should refer to five things that have been known to help the development of good teaching: content, instruction, pedagogical content knowledge, knowledge of learning and development, and efficacy. Whereas effective development of professionals according to Burns (2011) should meet the followings: (i) implemented over a long period of time, (ii) sequential, (iii) differentiated based on teacher needs and reality, (iv) providing opportunities for teachers to see (v) help teachers plan and design their application in the classroom, (vi) provide practice and reciprocity to teachers, and (vii) have opportunities for revision. Other views related to professional development of teachers are given by the Asia Society (2010) through stating that a strong professional development system can be realized only in educational systems that do the following: (i) evaluating teachers on indicators providing formative feedback useful in improving teaching and on some indicators for overall performance evaluation, (ii) stimulating teachers in designing curricula, teaching, and assessment to align and strengthening teachers' understanding of how to achieve agreed standards. Bhawan (NCTE, 2009) argues that in every effort to strengthen the professional practice of teachers, every teacher should be viewed and respected as a professional. Including the training content and approaches, how the trainings are announced and how they are implemented. Professional teacher development programs should build and strengthen the identity of teachers as professional teachers and also establish and maintain relationships with the academic discipline of their interests in many cases.

To strengthen the professional practice of teachers, there should be a training model for mathematics teachers which contains solution for existing problems, innovation, independence, and sustainability characteristic in teacher training programs. The solution providing the characteristic implies that the training objectives should be based on finding solutions to the problems factually faced by the teacher and in the form of a bottom-up training model in addition to the needs and real problems of the math teacher in the field. So, the training can be a solution to teacher problems. The innovation characteristic of the training model refers to Patel's opinion (2011) that innovation in teaching mathematics can be diversified in terms of methods, pedagogic resources, and mastery of learning strategies. This suggests that innovative training models need to pay attention to innovations in mathematics learning including teachers' efforts to achieve learning mastery, applied methods and learning strategies and use of pedagogic resources such as developing a learning media, building classroom activities based on student activity and developing good teaching materials

according to curriculum demands. While the independence characteristic means that training activities do not only rely on the existence of training programs from the government, but training activities can be initiated by a group of teachers in a particular region or teachers of mathematics subjects that are collected in an educational foundation as well. The training model should also have the sustainability characteristic which means that there is further assistance both in group and in individual after the training, as well as further training programs.

INNOMATTS Training Management: A Conceptual Framework

According to Yayat (2007) the theoretical cycle of training management is "Systematic Training Approach". This approach is related to the procedure of managing the training, which begins with the existing problems that may interfere the achievement of the expected objectives, up to the evaluation and follow-up in accordance with the problem-solving efforts through training. General and hierarchical training management procedures contains ten steps: Step 1: Identifying and Analysing Training Needs, Step 2: Testing and Analysing Positions and Duties, Step 3: Classifying and Determining Training Participants, Step 4: Defining Training Objectives, Step 5: Designing the Curriculum and Training Syllabus, Step 6: Planning Training Program, Step 7: Preparation and Development of Terms of Reference (TOR), Step 8: Implementing the Training Program, Step 9: Evaluating Training Program, and Step 10: Follow Up Training. The quality of the training depends on the management of the training such as on the accuracy of selecting the training materials, the quality of the resource, the training method and the evaluation. An analysis of training needs as a stage in the preparation of programs related to the types, procedures, models and training techniques needs to be done in training management. The procedure begins on analysing existing tasks/functions and requirements to fulfil the functionality qualifications. After that, it continues with looking for a solution of training type including a material to be presented and appropriate training methods to meet the required qualification types related to the expertise's skills and areas. At the end of the training, it should be evaluated to determine the effectiveness of changing or improving the behaviour of trainees in an effort to improve performances.

Russell in Sulistiyani & Rosidah (2003) explained that training stages include: 1) need assessment, which aims to gather information to determine whether training programs are needed or not, 2) development of training programs, which aims to plan the training environment and training methods needed to achieve the training objectives, 3) the evaluation of the training program, which aims to assess whether the training has achieved the expected objectives. The stages of the training program are designed carefully according to the needs. The benefits of training-need analysis are as the basis for formulating training programs. Goldstein and Ford (2002: 327-328) proposed the model of training-process cycle as shown in Figure 1. According to Davies (in Rosidah, 2003) training management is closely related to the activity trident, i.e. (a) planning, (b) implementation, and (c) evaluation. Depending on the used approach, three components can be developed into several activity steps. The training management procedures in the INNOMATTS (Innovative Mathematics Teaching Study) model are:

- Identify and analyze the needs of Junior High School (JHS) / Sekolah Menengah Pertama (SMP) mathematics teachers in an effort to improve their competence
- Analyzing various competency views of the mathematics teachers and their tasks
- Classify the requirements of trainees and assign trainees
- Formulate training objectives (stated in INNOMATTS implementation manual)

- Design a training syllabus (included in the INNOMATTS implementation manual)
- Plan the training program according to the flow and mechanism set out in the manual
- Compiling the Terms of Reference Training (stated in the guidebook)
- Implement INNOMATTS model training program
- Evaluate the implementation of each activity at each level and a thorough evaluation of the implementation of the INNOMATTS model
- Provide follow-up activities of training results

The first step is assessment and analysis of training needs in managing the training program. As a result of various changes these training needs can be categorized into two types such as current needs and future training needs,. On the other hand, this step is added by the identification of the resources available to enable the problem to be solved.

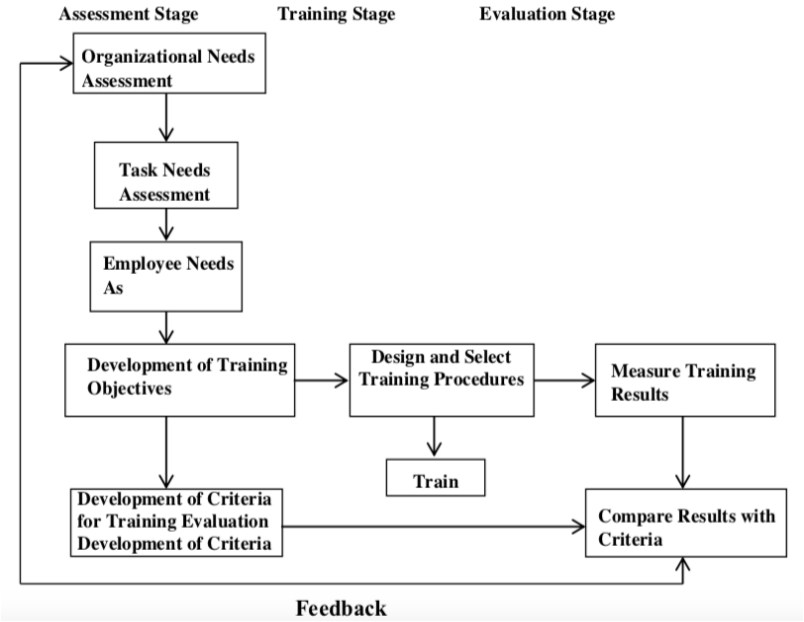

***Figure 1**. Model of the training process (Goldstein dan Ford, 2002)*

Referring to the various description above then developed a model of training for Math teachers called INNOMATTS model. One of the theoretical underpinnings of model development is Burn Theory (2011) on the importance of a teacher training model for the development of qualified professionals. Burns (2011) provides the following characteristics of high-quality professional development of teachers: (1) developing a competency base that focuses on helping teachers develop knowledge, skills, attitudes, and dispositions to improve teaching, (2) basing on the understanding of teacher needs and work environment (3) focusing on the teacher's content and pedagogical skills, (4) appropriately modelling the behaviour of teachers in the classroom and including opportunities for practice, research, and reflection, (5) integrating in the workplace of educators during and ongoing schooling over time, (6) basing on a sense of collaboration and collaboration among teachers as well as between teachers and principals to solve important problems related to teaching and learning, (7) building a professional learning community (the technical and social support provided by this community can help to overcome stagnation and help teachers make complex changes). In addition to providing characteristics to enable professional development of qualified teachers, Burns (2011) also provides indicators for effective professional development: (i) implemented over a long period, (ii) sequential, (iii) differentiated based on teacher needs, (v) to help teachers plan and design their application in the classroom, (vi) provide training and reciprocity to teachers, and (vii) have opportunities for revision. In addition to referring to

Burn (2011) theory, several professional-teacher-development models that also inspire and provide a theoretical basis in developing INNOMATTS models are: (1) Reflection Connection Cycle model (Taylor, 2011), (2) Problem Solving Cycle model (Jacobs, 2007), (3) model of Rogers (2007), (4) Teacher Professional Development model (Hooker, 2011), (5) Lesson Study model (Lewis et al, 2003, 2004) and (6) Based Training (Pattanida, 2004).

According to Rogers (2007), mathematics teachers need time to implement learning changes in their classes and critically reflect changes that occur in student learning. This process also requires the support of mathematics learning experts in the area who participate in providing input. Finally, if the change in inclass treatment brings a positive or negative impact on student learning outcomes, then changes in teacher beliefs and attitudes will also occur. The cicular model is compatible with the PSC (Problem Solving Cycle) model of Jacobs. Jacobs (2007) who said the mathematical-profession-development model needed to be carried out repeatedly with a long-term approach to support teacher learning/training. One iteration of the PSC consists of three interrelated workshops where teachers share their pedagogy and mathematics experience. The PSC model is designed to be implemented by a facilitator. Facilitators can come from more knowledgeable teachers, math trainers, department directors, education specialists, or other teacher educators. In the model, group meetings in clusters are in line with the RCC (Reflection Connection Cycle) structure in a professional development program that consists of two important components (1) group meetings and (2) assignments both in class and home tasks. According to Zeichner and Listen (2011) as researchers and inventors of the RCC model, the group meeting and assignment process is designed to give teachers an opportunity to get a picture of a shared-knowledge and support the relationship between their own assignments and teaching. The core components of each group meeting include classroom video review, discussion of assignment, sharing of applied learning, and creating new lessons. The results of the 2011 CIMT (Center for Innovation in Mathematics Teaching) study entitled "International comparative study in mathematics teacher training" recommended that mathematics teacher training should take into account: (a) math skills of trainees, (b) duration of training, (c) the balance between theory and practice, and (4) the role of tutors from universities

Based on the above basic principles, the characteristics of the INNOMATTS training model are as follows: (1) Solution for existing problems: The training program is oriented to the needs and problem solving faced by Junior High School Mathematics teachers in learning, (2) Independence: The training program can be implemented with or without program support and government funding. Initiation can start from the Mathematics teacher community either in school, foundation or MGMP (Teacher Education Consensus Points), (3) Innovation: The innovative understanding of the INNOMATTS model is seen in two concerns such as the training model and on the content or training materials and (4) Sustainability: There is further assistance both individually and individually after the training as well as further training programs. The implementation strategy of the INNOMATTS training model or the means used to achieve the stated objectives is as follows: (1) the training can be carried out as part of routine scheduled activities in an organization or association of Mathematics teachers such as MGMP of Mathematics Junior High in a region, 2) the training model is designed and implemented in the cycle model (application of the Deming PDCA/Plan-Do-Check-Act cycle), with activities based on group work and individual work. For example, group-based activities (activities undertaken in clusters) are teachers together with other members in a cluster planning lesson plan, and followed up by doing classroom learning, one of the teacher as the teacher model while the other teachers observing and observation results discussed together again. Furthermore, each teacher performs an action in each school without being observed by peers, and so on over and over (in accordance with the program designed

thoroughly), (3) Assistance by the tutor during the training process, both in activities in the cluster and individual activities. The purpose of this paper is to analyse the impact of the INNOMATTS Model on content knowledge and impact on pedagogical content knowledge related to the teacher's role.

METHODOLOGY

a) Research Design

The adopted research design is an adaptation of Research and Development (R&D) research design from Gall (2007). The first step of the study is an exploratory study that includes literature review and direct-observation of data sources to obtain data on teachers' perceptions and expectations about training activities. The results of the exploratory study are supported by the deepening of the literature review and informal discussions with teachers as well as with experts. Those are used as the basis for the formulation of conceptual models which subsequently developed into hypothetical models. The next step is a model development activity in the form of formative evaluation. Formative evaluations in the development of this model include validity, practicality and effectiveness.

b) Data Collection

Data and information were obtained from the respondents who are Junior High School Mathematics teachers in Semarang City selected as I trainees. Data used collection tools are questionnaire and test. Questionnaires were used to reveal the perceptions and expectations of the trainees on the training activity and training management while the tests were used to determine the impact on content knowledge and impact on pedagogical content knowledge related to the teacher's role. The instrument of exploratory study was developed based on the content outline that was compiled referring to the study of theory and government documents. Test was conducted to fulfil the empirical validity of the instrument. Data are classified by type and developed-model components.

c) Data Analysis

The data were analysed descriptively narrative and quantitative calculation. The hypothetical model was developed from a conceptual model with reference to the exploratory results as well as the deepening of various theoretical and discussion studies. The hypothetical model of the INNOMATTS model is validated using the Delphi technique. This technique is used as validation because it has two advantages that have the ability to accommodate every individual's subjective opinion and allow free expression of opinion which has no effect of domination. In this research, expert validation is done in two stages. The experimental empirical model is intended to determine the practicality and effectiveness of the model. The practicality of the model is indicated by the suitability of model implementation in the field with the model, while the effectiveness is indicated by the conformity of the objectives with the results of the model implementation. The test subjects in the development of the training model are 30 Junior High School Mathematics teachers in Semarang City from public and private schools. The thirty teachers are divided into 5 clusters in each consist of 6 teachers.

The purpose of the test is to determine the practicality and effectiveness of the model. In accordance with the test purpose, the test to see the effectiveness of the model is done with one test. This test is conducted for the purpose of detecting any possible change in teacher competency before and after training using the model. The design of the test is One Group Pretest - Postest or experimental design before-after (Sugiyono, 2010). Tests are conducted through several stages. In general, these stages are the preparation stage, the implementation stage of the model, the analysis stage of the assessment of the model implementation, and the

preparation stage of the test report. The preparation stage is the stage of checking and preparation of various instruments that have been arranged as well as a means of assessing the success of model implementation. Implementation stage of the model is the beginning of implementing the program in accordance with the structure of the designed program. The plan covers each activity (classical activity/IN, and cluster and class activity/ON) and Review (R) activity both in class and in cluster repeatedly according with the groove model. The training is planned cyclically starting from the class or large group, clusters and individual activities repeatedly.

Table 1. *Impact on pedagogical content knowledge related to the teacher's role*

Characteristics	Indicators	Effectiveness (%)	Effectiveness of Each Component (%)
Solution for Existing Problems	Ability of the training activities in helping to overcome the problems faced by teachers	62.17	75,19
	The suitability between the success indicators of the training program and the needs of the mathematics teachers in the field	78.83	
	The preparation of the training program takes into account the needs / problems of the math teacher	80. 92	
Inovation	Beneficial for the trainees	70. 83	76,10
	Unlike the previous model implemented	73. 63	
	Training activities optimize the role of external resource persons	74. 75	
	The implementation of the training activities was completed by creative and innovative activities.	73. 25	
Independence	Training activities follow the development trend of learning	77. 79	74,25
	Training activities are easy to implement independently	76. 33	
	There are no obstacles faced in implementing the model independently	72. 17	
	Not implemented because it is difficult to organize the activity stage	74. 25	
Sustainability	There is an evaluation to see the effects of plans and training outcomes on the parties concerned	80. 75	75,54
	There are programs and implementation of post-training follow-up programs	70. 33	

Based on the above table, the average of overall effectiveness is found to be 75.35 included in good category.

The results of the assessment based on the training management namely the suitability between the steps of activities undertaken at each stage and the steps of the model shown that: (1) in the planning stage of 97.5%; (2) on the implementation stage of 77.5%, and (3) at the evaluation measures of 65%. The average implementation of training activities in accordance with the steps of the model is 80%. Thus it can be said that the INNOMATTS Model is practical. Assessment of the effectiveness of INNOMATTS Model on the improvement of teacher competence is based on (i) the result of the assessment of the Lesson Plans (RPP) which is the average of the assessment by the first assessor is 77.46, while the average assessment of the second assessor is 77.97, so that the average the total is 77.72. These results indicate that the ability of teachers in INNOMATTS trainees in arranging the RPP included in good category, (ii) the results of the assessment of the implementation of the teaching namely average assessment by the first assessor obtained by 77.35 while the average assessment of the second assessor is 80.34, so the overall average is 78.85. These results indicate that the ability of INNOMATTS trainees in implementing the lesson plan is included in good category, (iii) the result of teacher professional competence test (UKG) before the

implementation of the INNOMATTS model is obtained 64.45, while the competency test after the implementation of the completed model is obtained average 81.30. The effectiveness of the overall training model from before to after the implementation of the model on the professional competence of teachers increased. The average gain normalized of the professional competence of teachers before and after the implementation of the model was 0.47 (47%) with the medium category. While the effectiveness of INNOMATTS overall training model from before to after model implementation of teacher competence, there is an increase. The average gain normalized of the effectiveness before and after the implementation of the model for teacher competence was 0.62 (62%) in the medium category. The effectiveness of the Model on the implementation of the Model characteristics for the solution of existing-problem component is 75.19; the innovation component of 76.10; the independence component is 74.25 while the sustainability component is 74.25. The average overall effectiveness is 75.35 in the good category.

Related to the expectations and needs of teachers on the existence of training that can be stated that teachers of SMP Mathematics in Kota Semarang need innovative training which follow the demands of the time, as well as training materials in accordance with the needs of teachers. During this time, they would attend training only if there were programs from the government. Teachers also expect academics and other professionals to train them. The involvement of academics in teacher training will be more manageable and organized if the training provider is the teacher community itself, thereby reducing the involvement of others as it can independently be managed by the teacher community.

The expectations and needs of the teachers will be more easily met if there is a community of teachers who initiates the training of teachers with materials that match the needs and problems they face. The INNOMATTS model can be an option because the characteristics of this model are solution for existing problems and independence meaning that the teacher community can independently coordinate the training by involving experts from the universities.

Teacher perceptions related to the training management that had been followed previously obtained data that less than 60% mathematics teachers in Semarang City who had attended, knowing the training plans, training objectives, training support elements, and management activities that occurred during the training process. Associated with the evaluation, only about 50% of teachers who think that there is evaluation during training program and the evaluation process to see the effects of training plans and results. What strikes most from teachers' opinion is that 73% of teachers think that the training they attend does not provide post-training follow-up programs. This result is in line with the findings of Ardhana (2003) which stated that there has not been found operational and practical training in educational praxis. The results of the exploratory study in this study also support the findings of Hendayana (2007), Suparlan (2006) and Lie (2010) who said that the training did not have a significant impact on the improvement of learning quality.

The first stage of expert validation results, obtained data that the percentage of assessment in all components are above 70% which means the items on the components are good. Based on the validation of the first stage is actually a model can already be said valid. But there are some suggestions for improvements provided by validators that are critical to model improvement.

Completion of the model is done by taking into account the justification and suggestion of refinement given by the expert. The model and its guidance are thoroughly reviewed so that it becomes clearer and easier for experts to judge. Revisions or improvements to the model, guide, or instrument are used in second stage model validation. Expert validation results of the model in the second stage showed that of the 34 grains of the all model components assessed, obtained more than 70 percent. The results of Kruskall Wallis

hypothesis test showed that there is no significant difference in the assessment given by the academia, professional trainers and practitioners. The above test results indicate that there is no component that must be revised or refined, it means that there has been agreement of the second stage expert validation.

The result of formative evaluation of empirical model implementation in the test to measure the practicality and effectiveness of the model shows that the process stages of INNOMATTS empirical model implementation is done according to the model and guidance. There are only some stages that the implementation is not optimal yet. There is a very interesting finding to consider as a refinement of the final model. Firstly, the implementation of the activities has implemented the right strategy that the participants are actively discussing, learning while working, intensive group approach and implementing the principles of Plan-Do-Check-Act. Although the participants' little inconvenience (such as designing RPP) were expressed. This is due to their relatively unequal experiences and abilities. Therefore, it is countered by tutorial strategy and multiplying to give example so that finally the implementation in general become conducive. Secondly, the leadership role of the cluster leader as the motivator and facilitator, raises the sympathy of the participants, supports the smooth implementation of the training, and gives a positive impact on the trainees' sustainability and comfort.

Associated with the results of formative model assessment, namely the execution of model characteristics, the measurement results show that overall effectiveness was quite high that was equal to 75.35. The effectiveness of the overall INNOMATTS training model from before to after the implementation of the model on teacher competence was increased. The magnitude of the average gain normalized effectiveness before and after the implementation of the model for teacher competence was 0.62 (62%) with high category. All components / indicators demonstrate good performance as a direct or indirect influence of the implementation of the INNOMATTS empirical model indicated by the magnitude of effectiveness achieved. Direct influence can be explained that the increase of magnitude occurs due to the activities carried out directly related to the component / indicator such as seen in the indicators of learning activities in the classroom that educate, communicate with learners, and master materials, structures as well as mathematical concepts.

CONCLUSION

Based on the results of research and discussion described above obtained the following conclusions. In relation to the perception, the expectation and needs of teachers related to training is only 27% of teachers who think that the training that followed so far there is a post-training follow-up program; 60% of teachers found that they only participated in training if there were programs from the government; 75% of teachers thought about the need for the suitability between training materials and the needs in the field. 97.5% of teachers expect innovative and up-to-date training; 92% expect the presence of colleagues, supervisors, academics and professionals involved in teacher enhancement training activities; 55% of teachers expect an evaluation of the training conducted during the training process not only at the end of the training.

The result of model development related to practicality of the model based on suitability between training implementation and model steps is 80%, while model effectiveness toward improvement of teacher professional competence with indicator ability to develop learning tools is equal to 77,72 with good category; for learning activity indicator of 78,85 with good category; while the result of professional teacher competency test obtained the average gain normalized professional competence of teacher before and after implementation of model is equal to 0,47 (47%) with medium category; the effectiveness of the overall INNOMATTS

training model from before to after the model implementation of teacher competence has increased; the magnitude of the normalized average gain effectiveness before and after the model implementation is 0.62 (62%) in the medium category; while the average effectiveness of the overall model characteristic is 75.35 which is included in good category.

Taking into account the effectiveness of the INNOMATTS empirical model of both process and product as a whole, the increase of overall gain effectiveness of pretest and posttest, as well as the results of the RPP assessment and implementation indicate that the implementation of the INNOMATTS model contributes to the improvement of professional competence of Junior High School Mathematics teachers in Semarang City. The solution providing the characteristic implies that the training objectives are based on finding solutions to the problems factually faced by the teacher and in the form of a bottom-up training model in addition to the needs and real problems of the math teacher in the field. So, the training is a solution to teacher problems and contains solution for existing problems, innovation, independence, and sustainability characteristic in teacher training programs. As an impact, the professional practice of teachers is strengthen.

ACKNOWLEDGEMENTS

The research reported here was supported by a grant from Kementerian Riset, Teknologi, dan Pendidikan Tinggi RI through 'Skema Penelitian Hibah Bersaing tahun 2013 dan 2014'.

REFERENCES

Anthony, G., & Walshaw, M. (2007). *Effective pedagogy in pāngarau/Mathematics: Best evidence synthesis Iteration [BES]*. Wellington: Ministry of Education.

Ardhana, W., Kaluge, L., & Purwanto, P. (2005). Pembelajaran Inovatif untuk Pemahaman dalam Belajar Matematika dan Sains di SD, SLTP, dan di SMU. *Laporan penelitian hibah pascasarjana Angkatan I tahun III.* Direktorat Penelitian dan Pengabdian pada Masyarakat. Ditjen Dikti. Depdiknas.

Asia Society. (2010). *Learning from the world*. New York.

Burns, M. (2011). *Distance education for teacher training: modes, models, and methods*. Washington, DC: Education Development Center, Inc.

Butler, D., & dan Leahly, M. (2003). *The TeachNet Ireland project as a model for professional development for teacher*. Dublin: St Patricks College of Education, Duplin City University.

Cerbin, W., & Kopp, B. (2006). Lesson study as a model for building pedagogical knowledge and improving teaching. *International Journal of Teaching and Learning in Higher Education, 18*(3), 250 – 257.

Ditjen PMPTK. (2010). *Panduan Penilaian Kinerja Guru*. Jakarta: Pusbangprodik.

Ditjen PMPTK. (2010). *Pedoman Pengelolaan Pengembangan Keprofesian Berkelanjutan (PKB)*. Jakarta: Pusbangprodik.

Gall, M. D., Gall, J. P., & dan Borg, W. R. (2007). *Educational Research: An Introduction, 8th ed*. New York: Pearson.

Guskey, T. R., & Jung, L. A. (2009). *Grading and Reporting in a Standards-Based Environment: Implications for Students with Special Needs*. Paper presented at American Education Research Association Conference.

Hendayana, S. (2007). *Lesson Study: Pengalaman IMSTEP-JICA*. Bandung: UPI Press.

Hill, H. C., Ball, D. L., & Schilling, S. G. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuringteachers' topic-specific knowledge of students. *Journal for Research in Mathematics Education, 39*(4), 372–400.

Hooker, M. (2011). *Models and Best Practices in Teacher Professional Development*. Online. Avaliable from infoDEV.

Jacobs, J., Borko, H., & Roberts, S. (2009). *The problem solving cycle: A model of mathematics professional development*. Tersedia di http://www.colorado.edu/education/staar/documents/PSC_NCSM_013007_FNL.pdf [diakses 21 Januari 2012].

Kristin L. (2011). *Preparation of Effective Teachers in Mathematics*. National Comprehensive Center for Teacher Quality. USA.

Lewis, C. (2006). *Lesson study in North America*: *Progress and challenges*. Tersedia pada http://www.lessonresearch.net/res.html. [Diakses 15 Agustus 2007].

Lewis, C., Perry, R., & dan Hurd, J. (2004). A Deeper Look at Lesson Study. *Academic Search Premier, 61*(5), 18-22.

Lewis, C., Perry, R., Hurd, J., & O'Connell, M. P. (2002). *Lesson study comes of age in North America*. Tersedia pada http://www.lessonresearch.net/LS_ 06 Kappan.pdf. [Diakses pada tanggal 15 Agustus 2007].

Mark, J., Gorman, J., & Johannah, N. (2009). Keeping teacher learning of mathematics central in lesson study. *NSCM Journal, 12*(1), 3-11.

Marsigit. (2007). Mathematics teachers professional development through lesson study in Indonesia. *Eurasia Journal of Mathematics, Science and Technology Education, 3*(2), 141-144.

National Council for Teacher Education (NCTE) (2009). Towards preparing professional and human teacher. Published by Member-Secretary, National Council for Teacher Education Wing II, Hans Bhawan, 1, Bahadur Shah Zafar Marg, New Delhi-110002.

Patel, R. (2011). *Innovations in Teaching Mathematics*. Waymade College of Education.

Pattanida P. (2004). *School-Based training for in-service teacher development: atrategy for the succes of learning reform in Thailand*. Paper in the Fourth Scrutinizing Committee of the Council Minister.

Penso, S. (2002). Pedagogical content knowledge: How do student teachers identify and describe the causes of their pupils' learning difficulties? *Asia-Pacific Journal of Teacher Education, 30*(1), 25-37.

Rogers. P. (2007). *Teacher professional learning in mathematics: An example of a change process.* Proceeding of 30Th annual conference of Math Education Research Group Of Australasia MERGA Inc.

Saad, N. S. (2008). *Teaching mathematics in secondary schools: theories and practices*. Perak: Universiti Pendidikan Sultan Idris (UPSI).

Sugiyono, S. (2010). *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D)*. Bandung: Alfabeta.

Taylor, E.V. (2011.) *Supporting children's mathematical understanding: profesional development focused on out-of-school practices*. Journal Math Teacher Education, *15*(4), 271-291.

Volker, U. (2010). Systemic Innovations of Mathematics Education with Dynamic Worksheet as Catalysts. *Proceedings of CERME 6 page 1280-1289.* Lyon France INRP 2010.

West, L., Hanlon, G., Tam, P., & Novelo, M. (2007). Building Coaching Capacity Through Lesson Study. *NSCM Journal*, *1*(1), 26-33.