

Mathematics Teachers’ Belief related to Continuing Professional Development (CPD)

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Abstract The study aims to describe the number of JHS mathematics teachers in Bandar Lampung, Lampung, Indonesia toward belief related to CPD activities. This type of study was a mixed method (or quantitative-qualitative) using explanatory sequential strategy. The subjects were 181 Junior High School (JHS) mathematics teachers in Bandar Lampung, Lampung, Indonesia who have already become civil servants. Meanwhile, the quantitative research sample was 63 JHS mathematics teachers in Bandar Lampung, Lampung, Indonesia established using stratified random sampling technique based on teachers’ worked experiences, then chosen on each level with proportional random sampling. Furthermore, the qualitative sample was eight teachers for the case study which was decided by purposive sampling technique. The research instrument consisted of questionnaire and interview list. Data analysis techniques was conducted using categorized into 5 groups: really belief, belief, quite belief, less of belief, and unbelief. The result of research show that JHS mathematics teachers’ belief toward CPD activities is in the belief category. Then, based on teachers’ experiences related to CPD belief is founded that there is no differences on their belief.

Keywords *Continuing Professional Development (CPD); Mathematics Teachers’ belief*

A. INTRODUCTION

Education has a major influence on various aspects of the development of sustainable living, where the supporting factors make a major contribution to sustainability and peace, have a direct influence on reducing poverty, promoting health, gender equality, and a sustainable environment (UNESCO, 2014). The importance of the influence of education on human life is one of the factors that underlies UNESCO to continue to aggressively voice the idea of lifelong learning, which began in 1972 (Tuijnman & Boström, 2002).

The importance of increasing the ability, expertise, and attitude as a determinant of the quality of human resources of a nation. Each individual is responsible for becoming a lifelong learner, learning to develop themselves, to continue to be able to develop and improve their competencies and expertise as science and technology advances. The teaching profession is no exception, teachers are required to carry out professional development throughout their careers related to their duties and roles (Gray, 2005)

Teachers play a strategic role in providing quality learning for students (Merliza & Retnawati, 2018). Teachers play a central role in the implementation of quality education for a nation, so it takes teachers who have the awareness and willingness to not stop doing professional development (Merliza & Retnawati, 2018). This is also supported by facts based on research data on TCF Hong Kong (Shun-wing, 2016: 16) which states that teachers actually have the opportunity to continue to develop and increase their professional level, as teachers need opportunities to be involved in professional development activities.

Mathematics is one of the sciences that plays an important role in equipping students to face a competitive life. Alnoor & Yuanxiang explained that mathematics is a tool needed in the field of science and technology, mathematics is not only aimed at teaching arithmetic, but also provides opportunities for students to become scientists; explore concepts related to everyday life (Gray, 2005). The purpose of mathematics education which requires the ability to think logically, analytically, systematically, critically and creatively as well as the ability to work together (Government Regulation No. 23, 2006: 61) will be very useful in preparing a generation that is highly competitive.

Based on the results of UKG 2016, mathematics teachers still need to improve their competence (PPPPTK Matematika, 2016). Continuing Professional Development (CPD) is a form of continuous learning for teachers which is the main vehicle in an effort to bring about the desired changes related to the success of students (Soeharto et al., 2013). Suharto, Sukir & Nugraha explain that CPD is an effort to continuously improve professional knowledge and skills beyond the initial basic training required in carrying out work (Soeharto et al., 2013).

However, based on several research results, teacher CPD activities in several regions in Indonesia are still not encouraging. Based on the research results of Merliza & Retnawati, mathematics teachers' CPD implementation still in "very poor" category, it can be caused This can be due to the difficulty of teachers to engage in CPD activities (Merliza & Retnawati, 2018). Nuraeni & Retnawati, the professional development of vocational mathematics teachers in Wonosobo Regency is still in the low category (Nuraeni & Retnawati, 2016). This situation is in line with the findings of Kartowagiran which states that the performance of post-certification teachers in professional development is still not satisfactory (Kartowagiran, 2011). Meanwhile, based on the results of Noorjannah's research, fraud was found in the CPD in the form of scientific writing activities (KTI), where it is known that 70% of teachers use writing services, PTK, for promotion or for other activities such as certification (Kartowagiran, 2011).

According to the results of research by Aina, Bambang, Retni, Afreni & Sadikin, there is still a lack of scientific writing by teachers due to the difficulties of teachers in preparation related to busy teaching hours, ignorance of ethics and writing techniques, and the teacher's unfamiliarity with expressing ideas. and ideas (Aina et al., 2015). Meanwhile, according to Supriyanto, CPD activities in the form of KTI made by teachers basically have not been carried out periodically, even KTI writing policies for promotions have not been responded to positively (Supriyanto, 2009). Another fact related to CPD teachers and their credit figures, was found based on the results of Wuryandini's research which stated that many class VI A teachers had not been able to be promoted to class VI B because the credit numbers related to the implementation of CPD activities had not been fulfilled (Wuryandini, 2014).

Furthermore, based on the research findings of Wibowo & Jailani, that to reveal the CPD for junior high school mathematics teachers in Wonosobo is based on the understanding, implementation, and difficulty of CPD teachers, where it is known that each is in the medium, little, and very few categories (Wibowo & Jailani, 2014). Meanwhile, de Vries, Ellen, Wim, et al. linking teacher involvement in CPD activities to their beliefs, it is known that teachers' beliefs about something will affect the learning process (CPD) and their profession, meaning that teachers' understanding affects their beliefs (Siebrich de Vries et al., 2013).

Therefore, research is needed related to the analysis of sustainable professional development (CPD) for junior high school mathematics teachers in Bandar Lampung City, which can be viewed from the aspects of belief related to CPD.

In book I about CPD teachers published by the Ministry of National Education (Pembinaan Dan Pengembangan Profesi Guru Buku I: Pedoman Pengelolaan Keprofesian Berkelanjutan (PKB) Dan Angka Kreditnya, 2010), CPD is defined as a form of continuous learning for teachers who are the main vehicle in an effort to bring about the desired changes related to the success of students. Thus all students are expected to have more knowledge, have better skills, and show a deep understanding of the teaching material and be able to show what they know and are able to do. CPD includes various ways and/or approaches in which teachers continuously learn after receiving initial education and/or training as teachers.

Borg adds that there are several prerequisites for CPD that have a positive impact on teachers, students, and schools if: (1) it is relevant to the needs of teachers in learning practices; (2) it is the teacher who is actively involved in the CPD material; (3) in the CPD there must be a process of discussion and sharing of experiences and problems in the classroom; (4) The CLA process must be accompanied by competent parties; and there is the involvement of leaders who support the professional development process of a teacher(Borg, 2015).

Oper and Pedder state that there are three effects of professional development carried out by a teacher on an ongoing basis, namely, (1) CPD has an impact on students, teachers and classroom teaching practices; (2) CPD has an impact on teacher status and career prospects even on teacher salaries; (3) CPD has an impact on teachers' memory(Opfer & Pedder, 2014).

According to Scales, Pickering, Senior, Headley, Garner & Boulton, effective CPD includes the following activities: (1) activities, (2) planning, CPD is carried out with a clear vision and clear impacts/benefits; 3) develop skills, knowledge, and understanding, (4) CPD training, (5) learning observation, 6) effective CPD model strategies for learning, (7) CPD activities promote learning to discover and develop scientifically, (8) feedback back from CPD activities. An effective CPD is believed to have a much more beneficial impact than the mere implementation of CPD(Scales et al., 2011).

CPD is a planned, sustainable, and lifelong form of learning for a teacher in his profession which is expected to describe the increase in his knowledge, skills, and professional competence. So it can be concluded that the CPD for mathematics teachers is a planned, sustainable, and lifelong form of learning for a mathematics teacher in his profession which is expected to describe the increase in knowledge, skills, and professional competencies that have a positive impact on himself, students, and educational institutions.

Meanwhile, based on the form of CPD activities, Little mentions that in addition to involvement in workshops, CPD activities are in the form of participation in local, national, and international conferences, university-level courses or special institutions as well as activities to design, select, and determine a new curriculum or school improvement plan assessment activities(Desimone, 2009). Huang, Ye & Prince (2017: 21) explain the form of the teacher CPD hierarchy, namely: induction programs, practice-based teaching research program, upgrading degree program, new curriculum training program, master teaching training program(Desimone, 2009).

It is very important for teachers to carry out their professional development continuously, because it will have a big impact on his ability to facilitate learning in the classroom (Merliza & Retnawati, 2018). The teacher's belief in various activities will affect the effort to be carried out.

According to de Vries, Grift, & Jansen, teacher belief is a proposition about teaching and learning that is true according to the teacher which is applied in learning practice (Siebrich de Vries et al., 2013). Furthermore, Cooper & McGaugh define belief as an attitude that combines a large number of cognitive structures. Beliefs are formed from a person's cognitive knowledge (Leder & Forgasz, 2002). So the teacher's belief is indicated to depend on the teacher's proposition about something related to commitment, stability, and the impact of something(Skot, 2015). Cross (2009: 326) states that the belief of a mathematics teacher will affect how a mathematics teacher designs learning in the classroom. Similarly, Ertmer asserts that belief is obtained after a person obtains a proposition about a knowledge which is then connected with previous experience(Ertmer, 2005).

According to Ernest (1989: 1), the key components of mathematics teacher beliefs can be seen from, (1) the teacher's view of the nature of mathematics, (2) the teacher's view of teaching mathematics, and (3) the teacher's view of the mathematics learning process.

Regarding the relationship between teacher beliefs and participation in CPD activities, Schommer) explains, based on the theory of epistemology of beliefs in adult learning, an individual's belief about knowledge and learning will affect his learning and work (De Vries et al., 2013). The results of the learning process (CPD) and work (teaching) must have consistent beliefs. De Vries, et al., divides 3 types of CPD activities that are associated with teacher beliefs, namely, (1) efforts to update knowledge and skills (updating knowledge and skills), belief in the form of efforts to develop knowledge both in theory and practice; (2) reflection, beliefs regarding reflection

activities based on findings or learning experiences either independently or collaboratively; and (3) collaboration with other mathematics teachers (collaboration with colleagues), beliefs related to supportiveness consisting of exchange activities (eg problem discussions, exchanging teaching materials) and collaborative engagement (eg CAR).

Furthermore, Leder, Pehkonen & Torner describe the processes that influence teacher beliefs, namely, (1) descriptive beliefs are formed through the teacher's direct experience; (2) conclusions about beliefs are based on logical rules in drawing conclusions; (3) information about beliefs is formed through information available outside (Leder & Forgasz, 2002).

Beliefs are simple propositions of an individual about some existing aspect which influences his attitudes and actions. Meanwhile, the junior high school mathematics teacher's belief in CPD activities is the proposition of a junior high school mathematics teacher who can predict attitudes about CPD that affect the decision to carry out CPD activities. Beliefs which consist of (1) belief in CPD related to the benefits for increasing self-competence, learning mathematics, and students; (2) belief in efforts to update knowledge or skills both in self-development activities, scientific publications, and innovative works; (3) belief in reflection activities in self-development activities, scientific publications, and innovative works, and (3) belief in collaboration activities (collaboration with colleagues) in self-development activities, scientific publications, and innovative works.

B. METHOD

This research is descriptive approach utilizing mixed methods (or quantitative-qualitative method). The study was conducted at junior high schools in Bandar Lampung, Indonesia. The population in this research was 181 mathematics teachers of junior high schools in Bandar Lampung in 2017. Samples were identified using stratified random sampling procedure based on the teachers' teaching experiences, then subsequently selected through proportional random sampling technique. The samples were 63 mathematics teachers, whereas for qualitative research, eight respondents were chosen using purposive sampling technique.

The data collection was conducted from February to March 2017, through direct meeting of the researchers with respondents at their respective schools and mathematics subject-teachers forum (or *Musyawah Guru Mata Pelajaran - MGMP*) for junior high school (JHS) teachers in Bandar Lampung.

The instrument to collect the data consisted of teachers' beliefs questionnaire and interview guide. The questionnaire was used to uncover teachers' belief related to CPD activities. It contained 37 items using likert scale model that categorized into 5 groups: *very belief, belief, quite belief, less of belief, and unbelief*.

Interview guide was used to obtain the information of the teachers' belief toward CPD activities. The validity of the instruments was in the form of content validity: face and logical validity, and was done by two expert judgments and then proved by Aiken's validity (Retnawati, 2014). The reliability of the instrument difficulty was 0.960 and the SEM was 4.165, which means that it was in a very good category of reliability.

Data analysis techniques used in this research is descriptive quantitative. The beliefs of teachers's CPD was determined based on the categorization adapted from Widoyoko (Eko Putro Widoyoko, 2009), which is presented in Table 1.

Table 1. Categories of the mathematics' teachers belief related to CPD.

Formulas	Category
$X > Mi + 1,8 S_{bi}$	Very belief
$Mi + 0,6 S_{bi} < X \leq Mi + 1,8 S_{bi}$	Belief
$Mi - 0,6 S_{bi} < X \leq Mi + 0,6 S_{bi}$	Quite belief
$Mi - 1,8 S_{bi} < X \leq Mi - 0,6 S_{bi}$	Less of belief
$X \leq (Mi - 1,8 S_{bi})$	Unbelief

Specification:

X : score of respondents or actual score

Mi : a mean score of ideal

SBi : ideal standard deviation

Furthermore, qualitative data analyse using interactive model by Miles, Huberman, & Saldana (Leder & Forgasz, 2002) are presented in Figure 1.

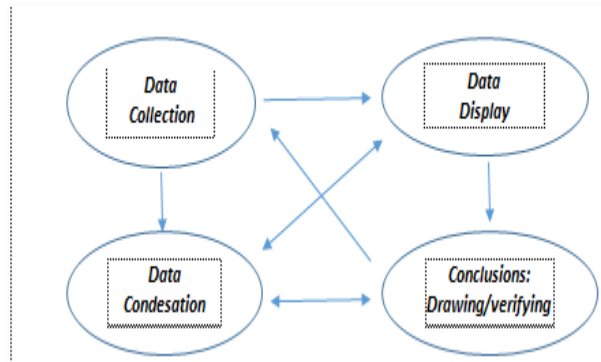


Figure 1. Interactive Model Scheme

The results of the data will have to go through a process of data reduction, data display, as well as drawing conclusions and verification.

C. RESULTS AND DISCUSSION

Based on the results from the beliefs of JHS Mathematics' Teachers toward CPD in Bandar Lampung city.

The results of quantitative research are obtained based on categorization techniques. Based on the results of questionnaire has the actual mean score (X) of 125,86 (beliefs category), the ideal mean score (Mi) of 111, the ideal standard deviation of 24,67 with maximum score 185 dan minimum score of 37, as presented in Table 2.

Tabel 2. Score of CPD beliefs of JHS Mathematics Teachers in Bandar Lampung

Interval	Category	Total	Percentage
$X > 155,40$	Very belief	0	0%
$125,80 < X \leq 155,40$	Belief	52	83%
$96,20 < X \leq 125,80$	Quite belief	11	17%
$66,60 < X \leq 96,20$	Less of belief	0	0%
$X \leq 66,60$	Unbelief	0	0%
Total		63	100%

Tabel 2 shows that CPD beliefs of 52 JHS mathematics teachers in Bandar Lampung is in 'belief' category, meaning that the majority of the teachers are have good belief toward CPD activities. The comparison of the results of teachers' CPD belief are presented in the following table.

Table 3. Average Results of the CPD belief Questionnaire for JHS Mathematics Teachers in Bandar Lampung City

Aspect		CPD belief toward mathematics learning	Belief toward CPD effort	Belief toward reflective activity	Belief toward collaborative activity	Total
Group						
Gol III B	Mean	16	53,6	36	19,8	125,4
	Cat	Belief/Good	Quite belief	Belief	Very belief	Quite belief
Gol III C	Mean	15,6	56,5	39,6	19,1	130,8
	Cat	Belief	Quite belief	Belief	Very belief	Belief
Gol III D	Mean	13	55,5	36,2	18,6	123,3
	Cat	Belief	Quite belief	Belief	Very belief	Quite belief
Gol IV A	Mean	14,2	52,3	35,4	19,8	121,7
	Cat	Belief	Quite belief	Belief	Very belief	Quite belief
Gol IV B	Mean	14,9	56	38,2	18,7	127,8
	Cat	Belief	Quite belief	Belief	Very belief	Belief
Total	Mean	14,65	54,26	36,98	19,42	125,86
	Cat	Belief	Quite belief	Belief	Very belief	Belief

Table 3 shows that there are differences in the belief categories of mathematics teachers in Bandar Lampung City, it is known that teachers of class III C and IV B have a belief category, while teachers with other levels are categorized in Quite belief category.

Table 4. The Results of Each Subaspect In Beliefs' Questioners

No.	Subaspect	Mean	Category
1.	Belief related to the benefit of CPD	14,65	Belief
2.	Belief related to effort to participate in functional training : training, workshop, etc	9,50	Quite belief
3.	Belief related to effort to participate in functional training : training, workshop, etc	6,19	Quite belief
4.	Belief related to effort to participate in publication	5,46	Belief
5.	Belief related to effort to reaching advanced education (S2/S3) or joining relevan course	6,74	Less of belief
6.	Belief related to effort to develop innovative product.	7,36	Belief
7.	Belief related conducting reflective activity in term self-developing.	14,11	Belief
8.	Belief related conducting reflective activity in term science publication	11,17	Belief
9.	Belief related conducting reflective activity in term innovation product	11,69	Belief
10.	Belief related conducting collaborative activity in term self-	7,49	Belief

No.	Subaspect	Mean	Category
11.	developing. Belief related conducting collaborative activity in term science publication.	3,88	Belief
12	Belief related conducting collaborative activity in term innovation product.	8,04	Belief
	Total Score Actual	106,28	Belief

Based on Table 4, it can be described that teachers are "confident" regarding the benefits of CPD activities as indicated by an average score of 14.65. Meanwhile, mathematics teachers are quite confident regarding the effort to participate in functional training activities, with an average score of 9.50. Teachers' beliefs related to efforts to participate in the teacher's professional learning community reached an average score of 5.46, which was categorized as quite sure; teachers' beliefs regarding efforts in the form of scientific publication activities are categorized as confident (5,46). Belief; teachers' beliefs regarding the improvement of educational qualifications for S2/S3 are included in the less sure category, with an average score of 6.74; teachers' beliefs regarding efforts related to the form of innovative work activities are included in the sure category (7,36).

Furthermore, the form of belief related to the teacher's reflective activities in the self-development subsection is included in the confident category, with an average score of 14.11; teachers' beliefs related to the reflective activities of the scientific publications subsection reached an average score of 11.17, which means that they are categorized as confident; The belief related to the reflective activities of the innovative work subsection teacher reached an average score of 11.69, categorized as confident. Furthermore, mathematics teachers are categorized as confident regarding collaborative activities in the sub-section of self-development, scientific publications, and innovative works with average scores reaching 7.49, 3.88.

The results of the qualitative research analysis in this study are using the Miles and Huberman interactive model which is based on the acquisition of interview data Interview data were obtained from eight respondents who were selected (purposive sampling) based on the results of categorization in quantitative research, consisting of respondents in the order of 5, 11, 17, 34, 46, 50, 54, 60.

Information obtained based on the results of interviews with junior high school mathematics teachers' beliefs about CPD implementation activities, it is known that teachers' beliefs related to CPD implementation efforts, that is, it is known that some teachers have sufficient belief in the form of business that should be carried out, can be in the form of trying to get personal money in participating in training activities, seminars or efforts to improve educational qualifications both at home and abroad. However, some believe that they are reluctant to carry out these activities. This is in line with the information provided by several teachers who do not believe that CPD activities can be a means of increasing self-competence.

Constraints raised for example in the activities of writing scientific papers. Writing activities really need time while with a busy teaching schedule it is felt that it will not produce quality writing; making CAR work for promotion should be distinguished from academics, this is very burdensome for mathematics teachers while the quality of the work produced is not yet known.

Furthermore, based on the belief in the reflective activities of mathematics learning, information was obtained that the teacher's participation in model-based training and learning non-routine mathematics learning questions, it is known that all teachers have the same belief regarding the importance of training to be able to direct and inspire teachers to be able to provide non-routine questions in the classroom, this is because the provision of non-routine questions will provide opportunities for students to be able to construct knowledge on their own mathematical material. It is not only good for the cognitive aspects of students, but also has a positive effect on the affective aspects. All teachers have good beliefs regarding the form of reflective activities from the implementation of CPD.

Meanwhile, belief is related to the form of collaborative activities, some mathematics teachers believe in good beliefs regarding their collaborative activities with their fellow mathematics teachers or experts in the form of CPD activities. This is because it is related to the importance of mutual encouragement between teachers. However, different answers were given by some teachers doubting the ineffectiveness of collaborating activities in CPD, because based on experience in teacher learning forums, these activities did not run effectively, only being an arena for discussion, only some teachers were active. The conclusion of interview results can be presented in Table.5

Tabel. 5 Data Analysis of interview results

Aspect	Reduction and Presentation Results	Conclusion
Teachers' Belief	Some respondents believe that it is important to try to be involved in CPD activities even though they use personal funds to increase their competence.	✓ Most teachers believe that by trying to be actively involved in CPD activities, they can improve their self-competence. ✓ respondents believe that the reflective activities involved in learning non-tutin math problems will be beneficial for students. ✓ • Some respondents are not sure that collaborative activities can improve the implementation of CPD for mathematics teachers.
	Some respondents are not so sure that participation in study group activities can contribute to learning mathematics in class	
	Some respondents believe that collaborative activities (between teachers and experts) can help them carry out CPD activities, especially research activities and writing scientific papers.	
	Most respondents believe that CPD activities can provide reflective learning for students.	
	Some respondents believe that CPD activities will be much more useful, especially in the form of activities that teach junior high school mathematics content that can support teacher activities during the learning process.	

In the realm of belief, it is known that teachers' beliefs regarding efforts to implement CPD are good enough, belief in the form of business that teachers should need to do related to CPD, this can be in the form of efforts to raise personal funds in participating in training activities, seminars or efforts to improve educational qualifications both within and outside the school. overseas. Furthermore, regarding the good belief in improving educational qualifications, it was found that this belief was not applicable by several respondents, respondents argued that several obstacles faced them, including busy teaching hours and the retirement age of the teacher.

Meanwhile, the obstacles raised for producing scientific papers are related to a busy teaching schedule so that it is felt that it will not produce quality writing; making CAR work for promotion should be distinguished from academics, this is very burdensome for mathematics teachers while the quality of the work produced is not yet known. Another fact was found that young teachers (class III level) showed more enthusiasm for the belief in the importance of follow-up work by experts or related agencies. Furthermore, based on the belief in reflective activities in mathematics learning, information was obtained that teachers have the same belief regarding the importance of training to be able to direct and inspire teachers in providing more diverse learning in the learning process.

In the aspect of belief related to the form of collaborative activities, some mathematics teachers have good beliefs regarding their collaborative activities with their fellow mathematics teachers or experts in the form of CPD activities. This is because it is related to the importance of mutual encouragement between teachers. However, there are still fellow teachers who believe that collaborative activities will not be an effective learning platform for teachers. The facts found are also supported by information based on the research results of The Teaching Commission (Archibald et al., 2011) where of all research respondents, 42 percent said that professional development activities have not provided benefits for them.

D. CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that JKHS mathematics JHS teachers' belief in CPD is included in the belief category, meaning that JHS mathematics teachers in Bandar Lampung City have good beliefs about the benefits of CPD, efforts to implement CPD, and beliefs related to involvement in reflective and collaborative activities in each subsection. CPD activities. The fact is that there is no difference in the beliefs of CPD JHS mathematics teachers based on the level of their employment group as well.

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