The Motivation of Mathematics Teachers in Continuing Professional Development

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Abstract. Continuing Professional Development (CPD) of mathematics teachers is central to improve mathematics education quality. The implementation of mathematics teacher's CPD is influenced by teachers' motivation. This study examines the motivation of mathematics teachers in CPD’s implementation. Data were collected from 73 mathematics teachers in high school. Researchers collected quantitative and qualitative data simultaneously by using questionnaire and interview. The research results are (1) motivation of mathematics teachers in implementing CPD certainly vary; (2) they have various reasons for implementing CPD. From the analysis results obtained two aspects of mathematics teachers’ motivation in implementing CPD, namely: intrinsic factors and extrinsic factors. Intrinsic factors of mathematics teachers’ motivation in implementing CPD include expanding mathematical knowledge of teachers, improving teachers’ experience, improving personal quality in teaching, making teachers feel valued, and increasing job satisfaction. While extrinsic factors of mathematics teachers motivation in implementing CPD include increasing salary, appropriate working environment, preparation of changes, following government policies, improving students mathematics achievement, and develop the career. The results showed that intrinsic factors motivation has a major influence on the implementation of CPD. The most intrinsic factor that motivates mathematics teachers to implement CPD is expanding mathematical knowledge of teachers and improving personal quality in teaching.

1. Introduction

The quality of education continues to be the government's attention. The government continues to improve the quality of education with programs such as curriculum improvement as well as training for teachers. Teachers are an important part that affects the quality of education. Teachers are the most influential component of the creation of quality education processes and results [1]. So as to achieve good quality in the field of education, it is necessary to improve the quality of teachers. Teachers have many important tasks in educating their students. With many important tasks performed by teachers, it is necessary to have competencies that must be mastered by the teacher. Mathematics teacher's knowledge competence model called mathematics knowledge of teaching (MKT), which is based on teacher's pedagogical (PCK) and mathematics concepts (SMK) [2]. On the other hand, teacher competence includes mathematics content knowledge (MCK), mathematics pedagogical content
knowledge (MPCK), and general pedagogical knowledge (GPK) [3]. These competencies have an important role in the development of teaching profession.

The development of mathematics education is influenced by many factors. Teachers become one of the factors that influence the development of Mathematics Education. One of the standards of professional development is developing as a teacher of mathematics. The National Council of Teachers of Mathematics (NCTM) established standards for the professional development as follows: (a) knowing mathematics content and school mathematics, (b) knowing students as learners of mathematics, (c) knowing mathematics pedagogy, and (d) developing as a mathematics teacher [4]. Development activities should be tailored to the needs of the teacher in carrying out his profession. Teacher professional development is an attempt to equip teachers with knowledge and skills that can lead teachers to change the quality of teaching practice [5]. Classroom activities and teaching strategies that support students’ mental activity include appropriate tasks, representational tools, and practices that engage students to apply their knowledge [6].

The Indonesian government must improve the professional competence of teachers and principals because the results of student's outcomes in Indonesia are still relatively poor [7]. To improve the teacher's competence, the government held a Continuing Professional Development (CPD) program. Based on the data obtained from the Education Hall of Bantul district, the score of high school mathematics teacher's competency test obtained a high enough score of 78.34 whereas the national average score was 53.02. This article will discuss the motivation of high school mathematics teachers in implementing CPD and also the various reasons they implement it.

Continuing Professional Development (CPD) has been defined as formal and/or informal learning that leads to the enhancement of knowledge, skills and personal attributes necessary to carry out professional duties [8]. It is a career-long process in which educators finetune their teaching to meet student need [9]. Improving the teacher's knowledge and skills will have a positive impact on learning in the classroom. Professional Development is critical for improving and maintaining teacher quality and the effect flows on into the classroom [10]. Therefore CPD performed by mathematics teachers will have a positive impact on learning mathematics students in the classroom. The professional development of teachers is designed to improve the knowledge of mathematics teachers about mathematics and the skills of mathematics teachers to effectively teach mathematics to students [11].

The implementation of CPD has a wide range of activities. The types of CPD activities include: a) In-school workshop or seminar, b) Non-university accredited courses, c) University courses, d) Out-of-school workshops or seminars, e) Teacher networks or collaboratives, f) Conferences, g) Mentoring, coaching, lead teaching or observing peers, h) Committees or task forces, i) Teacher study groups, and j) Independent study [12]. In Indonesia, there are three components CPD’s implementation namely self-development, scientific publication, and innovation work [13]. Self-development activities are activities undertaken by teachers to improve the competence and professionalism. The components of self-development activities include a) functional training, and b) collectives' activity. The components of scientific publication activities include a) presentations on scientific forums, b) scientific publications of research results or innovative ideas in the field of formal education, and c) publication of textbooks, textbooks, and teacher guides. Furthermore, the components of innovative work activities include: a) finding appropriate technology; b) find or create artwork; c) create or modify a instructional package, visual aid, or practicum; and d) following the development of the preparation of standards, guidelines, exercise, etc. The role of mathematics teacher’s CPD in mathematics education is shown in the following diagram.
Figure 1. The conceptual framework for studying the role of CPD of Mathematics Teachers in Mathematics Education (adapted from Desimone [14]).

The conceptual framework in Figure 1 appears that the improvement of Mathematics Education is influenced by the implementation of mathematics teacher’s CPD. Teachers who have implemented CPD as a form of effort to provide opportunities for continuous learning. The accumulation of overall opportunities has positive implications for improving the quality of teaching practice so that it has a good impact on the quality of education [15], especially in mathematics education. Increased intensity CPD also has an impact on improving student achievement [16].

Each teacher has many different motivations in implementing CPD. The teacher's motivation is influenced by many factors. Alam and Farid argue that amongst those factors a few are: a) personal/social factors, b) classroom environment, c) socioeconomic status, d) student's behavior, e) examination stress, f) rewards/incentives, g) self-confidence/personality of teacher etc [17]. Imusah and Joseph also add that there are two factors that influence teacher's motivation that is the extrinsic factor and intrinsic factor. Extrinsic factors include excellent payroll, the discipline of the pupil, and good working condition status. While intrinsic factors that influence teacher motivation include self-development and professional development, as well as the circumstances of the work environment [18]. The reasons for the CPD implementation of the teachers include, a) improving individual teacher work skills; b) broaden the teacher's experience for career development or promotion; c) develop the professional knowledge and understanding of teachers individually; d) enhance the personal education or general education of an individual; e) make teachers feel valued; f) enhance work satisfaction; g) enhance a positive outlook on employment; h) allow teachers to anticipate and be prepared for change; i) clarify the whole school or government policy [19]. According to Bassett-Jones and Lloyd, motivation depends on one of two views of human nature: (1) humans are essentially lazy and require external stimuli; or (2) true motivation can be stimulated internally [20]. Many motivational theories are developed in the context of authoritarian and hierarchical management and thus tend towards external approaches [20].

From some of the above definition, it can be concluded that the motivation of teachers in implementing CPD includes intrinsic and extrinsic factors. Intrinsic factors of mathematics teacher motivation in implementing CPD include expanding mathematical knowledge of teacher, improving teacher experience, improving personal quality in teaching, making teacher feel valued, and increasing job satisfaction. While extrinsic factors of mathematics teacher motivation in implementing CPD include increasing salary, appropriate working environment, preparation of changes, following government policies, improving students mathematics achievement, and develop the career.
2. Methods
This study examines the motivation of mathematics teachers in CPD’s implementation. The type of this research is a descriptive research type. The data obtained will be collected, analyzed, and integrated through quantitative and qualitative methods (mixed method). Quantitative research result data collected through survey method using a questionnaire to know the respondent answer about what motivation of mathematics teacher in executing CPD. Furthermore, interviews were conducted with mathematics teachers to deepen the information about their motivation in implementing CPD.

The research participants are all of civil servant mathematics teachers in Bantul, Yogyakarta. There are 73 mathematics teachers from 24 senior high schools with population age range 33-59 year. They have different teaching experiences. Their long of teaching experience is presented in Table 1.

| The long of teaching experience (year) | Number of teacher |
|---------------------------------------|-------------------|
| 9 – 13                                | 1                 |
| 14 – 18                               | 8                 |
| 19 – 23                               | 16                |
| 24 – 28                               | 29                |
| 29 – 33                               | 17                |
| 34 – 38                               | 2                 |

Data collection techniques in this study using non-test in the form of motivation questionnaire implementation of CPD. The questionnaire using a Likert scale to see how the level of constraints experienced by teachers. The result data of the research questionnaire in quantitative research is followed up qualitatively through an interview.

3. Result and Discussion
The motivation of high school mathematics teacher in carrying out CPD shows minimum score 93 and maximum score 128. Average teacher motivation score is 108.96 with standard deviation 10.05. Data from 73 teachers obtained the result in Figure 2. No teacher has very low motivation. The most factor that influence teacher motivation is to expanding mathematical knowledge of teacher and improving personal quality in teaching. Many mathematics teachers have difficulties in understanding the concepts, language interpretations, algorithms, and computational skills so that there is a need to improve the quality of education, especially to improve teachers ability in solving mathematical problems related to their professional abilities [21]. CPD can improve teacher’s knowledge and skills that will lead to improvements in classroom practice, and improving classroom practice, in turn, will improve student achievement and learning [22].

![Figure 2. Perccentation of Mathematics teacher’s motivation in CPD.](image-url)
The motivation of high school mathematics teacher in CPD’s implementation is influenced by intrinsic and extrinsic factors. Intrinsic factors of mathematics teacher’s motivation in implementing CPD include expanding mathematical knowledge of teacher, improving teachers’ experience, improving personal quality in teaching, making teachers feel valued, and increasing job satisfaction. While extrinsic factors of mathematics teachers motivation in implementing CPD include increasing salary, appropriate working environment, preparation of changes, following government policies, improving students mathematics achievement, and develop the career. The results of this study are presented in Figure 3 and presented deeply in Figure 4.

Figure 3. Mathematics teacher’s motivation in CPD.

One of the motivations of high school mathematics teachers in implementing CPD is to expand knowledge. The CPD concept involves teachers in long-career to develop their skills and knowledge. Mathematics is an abstract material for students so many students have trouble understanding it. Based on the research results, students had difficulties in answering the four difficult items of the mathematics national exam: 1) the lack of conceptual understanding, calculating, selecting information, 2) being misled by the distracters, 3) being unaccustomed to answering complex and non-integers test items and 4) answering the contextual test items that have been presented in the form of figures or narrative texts. Another study also mentioned that students’ difficulties were caused by the fact that the students had not been able to understand the narrative test items and to determine the results. When teachers experience such situations, teachers should expand their knowledge to make students understand. For example, the derivative material is one of the mathematics materials learned in high school. To deepen students' understanding the concept of this material, many teachers choose to re-explain or provide more examples. In fact, it is also not enough. From this study, the teacher experiences when teaching the abstract mathematical material, they are sometimes asked by students about the benefits of studying the material. From the teaching experience, the teacher should be able to give a good explanation to the students. Most teachers tend to use distance, velocity, and acceleration as an application of derivatives. Actually, there is still much use of the derivative material in everyday life that can motivate students to learn. Thus, it can occur to improve the quality of self-teachers in teaching which will also impact on student’s mathematics achievement. A teacher would be satisfied if the students they lead can achieve good achievement. International research confirms that teacher quality is a key factor in student achievement, and is a teacher of quality. Teachers can also improve student mathematics achievement through the development of Higher Order Thinking Skills (HOTS) students so students have the critical power and creativity that can be used to solve problems in everyday life. Although the teacher's knowledge about HOTS, the
ability to improve HOTS students, solve HOTS-based problems, and HOTS measurements students are still low, but the teacher has understood the importance of HOTS and taught it using various innovative learning models [28]. The use of software in learning can also help students understand and improve their skills [29]. The use of software in learning has begun to be facilitated because many schools began to provide standard electronic equipment as a result of the application of computer-based national examination (CBNE) [30].

![Figure 4. Mathematics teacher’s motivation agreement at CPD.](image)

Every teacher, including a mathematics teacher, must implement the CPD. The Ministry of Education in Indonesia has set policies on teacher’s CPD. So this government policy is also a motivation for mathematics teachers to implement the CPD. The Indonesian Ministry of Education stipulates that the teacher's ongoing professional development includes three things: self-development, scientific publications, and innovative work. On implementation in the field, many teachers actually claim to have difficulty maximizing various demands from the government. This is one of them influenced by the dense schedule of teaching hours teachers in schools, so they are difficult to take the time to implement the CPD's activities. Seeing the density of teaching hours, many teachers expect the government to immediately hire mathematics teachers of civil servants, so they can optimize their time to teach in schools as well as develop their own competencies through out-of-school seminars or training. Not only that, many mathematics teachers are hoping the government in their districts to implement cooperation programs with a university so that many math teachers can continue higher education together more easily. This program has been implemented by the district government more
than 10 years ago. However, the program is no longer executed. Therefore, if there are teachers who want to continue their education, they do permission to study to their principal. And it is only done by a small number of teachers only. Though extending education to a higher level is a strategy for self-development of math teachers [31].

Many other extrinsic motivations affect the implementation of CPD. One of them, teachers must always be ready to face many changes in education. For example, curriculum changes in Indonesia are still being monitored and evaluated. Teacher dominates communication in Indonesia's mathematics classroom. Only low percentage of mathematical problems can be considered to be of high complexity [7]. Because of this, teachers are motivated to attend the teacher training activities included in the CPD in order to participate in the change of mathematics learning in Indonesia. For example, there are problems related to teaching high school mathematics concepts. The incompatibility of the order of material in the mathematical prerequisites and physical material causes the teaching and learning process to be hampered. Therefore, one of the strategies carried out by physics teachers is to individually teach mathematics material as the first prerequisite and to make modules collaboratively with mathematics teachers [32]. Constraints are not only on high school math teachers. At the elementary level, teachers have difficulty in choosing the right technique, creating good instruments and formulating clear assessment criteria in thematic learning [33]. At the 2013 curriculum, teachers are still found to have difficulties in developing attitude instruments, applying authentic assessments, formulating indicators, designing assessment rubrics for skills, and collecting scores from various measurement techniques [34]. The test assessment does not only use paper and pencil tests (PPT), but computer-based test (CBT) has also been developed [35]. Therefore, teachers must always develop their professionalism in order to deal with various education system developments.

Teacher motivation in implementing CPD is also to enhance their career [36]. Mathematics teachers active in various training and teacher forums will have many opportunities to be involved as instructor teachers who are tasked with teaching other mathematics teachers who still have low teacher competence. In addition, an active mathematics teacher may also have the opportunity to take the test of being a principal. From the results of this study, within five years there are several mathematics teachers who are appointed principals. This certainly becomes the motivation of other mathematics teachers to raise his career. It also shows that the environment is also influential in the implementation of teacher CPD. Mathematics teachers in each district have a forum that routinely performs activities. Such activities usually contain training on mathematics learning. The place of execution of activities moves from one school to another. Distant school distance sometimes also lowers the motivation of teachers to follow these activities. But so far, more than 50% of mathematics teachers are always active in the activity. After further investigation, it turns out that many things that make mathematics teachers actively follow the forum. They can share problems and solutions in teaching mathematics. In addition, they can also work with other teachers to arrange various instructional package.

Another factor affecting CPD’s implementation is teacher salaries [22, 36]. From the results of this study, not so many teachers are motivated to implement the CPD to increase the salary. This is because teacher salaries have been upgraded by the teacher certification program that has taken place [7]. Most of the mathematics teachers of civil servants in this study have been certified so that they do not have a problem with the cost to implement the CPD. But there is no denying that there are also teachers who object to using their salary for seminar or training expenses.

4. Conclusion
High school mathematics teachers have a variety of motivations to implement CPD. The motivation is influenced by intrinsic and extrinsic factors. The intrinsic factors that motivate teachers include expanding mathematical knowledge of teachers, improving teacher’s experience, improving personal quality in teaching, making teachers feel valued, and increasing job satisfaction. While extrinsic factors of mathematics teachers motivation in implementing CPD include increasing salary, appropriate working environment, preparation of changes, following government policies, improving students mathematics achievement, and develop the career.
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