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Strengthening the Primary Mathematics Teacher's Self-Efficacy Through Online Professional Learning Communities

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Abstract: The perseverance, characteristics, and competencies of teachers can enhance the professional quality, motivation, and attitude of mathematics teachers. Recognizing the significance of professional development and personal growth for elementary school mathematics teachers, a Professional Learning Community (PLC) was implemented. This study aims to examine the impact of online PLC on teachers' self-efficacy in teaching mathematics. The research method used was mixed methods, quantitative and qualitative research. Data was collected by survey and interviews with 16 6th-grade mathematics teachers at Lentera Harapan School (SLH) in Indonesia. The questionnaire data were analysed by the Wilcoxon test, and the interview results were analysed qualitatively. The results find that after being given online PLC, there was a significant increase in teacher self-efficacy in teaching mathematics. Teachers respond positively to this activity because they can collaborate with other teachers from various elementary schools and support each other in their professional development. Teachers enjoyed the session of sharing experiences in overcoming learning difficulties faced by students in class. Thus, teachers' self-efficacy can be strengthened by ongoing online PLC activities that help teachers develop as professionals and provide optimal support for students' learning. By continuing to enhance teachers' self-efficacy, they may provide the best service for students and help students succeed in learning.

Keywords: self-efficacy, professional learning communities, primary mathematics teachers.

▪ INTRODUCTION

Education is the main pillar that needs to be improved to move towards a developed Indonesia. For advanced education, teachers need to have a heart to teach and adequate teaching skills. However, the current challenge in Indonesian education is that the teaching profession is not yet promising, and not many people are interested in becoming a teacher. To achieve a developed Indonesia, national education is continuously developed and follows many changes. Considering the importance of change in education, teachers also need to be equipped with sustainable self-development by Professional Learning Communities (PLCs), so that they can perform their duties and responsibilities, along with many other responsibilities in educating children.

Mathematics is a subject that is always studied at every level of education. Learning mathematics needs to start from childhood because it builds a foundation for logical, critical, and analytical thinking for students and requires the whole role of teachers and teachers' self-confidence in mathematics teaching skills. The teacher's responsibility is not only to teach the concept and manage the classroom, but also to guide students in obtaining adequate knowledge. Teachers need to be equipped with adequate mastery of mathematics concepts to support teachers' self-efficacy in teaching mathematics. In fact,

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in SLH Indonesia, many teachers are new teachers, and their teaching load is quite dense. In addition, the educational background of mathematics teachers in elementary schools is not only graduates of mathematics education study programs or elementary school teacher education programs that focus on teaching mathematics, but also graduates from other majors. The educational background of teachers will affect the quality of teaching (Mai, 2022; González-Martín, 2020). Moreover, it will also affect the teacher's self-efficacy in teaching mathematics. However, the tenacity, characteristics, and competence of teachers can build professional qualities, motivation, and an extraordinary attitude of mathematics teachers (Liu, 2024; Macaro, 2020). Consequently, by assessing these needs and conditions, PLCs are implemented, aimed at enhancing the competence and self-efficacy of primary mathematics teachers. PLCs are expected to be agents of change, improve teachers' professional identities, increase teachers' self-efficacy and perception, strengthen pedagogical skills, and foster critical dialogue (Julca-Vásquez, 2024; Kung, 2024; Cabezas, 2021).

Self-efficacy is important for a teacher because it affects their general orientation towards teaching, specific behaviors and practices in the classroom, and even students' academic achievement (Alibakhshi, 2020; Woodcock, 2022; Lauermann, 2021). Burić (2020) and Perera (2020) found that teachers' self-efficacy has a positive relationship with the three dimensions of teaching quality, and teaching quality has a positive relationship with students' motivational beliefs. Improvement of teacher self-efficacy is important for improving the quality of education (Li, 2025). In addition, the belief in teachers' self-efficacy encourages closeness and reduces conflict, so it needs to be developed and utilized to improve the quality of relationships in the classroom from a social cognitive perspective (Hajovsky, 2020; San Martin et al., 2021; Yada, 2022).

Self-efficacy is a person's belief in his or her abilities (Bandura, 1997). Self-efficacy and teachers' mathematical knowledge will affect student learning in problem-solving, cognitive development, and students' mathematical anxiety (Kaskens, 2020; Li, 2021; Teig, 2019; Voica, 2020). The research results of Toropova (2019) found that teachers with high self-efficacy provide higher teaching quality. Teacher quality's effect on student achievement and student perception of teaching quality. High self-efficacy will influence the implementation of more innovative teaching, maintaining a positive attitude and resilience in facing teaching challenges, and creating a supportive learning environment. Moreover, it will possibly lead to students' positive attitude in mathematics, being more actively involved in learning mathematics, and finally achieving good learning outcomes. Besides the values of the teacher, self-efficacy is also influenced by teaching experience, the teaching context, and mastery of the material, and the classroom also affects the teacher's self-efficacy (Wray, 2022; Barni, 2019).

Several factors that influence teacher self-efficacy are successful experiences teaching mathematics, for example having successfully improved students' understanding and achievement; the presence of peers who are role models and successful in teaching mathematics, thus inspiring and increasing self-confidence and empowering them also to succeed; verbal persuasion, namely support, motivation, and positive feedback from the principal and colleagues that can increase teachers' confidence in their teaching abilities; and physiological and emotional conditions (Sun, 2025; Pov, 2024; Fackler, 2021; Gál, 2025). If teachers are healthy both physically and emotionally, they will have a good self-efficacy tendency. The relevant and good-quality training and professional development

through PLCs allow teachers to gain new knowledge and skills and increase their confidence in teaching.

PLCs provide a collaborative space for teachers to share best practices in teaching, to reflect on the learning process, and to receive moral and professional support. Teacher collaboration can improve teaching practices, teacher development, and organizational learning and have an impact on teachers' effectiveness in teaching (Park, 2025; Hargreaves, 2019). Through participating in PLCs, teachers are expected to master teaching materials, improve pedagogical strategies, and strengthen their self-confidence to manage their classroom and deliver materials meaningfully. Through this approach, teachers' self-efficacy develops not only from individual experiences but also from social interactions and continuous collective learning. PLCs provide opportunities for teachers to grow professionally and personally, not only in teaching techniques but also in confidence in delivering mathematics material.

This PLC addresses mathematics teaching training using a concrete-image-abstract approach, providing a CPA-based handbook as support, enabling teachers to implement this approach effectively. Furthermore, PLCs provide a learning environment for teachers by connecting them at the same level to form a supportive community through a 24-hour online platform. They have never been trained in this mathematics teaching approach, even during their schooling. Participants are trained on how to apply it, and also each of them shares their experiences with implementation. The textbook based on the CPA provided structured, complete information that was systematic and easier for teachers to have a deep understand. The research results of Bragg (2021) and Goode (2020) show that online professional development has an impact on improving content mastery, confidence in teaching, teacher self-efficacy, and classroom teaching practices. Through these PLCs, it is expected to increase the teacher’s self-efficacy in teaching mathematics.

Development of new technology also affects education; that is why professional development is available online. Providing online support platforms that are already available at SLH, such as Microsoft Teams, makes it easier to implement online PLCs. Besides, the head office of SLH helps organize and facilitate various trainings for SLH teachers in Indonesia to meet the needs of teachers' professionalism. These PLCs are carried out simultaneously according to the level and the subject taught, considering that teachers can freely learn, discuss, and share experiences and their challenges, and discuss the best solution for the challenges they have faced in the classroom due to the same culture and characteristics of students.

The implementation of online PLCs makes it easier to discuss without being physically present at the same place, because it is not easy to gather teachers for on-site training. Moreover, the material is accessible, and recordings help them to relearn, providing opportunities to deepen content understanding and reach a wider audience for collaboration. The results of research by Chen (2020) show that online professional development with analysis videos not only has a significant and sustained effect on teachers' confidence and self-efficacy but also significantly affects their teaching behavior in the classroom. In addition, Aldahmash (2019) and Gardner (2019) found that involving teachers in professional development in integrated STEM increases teachers' self-efficacy and makes productive changes in their classroom practice, making it necessary to engage in ongoing professional development, which can be within a professional community.

Considering teachers' educational backgrounds, teaching experience, and other factors that influence them, it is necessary to provide adequate professional training and development and a supportive professional environment to achieve an environment in which they support each other to contribute to the development of Indonesian education. Based on the above-mentioned background, the purpose of this study is to see the impact of online professional learning communities on teachers' self-efficacy in teaching mathematics. By answering the research question, is there a significant difference in mathematics teachers' self-efficacy before and after participating in online PLCs? What factors in online PLCs contribute most to increasing teachers' self-efficacy in teaching mathematics?

▪ METHOD

Participants

Data was collected by a purposive sampling technique from 16 6th-grade mathematics teachers as participants, whose population is all the mathematics teachers at SLH in Indonesia. All teachers who teach in the 6th-grade elementary SLH school are new and experienced teachers who graduated from Pelita Harapan University. Every year, they will receive new graduates to teach mathematics, even though their education background is from various departments. The demographics of the sample can be seen in Table 1.

Table 1. Demographics of the sample

Category		n	%
Graduates of study programs	Primary Education	12	75
	Mathematics Education	2	12.5
	Chemistry Education	1	6.25
	Educational Technology	1	6.25
Gender	Female	13	81.25
	Male	3	18.75
Last Education	Undergraduate	15	93.75
	Magister	1	6.25
Teaching Experience	0-3 years	12	75
	4-7 years	1	6.25
	8-11 years	1	6.25
	>12 years	2	12.5

The background education of teachers will influence their teaching practice, especially in the mastery of mathematics concepts and communication in delivering learning materials to students with various levels of difficulty. Students come from various regions in Indonesia, and not all students get sufficient support from their parents, and have strong motivation to learn. Therefore, teachers often encounter students with low mathematical abilities, so teachers need to adjust learning objectives to students' mathematical abilities.

Research Design and Procedures

The research method used was mixed methods, quantitative and qualitative research, by comparing teachers' self-efficacy before and after being given online PLCs.

This aims to evaluate the impact of it. First, the teacher's self-efficacy questionnaire instrument and interview instrument were prepared, and then the experts validated and measured the reliability of the questionnaire instruments. After the questionnaire is valid and reliable, the self-efficacy data of the teachers are collected before they are given online PLCs. After that, PLCs are given online for one year. Online PLCs are carried out every month for two hours during the professional development schedule of teachers throughout SLH in Indonesia, who are guided by researchers as guest speakers. After the implementation of PLCs, the teacher's self-efficacy was then measured and compared with previous data to evaluate the impact of the PLCs that had been carried out. The activities carried out were adjusted to the needs of primary mathematics teachers, including the context of mastering the teacher's mathematics material and the need to overcome students' difficulties in learning mathematics.

Instrument

The questionnaire is based on the teacher's self-efficacy indicators and was adopted from the Mathematics Teaching Efficacy Belief Instrument (MTEBI) (Enochs & Riggs, 1990). Validation was done by expert validity and construct validity. Reliability test with Cronbach's alpha, with a reliability value of 0.747. The indicators of teacher self-efficacy in teaching mathematics include 1) having an optimistic view and confidence in one's abilities. It was an optimistic belief in mastering mathematics. With high self-efficacy in teaching mathematics, teachers are confident that they understand the concepts and materials they teach. 2) Confidence in success in facing obstacles. It is the teacher's belief in themselves that they have successfully overcome obstacles that arise in the teaching process, both in the material and problems in other classes. 3) Confidence in the ability to plan task completion. Teachers need to help students learn to achieve the mathematics learning outcomes that have been designed. 4) Consistency in doing assignments well with tenacity and perseverance. Teachers learn to strive for how students can understand and present good mathematics learning, and diligently develop mathematics teaching skills. 5) Responding to diverse conditions and situations well and positively. Teachers can overcome problems and challenges in teaching based on previous experience. (Bandura, 1997; Sumartini, 2020; Karakus, 2021; Teng, 2024; Tschannen-Moran, 1998).

Data Analysis

The data was collected by questionnaires and teacher interviews in the beginning and after the PLCs. This analysis provides an overview of the factors that affect teachers' self-efficacy and provides insight into how PLCs can be more effective in supporting the development of teacher confidence. After the data is collected, the questionnaire data is tested with SPSS using the non-parametric test, the Wilcoxon test. The closed interview data were analyzed by descriptive qualitative coding of the theme based on a self-efficacy indicator. This is used to look in-depth at the impact of PLCs on teacher self-efficacy.

▪ RESULT AND DISSCUSSION

Online PLCs Implementation

The following are the results of the research based on the results of SPSS:

Table 2. The results of the mean ranks and the wilcoxon test

Items	Efficacy-Before	Efficacy-After

Median	41.50	44.00
Interquartile range	8	11
Z	-3.521[b] (based on negative ranks)	
Asymp. Sig. (2-tailed)	.000	

Based on Table 2 indicates that there are significant changes in teacher self-efficacy before and after online PLCs. The value of Z is 3.521, and the p-value of the Wilcoxon test is 0.00, which means less than 0.05. This shows that the null hypothesis is rejected and leads to teacher self-efficacy before and after online PLCs being different. This means that after being given online PLCs, there is a significant increase in teacher self-efficacy in teaching mathematics. These findings are in line with the results of studies by Kelley (2020) and Liang (2022) that show teachers' self-efficacy increases after PLCs engage in practice as well as use knowledge to solve real problems, and teacher self-efficacy has a positive and significant relationship with teacher work engagement. In addition, Zonoubi (2017) found that teacher self-efficacy is increased by the implementation of PLCs in both beginners and experienced English teachers. The self-efficacy of experienced teachers increases in terms of using innovative teaching strategies, and the self-efficacy of novice teachers is improving in their classroom management, their autonomy, and their perceived language proficiency. Moreover, Wang (2023) and Liu (2023) found in their research that a good online learning community can increase teachers' efficacy, which has an impact on teacher learning achievement. The enhancement of the teachers' self-efficacy is illustrated in the following diagram:

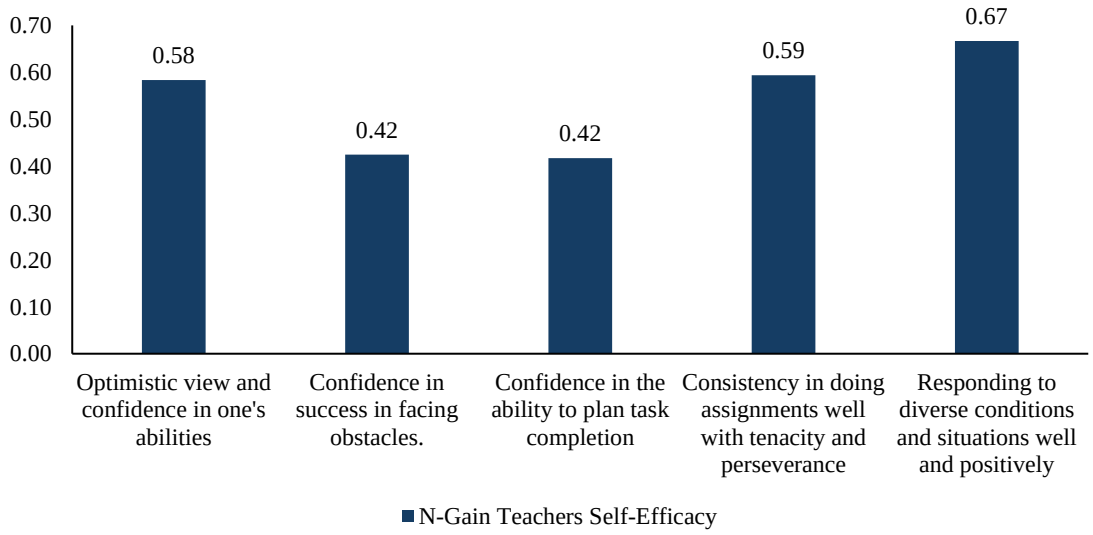

Figure 1. Comparison of self-efficacy

Based on Figure 1, there is an enhanced median of teachers' self-efficacy after teachers join the PLCs, according to the N-gain of each indicator. Discussing with colleagues helps them to face challenges in their class and helps address students' learning difficulties. When participants were asked, "What was most helpful during PLCs?" Teacher A said, "The ideas shared by the teachers when they implemented CPA in their classes helped me overcome obstacles in the classroom." Teacher B also said, "The

sharing sessions from senior teachers added new insights that I had never thought of." Zheng (2021) found that reflective discussion of teachers in groups and common goals, which is focused on students' mathematics learning, has significantly increased teachers' self-efficacy. The teacher's commitment to student learning is visible. Teachers are supported by the modules used in PLCs as they serve as a guide for teachers when teaching mathematics that is appropriate to the stages of students' development. Teacher C said, "The explanation from the speaker was beneficial, and the CPA module was a guidebook.

During the implementation of PLCs, teachers learned together how to teach elementary mathematics with a concrete, pictorial, abstract (CPA) approach. Through this approach, teachers are trained to teach mathematics in accordance with the stages of students' development. How mathematics is introduced in a real context is then illustrated in pictorial form, and after that, developed in an abstract form. Through CPA, it is expected can improve students' thinking processes and help overcome students' learning difficulties because many cannot understand abstract mathematics. In addition, teachers are also given modules on how to implement CPA to help them master the mathematics concepts well and guide them in its application. During the implementation of PLCs for one year, teachers also began to apply it in their learning. In PLCs, teachers can share their experiences on the challenges and strengths of their implementation in their classrooms. PLCs provide a space for teachers to collaborate in providing the best learning experience for their mathematics learning. Teachers share and share in solving problems they face in teaching. In addition, recordings are also provided to assist teachers in mastering mathematics materials. PLCs also provide open discussion opportunities for teachers in teaching students to be more proficient in the material, including deepening teachers' mathematical knowledge. Teachers receive strong support during PLCs and various learning methods and media that can make it easier for students to understand concepts according to their developmental stages.

PLCs also provide opportunities to teachers in discussing and mastering teaching material, including teachers' in-depth mathematical knowledge. Teachers receive strong support during PLCs and various methods and learning media that can facilitate students' understanding of concepts according to their developmental stages. One of the teachers (Teacher D) said, "Insight into teaching methods, preparing assignments and learning methods, as well as an in-depth understanding of material from discussions with teachers." Teachers realize the importance of PLCs and suggest that schools continue to carry out continuous PLCs online to help teachers develop as teaching professionals and provide support for students to be able to learn optimally by continuing to grow teacher self-efficacy so that teachers are more able to provide the best service for students, which can ultimately help students succeed in learning.

Effectiveness of Online PLCs

Online PLCs foster confidence in teachers' abilities to overcome students' math learning difficulties and provide chances in terms of overcoming their limitations in teaching mathematics classes. Teachers find that some of the students have conceptual difficulties, and teachers are helped by the modules used in mathematics PLCs because they are teachers' guides when teaching mathematics at the stages of student development. Even though teachers have limited time and busy schedules, teachers look for various

additional information that is appropriate to the training material so that students can understand the material more easily. PLCs provide much insight and are a solution in terms of teaching abstract material that is quite abstract for the 6th-grade elementary school. It is hoped that students who are slow learners can be helped by CPA methods, even though teachers struggle with fast learners. They also understand a lot about the stages of mathematical thinking of students by providing concrete concepts as a basis for them to understand pictorial and abstract forms. Teachers are more adept at combining various teaching methods to adjust explanations to the learning needs of students who have difficulty learning.

Before joining PLCs, teachers had made various efforts in teaching the material. However, there were still some students who could not understand the material. They were also not sure that they could overcome children's difficulties in learning math because some children already considered mathematics difficult, so it needed to be approached first to be able to bring children to love mathematics. Teachers are still constrained in thinking of unique or interesting ways when teaching mathematics. The teacher's disbelief is caused because not all students can follow every lesson that is taught well. Some students need extra time to learn because their ability to grasp and learning styles are different. The teacher gives extra hours to some students who are slower to understand the concept, for example, during break hours or while waiting for pick-ups. The teacher teaches the material slowly and gradually. Before PLCs were carried out, teachers had tried to give maximum effort and tried various ways to help students in learning, for example, learning from YouTube and asking the senior teachers in mathematics who understood the context of the lesson.

Based on teachers' confidence in their mathematical abilities and their belief in teaching mathematics aspects, PLCs have a significant influence because teachers' mathematical skills have developed. The material can help students because the basic concepts of mathematics are introduced, and it is easy to understand. They do not memorize, but also become challenged and think critically. The availability of various access to teaching resources on the internet adds to teachers' confidence that their math skills and teaching math will be better. Teachers are also confident because they can communicate mathematical concepts in a language that is easy for students to understand.

About teachers' confidence in helping students achieve math learning goals as well as teaching tasks, PLCs increase teachers' confidence in these abilities. This can be seen from every student achieving better learning outcomes. Teachers receive strong support during PLCs and various learning methods and media that can make it easier for students to understand concepts according to their stages of development, and enjoy learning with other teachers more. Teachers can explain better mathematical concepts in simple language and have good time management to achieve learning goals. Teachers do their best to help students understand the concepts and provide enough space for students to ask questions by initially inviting students to understand the concept with a concrete example approach, directing students to try difficult things with enough assistance, training students to recognize parts that are not understood, and providing assignments according to students' abilities, so that they can complete tasks well. Teachers have a sense of responsibility for student success. Good responsibility can also be carried out well if you work wholeheartedly.

When considering the development of self-efficacy among teachers with different educational backgrounds, the development of teachers' self-efficacy who graduate from non-mathematics education is higher than mathematics education graduates, with averages of 7.4 and 3, respectively. This PLC has a significant impact on teachers who are graduates of non-mathematics education. Based on the interview results, Teacher E, who graduated from a non-mathematics education background, said, "I always try to reinforce the concept first before teaching. So, I usually studied first before conveying it to students. So, I believe that the concepts I teach do not mislead students." Moreover, a teacher, F, who graduated from mathematics education, stated, "In my opinion, my math skills are good because I keep trying to understand the simplest basic concepts of math material. Now, I want to teach these basic concepts to students because they become the foundation for students in developing students understanding of mathematical thinking." Teachers who graduate from mathematics education and master elementary mathematics content will make it easier for them to prepare for teaching well, for example, getting used to re-reading important concepts of material before being taught, thinking about every possible difficulty that students will face, and trying to be consistent in teaching a concept. This condition makes teachers have high confidence in their mastery of the material and teaches well. PLCs are needed to support teachers' self-efficacy, especially for teachers without a mathematics education background. PLCs with the implementation of CPA are also very helpful for teachers in developing mathematics skills and teaching them.

Before PLCs, teachers also had confidence in their ability to help students achieve their mathematics learning goals and teaching tasks. The learning objectives that are arranged according to the context of the class determine a timeline that will help in completing each task that must be done on time. Usually, teachers inform students of the basic competencies to be achieved, emphasizing their usefulness for students, so that they can understand the learning objectives to be achieved. If students have difficulties, they will try to help each student understand the concept. Teachers are confident and, with all their heart, help students learn and understand mathematics. As much as possible, they bring mathematics lessons in a fun way so that children can achieve their learning goals and want to learn mathematics. They are confident that they can help every student who has difficulty learning, even though it is slow and not all can be understood and solved immediately by every student. Teachers provide homework, questions, and answers in class and extra hours of study to relearn material that is still not understood because students who are less able to understand the material will find it challenging to achieve learning goals. However, looking at the condition of children in some schools, some teachers have difficulties. Hence, they feel less confident that they will achieve their learning goals because the level of understanding of children's abstract material is quite tricky.

About the teacher's belief in consistency, tenacity, and perseverance in facing challenges, the teacher feels confident because they are constantly learning to develop their abilities, and there needs to be consistency, tenacity, and perseverance. In addition, teachers need to learn more about delivering material, making questions that suit students' needs, and finding other creative ways to learn. In class, some students have good mathematical skills, so teachers often ask critical questions about mathematical concepts. Teachers need to be diligent to learn and teaching mathematics, but not a few of them still

very difficult in mathematics. Teachers consistently support each student in the process of forming a mathematical thinking process and try to reach students one by one. By inviting students who understand the material faster to become fellow teachers in teaching their friends who are struggling, teaching them how to teach their friends, instead of directly giving answers. Every student needs to be reached and paid attention to the extent of his understanding and what his difficulties are, and he needs to be guided to overcome his difficulties. During the process, it can also be seen that students begin to open up about their difficulties and are sensitive to the constraints of their peers. An impactful teacher must have confidence and tenacity in their work and do all things for God, serving wholeheartedly and having an impact on students. Besides, a sense of responsibility and affection for children is needed. Each teacher must have expectations so that the children who are taught can understand their learning.

Many teachers already have experience in teaching mathematics, and this experience influences their teaching of mathematics. However, these PLCs help teachers to be able to teach mathematics based on the development stage. Teachers can help children to understand each lesson gradually, even though previous teachers had difficulties because they were teaching without a method that considered the primary student stage of thinking development. It helps teachers to know what needs to be improved and developed and become teachers so that they do not experience the same mistakes in the future, and further hone their mathematics teaching skills. It is in line with the findings of Podolsky (2019), who found that teaching experience has a positive relationship with improving student learning outcomes. The teacher's experience makes it possible to achieve a better measure of success in addition to test scores. Sharing experiences from colleagues who have successfully taught mathematics can inspire and increase teachers' confidence that they can help students learn successfully (Sun, 2025; Pov, 2024; Fackler, 2021; Gál, 2025). The effect of teachers' educational background and limited experience on the quality of learning can be minimized with these PLCs (Mai, 2022; González-Martín, 2020).

Teachers can apply ideas, types of assignments, and learning strategies that were interesting and successful in previous teaching. Even though the previous experience still found many students to have difficulty applying the formula given in the story questions, teachers were challenged to think of new learning methods. They began to consistently provide interesting and challenging questions that were tailored to the learning material and train students' ways of thinking according to the needs of the concrete-pictorial-abstract material. From this habit, students increasingly enjoy and look forward to learning mathematics. Teachers need to master the material well, because when teachers do not master certain materials, it will be difficult to convey the material, especially in the context of using language that is easy to understand. If the teacher has doubts, then the feeling of doubt is transferred to the students, which can cause students to get confused. However, there are also experiences of teachers who have taught the wrong mathematical concepts and realized how important it is for the teacher to learn and understand the material first, so that what is conveyed does not mislead students. In contrast to teachers who graduate from mathematics education study programs and have taught, it helps to position themselves as students so that teachers try to make learning enjoyable and feel very happy to process and think critically together with children in the classroom, according to their needs and level of understanding.

These online PLCs are carried out based on the need for teachers for richer debriefing in teaching mathematics, in accordance with the needs of teachers and school conditions.. The support of the schedule professional development organized by the head office of SLH enables this PLC to run well, so that it only needs additional experts to enrich this PLC. The teachers' high willingness to learn and the desire to provide the best for students are also supporting factors. However, the limitations of the internet network in certain areas, such as Papua Interior, were found several times to be less precise but not too impactful. The time difference between the western, central, and eastern parts of Indonesia also limited them from discussing whether they needed more time.

Some of the teachers have no experience as teachers in the classroom, and some previous teachers taught mathematics in the abstract without using concrete objects at the beginning so that some students still have difficulties. Teachers try to use concrete objects first so that students understand basic mathematical concepts faster; indeed, it is still difficult because children find it difficult to imagine abstract material/problems.

The limitations of this study include the small sample size; teachers can join other PLCs because an elementary school mathematics teacher can teach mathematics in several classes and subjects. This also makes it challenging to create a control group because it is limited to one SLH school spread throughout Indonesia, where all elementary school mathematics teachers receive the same program.

▪ CONCLUSION

There was a significant increase in teacher self-efficacy in teaching mathematics after being given online PLCs. Participating in online PLCs, teachers' confidence increased in their abilities to address students' difficulties in learning mathematics. PLCs bring a change in how teachers handle their limitations in teaching math classes. The ease of discussing and collaborating with colleagues greatly assists teachers in their growth. They become more consistent, resilient, and diligent in facing challenges, always seeking learning information through materials and videos shared during PLCs. However, they still need to spend more time to learn the difficult parts. Teachers' mathematical and pedagogical skills in teaching math have also grown because they can learn a lot from fellow teachers in various regions who provide new information and teaching strategies. Teachers' confidence is also increasing in helping students achieve their mathematics learning goals and teaching tasks. Teachers gain various insights in helping students overcome difficulties.

Schools need to continue to carry out continuous PLCs online to help teachers develop teaching professionals and provide support for students to be able to learn optimally by continuing to grow teacher self-efficacy so that teachers are more able to provide the best service for students, which can help students in their success in learning. Thus, the limitations in terms of teaching experience and the educational background of teachers can be minimized so that teachers can teach mathematics professionally. This study is limited to a small sample size because PLCs were conducted at the same time at each grade level, where elementary school math teachers can teach math in several classes and subjects. In addition, the study was only conducted in one SLH school spread throughout Indonesia, making it challenging to create a control group because it was limited to where all elementary school math teachers received the same program.

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