

Impact of Community of Practice and Lesson Study on Fostering the Student Thinking Competency

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ABSTRACT

Ample studies have confirmed that the concepts of Community of Practice and Lesson Study can effectively develop professional development, especially in the design of learning. This positive impact on learners is also evident. Therefore, this study aimed to examine the results that occurred with students who learned from teachers who used activities based on the concepts of Community of Practice and Lesson Study, focusing on studying cognitive competencies, including creative thinking, problem-solving, and analytical thinking. The study involved 60 elementary school students from 5 different science classrooms, taught by 5 collaborating teachers. In this research, two communities of practice were established: (i) Community of Practice A (CoP A), consisting of teachers with varying teaching experiences and teaching fifth-grade students, and (ii) Community of Practice B (CoP B), consisting of teachers with similar teaching experiences and teaching sixth-grade students. Data for this study was collected quantitatively through measures of analytical thinking, problem-solving, and creative thinking. The research results revealed that the students' thinking competencies improved significantly. In CoP A, the students demonstrate a positive trajectory in developing competencies across all thinking competency, particularly excelling in analytical thinking. In problem-solving and creative thinking, the majority exhibit proficiency ranging from high to moderate levels. Meanwhile, in CoP B, most of the students show positive progress in thinking competencies, with high and moderate proficiency in problem-solving and creative thinking. However, there's a noticeable trend of moderate to low emphasis on analytical thinking.

Key words: Problem Solving, Analytical Thinking, Creative Thinking, Community of Practice, Lesson Study

INTRODUCTION

Within the realm of educational pedagogy, small schools occupy a unique position, characterized by their intimate class sizes and closely-knit learning communities (Wannagatesiri et al., 2014). Despite the inherent advantages associated with such settings, small schools often cope with the challenge of providing students with opportunities for the cultivation of higher-order thinking skills (Sako, 1997). At the core of addressing this concern resides the imperative of enhancing teacher competence. According to Susilowati and Suyatno (2021), there are five competencies include educational competence, competence for technological commercialization, competence in globalization, competence in future strategies, and counsellor competence which are essential for teachers to incorporate higher order thinking in their lessons. The challenges related to teacher competence in small schools that may impede students' development of higher-order thinking skills are multifaceted and encompass several key aspects. Small schools often contend with

limited financial resources, resulting in restricted access to high-quality professional development initiatives. These limited resources can hinder teachers' capacity to remain abreast of cutting-edge pedagogical approaches conducive to fostering higher-order cognitive skills. In addition, geographical or social isolation is a characteristic feature of many small schools, constraining opportunities for teachers to engage in collaborative activities with their peers. The contribution of peers is discovered to enhance the capabilities of teachers in executing learning that focuses on higher-order thinking skills (Susilowati & Suyatno, 2021). Collaborative professional development and the exchange of best practices are crucial components of instructional improvement, and such isolation may delay the diffusion of innovative teaching methods. In the context of small schools, teachers may be required to teach across multiple subjects or grade levels, potentially weakening their expertise and specialization in areas vital to cultivating higher-order thinking abilities, such as critical thinking or problem-solving pedagogy.

Small schools may face limitations in providing a variety of professional development opportunities due to financial constraints or the absence of local resources. Consequently, teachers might not receive the requisite training essential for refining their instructional strategies in alignment with higher-order thinking objectives. Moreover, the multifaceted roles assumed by teachers in small schools, including administrative and extracurricular responsibilities, can lead to burnout and depletion of their capacity to focus on pedagogical enhancement. This burnout may translate into reduced attention to the cultivation of higher-order thinking skills. Small schools often struggle with providing specialized support for teachers in areas like curriculum development expertise, assessment tools, or instructional technology resources which are essential for enhancing higher-order thinking. Furthermore, Small schools may have a more homogenous student body and teaching staff, which can limit exposure to diverse perspectives and teaching approaches that can enrich higher-order thinking. These challenges in small schools often requires creative solutions, such as seeking external professional development opportunities, fostering online collaboration with educators from other regions, advocating for increased funding for teacher development, and providing targeted support and mentoring for teachers to enhance their competence in promoting higher-order thinking skills among students. Khun-In Keeree et al. (2022) suggest that ongoing support and development are essential for teachers to enhance their knowledge and practice of higher order thinkings in the teaching and learning process.

Lesson study and communities of practice are two evidence-based professional development approaches that can enhance teacher competence. Lesson study involves teachers collaborating to jointly plan, implement, observe, and reflect on a lesson. It comprises a recurring sequence of actions, which include the following stages: 1. planning: Teachers collaborate to develop a lesson, drawing from a common grasp of student learning requirements and the curriculum; 2. implement: one teacher delivers the lesson while others observe; 3. observation: The observing teachers gather information on student learning and teacher techniques; 4. reflect: the teachers convene to converse about the lesson, highlighting successes and areas for enhancement; and 5. Modification: The teachers refine the lesson and prepare to deliver it again. On the other hand, a community of practice represents a gathering of individuals united by a shared interest or objective, fostering mutual learning through ongoing interactions. Both lesson study and communities of practice have the potential to improve teacher proficiency in various ways (Darling-Hammond et al., 2017; Fernandez & Yoshida, 2004; Wenger, 1998). They can enhance teachers' grasp of subject matter and their pedagogical content knowledge (PCK). Lesson study offers teachers chances to glean insights from each other's expertise and self-reflect on their teaching methods, ultimately resulting in a more profound comprehension of the subject matter being taught and the most effective ways for students to learn. Lesson study and communities of practice necessitate collaborative efforts among teachers in planning, executing, and evaluating their

teaching approaches. This collaboration serves as a catalyst for the cultivation of teachers' teamwork abilities, which are indispensable for effective instruction in contemporary educational settings. Moreover, Lesson study and communities of practice promote the development of reflective teaching practitioners who actively participate in inquiry-driven learning. This, in turn, contributes to enhancing teachers' effectiveness in their instructional methods. Studies on lesson study and communities of practice have demonstrated that these methods can yield various favorable results for students. These measures can enhance student performance, as research indicates that students instructed by teachers engaged in lesson study tend to attain higher scores on standardized assessments compared to students taught by teachers who do not partake in lesson study. Additionally, research has demonstrated that lesson study is an effective approach for narrowing the achievement disparities among various student groups, such as those from diverse socioeconomic backgrounds or students with disabilities. Finally, Lesson study can assist teachers in crafting lessons that are more captivating and inspiring for their students, resulting in heightened student engagement and motivation for learning. Consequently, both lesson study and communities of practice serve as formidable resources for elevating teacher proficiency and enhancing student achievements

Objective and Research Questions

The use of Communities of Practice (CoP) in knowledge management involves teachers with shared interests and expertise coming together to exchange and enhance their collective knowledge, both explicit and tacit. When combined with the Lesson Study approach, which focuses on collaborative inquiry and improvement in teaching and learning, it leads to self-improvement and the advancement of teaching and student learning. CoP allows educators to continuously learn and adapt, resulting in the development of best practices and improved professional development. Undoubtedly, these positive outcomes have a beneficial impact on learners, enabling them to develop various competencies, particularly thinking competence, which will subsequently lead to critical literacy. Therefore, this study aims to explore students' thinking competences as managed by science teachers participating in the activities based on the concepts of Community of Practice and Lesson Study.

LITERATURE REVIEW

Thinking Competence and Critical Literacy.

A robust correlation exists between higher-order thinking and thinking literacy, with the latter denoting the capacity to engage in critical and creative cognition regarding information. It encompasses the competence to dissect, appraise, amalgamate, and employ information for the resolution of challenges and the formulation of decisions (Adams, 2015). Higher-order thinking skills transcend the mere memorization and recollection of data, involving the adeptness to critically, creatively, and analytically. The acquisition of

higher-order thinking skills is indispensable for literacy (Rianti et al., 2022). To foster a critical and creative approach to information, individuals must possess the ability to dissect, evaluate, synthesize, and apply it, not only in familiar contexts but also in novel situations requiring problem-solving. Thinking literacy stands as an imperative asset for scholastic achievement, professional competence, and a fulfilling life. It furnishes individuals with the capacity to make judicious decisions, tackle problems with efficacy, and exhibit inventiveness and originality. Moreover, it nurtures active citizenship and community engagement. By honing their higher-order thinking and literacy abilities, students stand to become more efficacious learners and thinkers, thereby enhancing their readiness for success within the spheres of academia, professional life, and personal fulfillment.

Community of Practice

Wenger (1998) posits that communities of practice (CoPs) are individuals who convene to exchange knowledge, expertise, and acquire insights from each other within a communal sphere of interest. These individuals engage in ongoing interactions and knowledge administration, specifically within the framework of intra-organizational knowledge dissemination. CoPs serve as tools for overcoming organizational barriers that hinder the flow of knowledge, aiming to address issues and foster organizational development. The salient characteristics of vital CoPs involve the convergence of individuals with shared interests, collaborating to exchange and learn together, with mutual interactions and ownership, fostering strong bonds and shared knowledge for the purpose of mutual assistance and continuous development. The essential components of a CoP are threefold: domain, community, and practice. All three elements must result from the collaborative participation of members, reaching a consensus and common understanding. The fundamental principles of CoPs include: (i) being a group of individuals with shared interests and expertise in the same domain or field; (ii) emphasizing sharing knowledge and experiences to enhance work efficiency and self-development; (iii) comprising a self-organizing group that does not necessarily require leadership or control; (iv) fostering communication and knowledge exchange among community members; (v) developing oneself and generating new knowledge through shared experiences; (vi) emphasizing experiential and problem-solving learning in real-life situations; and (vii) promoting continuous exposure and sharing of knowledge and experiences to support members' knowledge and expertise development through feedback and mutual support in learning and self-development. Apart from fostering positive relationships, CoPs also promote mutual understanding, knowledge exchange, and a culture of organizational learning and collaboration, creating a conducive environment for teachers to overcome the challenges in teaching and learning from others' experiences. Novice teachers participating in CoPs tend to demonstrate a propensity for skill and knowledge development as they have the opportunity to learn from experienced teachers and share their own ideas and experiences (Ribeiro-Barbosa et al., 2021). CoPs can offer a sense of belonging,

especially crucial for new teachers who may feel isolated or overwhelmed. When teachers are integrated into a community of practice, they frequently experience a sense of motivation and dedication towards their teaching responsibilities, as they find themselves encompassed by fellow enthusiastic teachers who provide assistance and inspiration. Teachers engaged in CoPs tend to develop a strong professional identity, as they can connect with like-minded colleagues who share the same values and interests and who can help them see themselves as professionals.

Lesson Study

Lesson Study refers to research or testing and examination of teachers' teaching practices, which is one method of professional development rooted in the effort to internally improve schools by working collaboratively with other teachers. It involves scrutinizing and analyzing each individual's teaching methods, which are critical to classroom instruction. In this study, the emphasis is on integrating educational principles into lesson plans and applying them in the teaching and learning process. The approach focuses on allowing teachers to learn from their practical experiences, observe classroom activities, and reflect on the learning outcomes together, aiming to address problems and enhance students' thinking abilities (Baba, 2007; Fernandez & Yoshida, 2004; Sotirhos, 2005). Lesson Study is an educational process that concentrates on the development of teaching and learning for both teachers and students, enabling teachers to comprehend the teaching process and students to the greatest extent possible. The steps involved in Lesson Study can be summarized as follows: Plan: Teachers participating in Lesson Study must design a teaching plan for development, taking into account the learning objectives of students and appropriate teaching methods to prepare students for that lesson. Do: Teachers participating in Lesson Study will implement the planned teaching and present the lesson in their classroom. See: Teachers participating in Lesson Study will promote observation of the lesson leader and the students. They will observe classroom events and identify issues or directions for improving the teaching process. Act: Teachers participating in Lesson Study will consider ways to improve or modify teaching practices to increase effectiveness. This may involve creating new lessons or adapting them based on the study's findings. Share: Teachers participating in Lesson Study will share the knowledge and experiences gained from the process externally, possibly through academic conferences or online media. The results from Lesson Study help teachers gain more knowledge and understanding of the teaching and learning process, further developing more effective teaching methods and fostering cooperation and teamwork in educational institutions. Applying the knowledge acquired from Lesson Study to transform teaching practices in schools is beneficial in enhancing the sustainable quality of education for students. Lesson Study enables novice teachers to learn from experienced teachers and practice teaching skills in a supportive environment. It helps new teachers learn from others' experiences in problem-solving situations similar to their own. This can assist novice teachers in developing

new strategies and seeing different perspectives on teaching (Jones, 2022). Lesson Study can also help novice teachers develop a strong professional identity by providing them with opportunities to work with like-minded teachers who share a passion for teaching. Asari et al. (2018) finds that implementing lesson study activity can improve teachers' pedagogic competence, specifically in developing teaching and learning plans, implementing learning, and evaluating learning.

An Activity for Building Teacher competence

Cojorn and Sonsupap (2023) develop activities based on the community of practice (CoP) approach in collaboration with lesson study resulted in four key components: principle, activity objectives, learning activity, and learning evaluation. These components were systematically structured with clear steps to facilitate teacher development and continuous guidance and supervision in real contexts. The use of the community of practice and lesson study as the foundation for designing activities focused on enabling teachers to acquire knowledge through experiential exchange, knowledge sharing among fellow practitioners, and applying knowledge collaboratively in designing teaching and learning activities. It promoted a continuous learning culture that fostered personal development and produced positive learning outcomes for students. Integrating the community of practice concept with lesson study enhanced teachers' development in terms of content knowledge, understanding, and instructional approaches, ultimately contributing to the improvement of student learning outcomes. It also provided a platform for resource sharing, collaborative learning, and reflective practice, elevating the quality of teaching and learning.

METHOD

Participant

Five elementary science teachers with less than 5 years of teaching experience, who volunteered to participate in the research, were selected. These teachers came from five different schools and taught at the 5th-grade level in three schools and the 6th-grade level in two schools. Two communities of practice (CoPs) were established based on the grade levels they taught, with the following details:

- CoP A comprises three 5th-grade teachers: A1, A2, and A3, with varying teaching experience of 1 and 3 years.
- CoP B comprises two 6th-grade teachers: B1 and B2, both with two years of teaching experience.

The students in the science classes conducted by the participating teachers consist of 5 classrooms with a total of 60 students, as follows:

- CoP A consists of 5th-grade students, divided into 3 classrooms: 21 students of A1, 10 students of A2, and 11 students of A3.
- CoP B consists of 6th-grade students, divided into 2 classrooms: 7 students of B1, and 11 students of B2.

Research Instruments

The activity employed in this study to combine the community of practice with lesson study was based on the scholarly work of Cojorn and Sonsupap (2023). The learning process consisted of four distinct stages: Educating, innovating, implementing, and reflecting which shown in Table 1. A panel of five esteemed experts evaluated the instructional activity, resulting in an outstanding suitability rating of 4.88. This score attests to the activity's effectiveness and alignment with objectives and educational context. The involvement of expert reviewers enhances the credibility and reliability of the evaluation process and findings.

The thinking competence assessment, which was the focus of this research study, involved five collaborating teachers from two practitioner communities. They to assess and promote students' thinking competencies in the areas of analytical thinking, problem-solving, and creative thinking. The researchers therefore developed three types of thinking assessment tools. The details are as follows:

- The analytical thinking assessment is structured as a situational multiple-choice exam with 12 items. It adheres to Bloom's three cognitive processes: differentiating, organizing, and attribute (Bloom, 1956). The analytical

Table 1. Description of the activity guideline based on CoP plus LS (Cojorn & Sonsupap, 2023)

Cop plus ls	Activity
Educating	This preparatory activity is designed to enhance teachers' understanding of instructional design and the development of innovative teaching methods that suit their particular teaching context. Its primary goal is to equip teachers with the necessary knowledge and skills to effectively implement instructional design tasks.
Innovating	This process entails assembling a community of teachers who have common objectives and teaching environments. The primary objective is to collaboratively generate ideas, share experiences, skills, and cooperate to develop appropriate educational innovations tailored to their specific settings.
Implementing	This step involves teachers implementing the educational innovations they've developed in their own teaching environments. During this process, their colleagues and experts observe their classrooms and provide feedback. Consequently, teachers can utilize this feedback to make necessary adjustments and improve the efficiency of their teaching methods.
Reflectin	It involves CoP members coming together to collectively review their teaching experiences, engage in shared learning and exchange, and collectively extract valuable knowledge and best practices from their interactions.

thinking assessment had congruence indices ranging from 0.80 to 1.00. The difficult (p) values ranged from 0.29 to 0.76, and the discriminant power values for each item were between 0.41 and 0.78. The reliability coefficient is 0.89.

- The problem-solving assessment is a situational multiple-choice test, based on Weir's (1974) problem-solving framework, which consists of four steps: problem identification, problem analysis, proposing solutions, and evaluating results. The item discrimination ranges from 0.21 to 0.82, and the difficult level ranges from 0.23 to 0.79. The reliability coefficient is 0.8
- The creative thinking assessment, in the form of open-ended questions, consists of 2 scenarios. It is based on Guilford's (1968) creative thinking framework, which includes four dimensions: fluency, flexibility, originality, and elaboration. The index of congruence between the questions and the measured behaviors is 1.00. Item discrimination ranges from 0.41 to 0.78, and the difficult level ranges from 0.24 to 0.79. The reliability coefficient is 0.8

Implementation of Activities and Data Collection

The researchers scheduled and provided explanations regarding understanding the implementation of activities based on the CoP plus LS approach in real classroom contexts. This process was divided into four phases:

Phase:1- Educating: This phase involved training to enhance knowledge and understanding of organizing teaching and learning activities. It was conducted during the first practical seminar. The teachers who participated in the research were scheduled to attend the first seminar. At the seminar, the teachers were required to participate in the educating step of the activity guideline based on CoP plus LS, as well as to create their own communities of practice and conduct activities within these communities based on the agreements they had made.

Phase:2- Innovating: During this phase, activities within each CoP aimed to agree on goals and collectively create teaching and learning innovations. These sessions foster the collaborative exchange of pedagogical experiences, knowledge, skills and identified challenges pertaining to individual teaching practices. Through collective deliberation and problem-solving, teachers will co-design and develop instructional activities explicitly aimed at addressing the jointly identified issues

Phase:3-Implementing: Involves activities carried out within each CoP. Both CoPs execute these activities following the jointly designed teaching and learning processes. In this collaborative effort, both CoPs design teaching and learning activities aimed at enhancing three dimensions of thinking: analytical thinking, problem-solving, and creative thinking. These activities are implemented according to the agreements made within each CoP. Throughout this phase, the researchers facilitate and regularly observe the activities conducted by each CoP. In the process of data collection pertaining to students' thinking competencies, insights will be gleaned from teachers in each classroom utilizing three

distinct types of rigorously developed and validated cognitive assessment tools.

Phase:4- Reflecting: After completing the activities, the researchers conducted group discussions on various topics, summarized best practices, analyzed data, and compiled the results of each CoP's activities during the second practical seminar. In assessing students' thinking competencies, the examination is conducted by the teachers themselves. Subsequently, the analysis and summarization of results will also be carried out by the teachers.

Data Analysis

In this study, the development of students' thinking competency is assessed by calculating Relative Gain Score (RGS), considering the changes in scores between the two assessments. The teachers have analyzed the scores and calculated the Relative Gain Score (RGS) (Kanjanaawasee, 2014) of thinking competency for each type of student in each classroom as follows:

$$\text{Relative Gain Score (RGS)} = ((X_2 - X_1)/(Y - X_1)) * 100$$

where X_2 Score of post-evaluation

X_1 Score of pre-evaluation

Y Full score of the evaluation

Subsequently, they have translated the meaning of scores according to developmental level criteria, which are divided into 4 levels (Kanjanaawasee, 2014) as presented in Table 2.

RESULTS AND DISCUSSION

As a result of the teacher-researchers' participation in the capacity-building activities aligned with the Community of Practice (CoP) concept and lesson study approach, along with the assessment of students' thinking competencies for whom they were responsible in designing instructional activities, it was observed that students showed improved development in their thinking competency.

The Study Results Regarding Students' Thinking Competencies were Managed and Facilitated by the Collaborating Science Teachers in CoPA

This is a study on the development of students' thinking competencies in analytical thinking, problem-solving, and creative thinking among 5th-grade elementary school students, involving three classrooms.

Analytical thinking

The data from the Table 3 reveal that the overall analytical thinking competency development of students in all

Table 2. The scoring criteria for developmental progression comparison (Kanjanaawasee, 2014)

Relative gain score	Level of development
76 – 100	Very High
51 – 75	High
26 – 50	Moderated
0-25	Low

three classrooms is mostly at the high (45.24%), level. Following that are the very high (30.95%), and moderate (23.81%), levels of developmental progress. There are no students at the low (0.00%), level of developmental progress.

Problem solving

The data from the Table 4 indicate that the overall development of problem-solving competency among students in all three classrooms is mostly at the moderate (38.10%) level. Following that are the high (28.57%), low (26.19%), and the very high (7.14%) levels, in that order.

Creative thinking

The data from the Table 5 indicate that, on the whole, students in all three classrooms predominantly exhibit a high (38.10%) level of development in creative thinking competency. Following this, there are levels of moderate (33.33%) and low (23.81%) competency. The very high (4.76%) level of developmental progress, is the least commonly observed.

From Figure 1, an analysis reveals that students who underwent instruction from teachers within Community of Practice A (CoP A) across all three classrooms exhibit a positive trajectory in the development of competencies across all three cognitive dimensions. Analytically, students predominantly demonstrate a high and very high level of developmental progress. Concerning problem-solving and creative thinking, the majority of students display a developmental level ranging from proficient to moderate.

Table 3. The analytical thinking development level of students learning with research collaborator teacher of CoP A

Classroom	N	Level of development	Frequency (n)	Percentage
A1	21	Very High	5	23.81
		High	9	42.86
		Moderate	7	33.33
		Low	0	0.00
A2	10	Very High	5	50.00
		High	5	50.00
		Moderate	0	0.00
		Low	0	0.00
A3	11	Very High	3	27.27
		High	5	45.46
		Moderate	3	27.27
		Low	0	0.00
CoP A	42	Very High	13	30.95
		High	19	45.24
		Moderate	10	23.81
		Low	0	0.00

The Study Results Regarding Students' Thinking Competencies were Managed and Facilitated by the Collaborating Science Teachers in CoP B

This is a study on the development of students' thinking competencies in analysis, problem-solving, and creativity among 6th-grade elementary school students, involving two classrooms.

Analytical thinking

The data presented in Table 6 indicates that the overall development of analytical thinking competency among students in both classrooms predominantly falls within the moderate (44.44%) and low (44.44%) levels. Subsequently, there are instances of very high (5.56%) and high (5.56%) levels of developmental progress, in that sequential order.

Problem solving

The data from the Table 7, can be observed that the majority of students in CoP B, overall, fall into the moderated (50.00%) developed level of problem-solving competency. Following this, in descending order, are the high (22.22%) level, very high (16.67%) level, and low (11.11%) level development categories.

Creative thinking

The data from Table 8 indicates that the general development of creative thinking skills among students in both classrooms is mostly concentrated at the moderate (44.44%) level. Subsequently, there are instances of both high (27.78%) and

Table 4. The problem-solving development level of students learning with research collaborator teacher of CoP A

Classroom	N	Level of development	Frequency (n)	Percentage
A1	21	Very High	1	4.76
		High	2	9.52
		Moderate	10	47.62
		Low	8	38.09
A2	10	Very High	2	20.00
		High	6	60.00
		Moderate	1	10.00
		Low	1	10.00
A3	11	Very High	0	0.00
		High	4	36.36
		Moderate	5	45.45
		Low	2	18.18
CoP A	42	Very High	3	7.14
		High	12	28.57
		Moderate	16	38.10
		Low	11	26.19

Table 5. The creative thinking development level of students learning with research collaborator teacher of CoP A

Classroom	N	Level of development	Frequency (n)	Percentage
A1	21	Very High	2	9.52
		High	7	33.33
		Moderate	11	52.38
		Low	1	4.76
A2	10	Very High	0	00.00
		High	4	40.00
		Moderate	1	10.00
		Low	5	50.00
A3	11	Very High	0	0.00
		High	5	45.45
		Moderate	2	18.18
		Low	4	36.37
CoP A	42	Very High	2	4.76
		High	16	38.10
		Moderate	14	33.33
		Low	10	23.81

Table 6. The analytical thinking development level of students learning with research collaborator teacher of CoP B

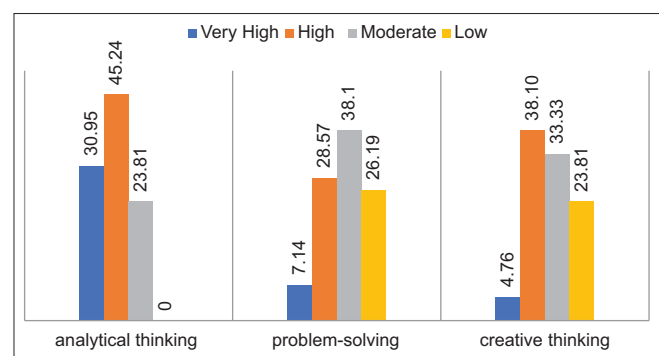
Classroom	N	Level of development	Frequency (n)	Percentage
B1	7	Very High	1	14.29
		High	0	14.29
		Moderate	4	57.14
		Low	2	28.57
B2	11	Very High	0	00.00
		High	1	9.09
		Moderate	4	36.36
		Low	6	54.55
CoP B	18	Very High	1	5.56
		High	1	5.56
		Moderate	8	44.44
		Low	8	44.44

low (27.78%) levels. However, there are no students exhibiting a very high level (0.00%) of developmental progress.

Figure 2 reveals intriguing insights into the development of problem-solving and creative thinking competencies among students within Community of Practice B (CoP B). Notably, a positive trajectory is evident in the acquisition of these crucial skills. The majority of students demonstrate high and moderate proficiency in both problem-solving and creative thinking. However, a divergence in developmental trends emerges when scrutinizing analytical thinking. While still present, the emphasis on this competency appears to be moderate to low.

Table 7. The problem-solving thinking development level of students learning with research collaborator teacher of CoP B

Classroom	N	Level of development	Frequency (n)	Percentage
B1	7	Very High	0	00.00
		High	1	14.29
		Moderate	4	57.14
		Low	2	28.57
B2	11	Very High	3	27.27
		High	3	27.27
		Moderate	5	45.45
		Low	0	00.00
CoP B	18	Very High	3	16.67
		High	4	22.22
		Moderate	9	50.00
		Low	2	11.11

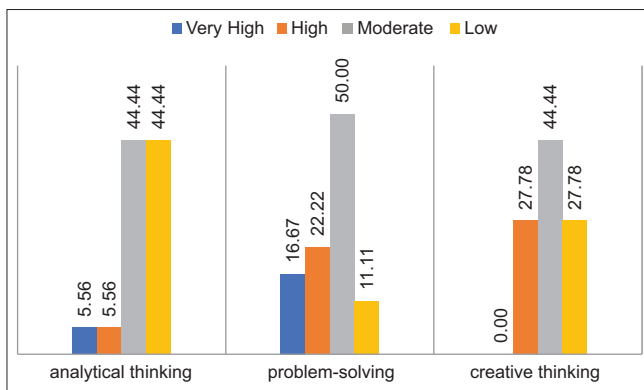
**Figure 1.** The proportion of students based on their proficiency in analytical thinking, problem-solving, and creative thinking skills within each classroom in CoP A

DISCUSSION

The competence in thinking of students who learn with research collaborator teachers has shown improvement. It can be observed that in CoP A, the development of thinking competencies, including analytical thinking, problem-solving, and creative thinking, is at a high level. Meanwhile, in CoP B, the development of thinking competencies is at a moderate level. Therefore, it can be said that the activities aimed at enhancing the teachers' instructional design skills within the community of practice plus lesson study not only improve the teachers' teaching capabilities but also positively impact the students' thinking competencies. Moreover, it can be seen that in the stages of the teacher development activities in instructional design within the community of practice plus lesson study, during innovating stage and implementing stage, the research collaborator teachers in each community come together, exchange, and link their experiences in managing their own teaching. They integrate the new knowledge and ideas they have gained in educating stage to collectively design teaching and learning activities, considering context, content, and students. In these community of practice, the emphasis is on knowledge creation and sharing, exchanging

Table 8. The creative thinking development level of students learning with research collaborator teacher of CoP B

Classroom	N	Level of development	Frequency (n)	Percentage
B1	7	Very High	0	0.00
		High	3	42.86
		Moderate	2	28.57
		Low	2	28.57
B2	11	Very High	0	0.00
		High	2	18.18
		Moderate	6	54.54
		Low	3	27.28
CoP B	18	Very High	0	0.00
		High	5	27.78
		Moderate	8	44.44
		Low	5	27.78

**Figure 2.** The proportion of students based on their proficiency in analytical thinking, problem-solving, and creative thinking skills within each classroom in CoP B

thoughts, strategies, and resources among teachers to support the development of effective teaching methods collaboratively. Furthermore, community members focus on mutual support and collaboration in a friendly and constructive environment, providing suggestions and creatively solving problems together effectively (Bennet & Bennet, 2008; Hildreth & Kimble, 2004; Jones et al., 2013; Wenger, 1998; Yildirim, 2008). Moreover, CoP have proved to be successful in enhancing teacher professional growth, promote the collaborative development of robust teacher confidence (Takahashi, 2011) and hold promise for boosting educator performance and improving student education outcomes especially student thinking skills (Lieberman & Miller, 2011). Throughout, the educational concept is implemented through lesson study that involve collaborative classroom observations, reflection on teaching practices, and critical analysis for improvement. During the reflective discussions, strengths and weaknesses in teaching practices are openly discussed, leading to the development and improvement of future teaching activities. This educational approach fosters a continuous learning experience for teachers through effective classroom

management, promoting teachers' reflection on lesson outcomes, analyzing student responses, and adjusting teaching strategies. As a result, continuous improvement is achieved (Fauziyah et al., 2021; Fernandez, 2002; Lewis et al., 2006; Triwaranyu, 2016). As a result, research collaborator teachers who are members of the practitioner community have developed highly effective teaching activities that have been tested, adjusted, and then implemented in their own contexts. This undoubtedly serves as an activity that can effectively cultivate thinking skills in students and contribute to achieving the intended educational goals. In this research study, it also means promoting students' thinking competencies. This leads to students who learn with research collaborator teachers, using the developed activities, showing significant improvement in their thinking competencies. This aligns with research findings indicating that utilizing community of practice and the educational concept through lesson study in developing teachers' professions is an effective approach. It has been found that both of these approaches can enhance teachers' teaching management skills, content knowledge, teaching methods, and technological proficiency effectively (Chang & Hsu, 2017; Shúilleabháin, 2013; Vescio et al., 2008) Furthermore, it has been found that utilizing both of these approaches can enhance students' thinking competencies, including critical thinking, problem-solving, analytical thinking, and creative thinking. This improvement extends not only to the teacher themselves but also fosters the development of students' thinking competencies when learning with teachers who apply community of practice and lesson study guidelines effectively (Cojorn, 2017; Cojorn et al., 2022; Janet, 2013; Triwaranyu, 2016). Hence, the combination of these two approaches effectively enhances both teachers' instructional management skills and students' thinking competencies.

When considering the development of students' thinking competencies in each practitioner community, it is observed that in CoP A, which consists of science teachers teaching at the 5th-grade elementary level with varying teaching experiences, students have shown moderate to high levels of development in thinking competencies, including analytical thinking, problem-solving, and creative thinking. However, in CoP B, which comprises science teachers teaching at the 6th-grade elementary level and sharing similar teaching experiences, students have shown moderate levels of development in thinking competencies. The exception is analytical thinking, which exhibits both moderate and low levels. Through classroom observations, it becomes evident that students who have been taught by teachers within the community of practice exhibit proficiency in applying analytical thinking to logically dissect intricate problems. They also demonstrate the ability to use creative thinking to innovate and generate creative solutions to intricate problems. Additionally, students can solve problems using logical reasoning and accurate analysis. This has led to increased confidence, a willingness to express diverse viewpoints, and the ability to answer questions and explain their rationale effectively. The classroom environment is marked by its welcoming nature, fostering active and constructive

engagement among students. However, it is important to note the differences in the levels of development of thinking competencies in both practitioner communities. This divergence may be attributed to the diverse experiences of community members in managing science education. When these members come together, exchange knowledge, share experiences, ideas, and good practices, it leads to a diverse range of perspectives and a broader understanding of various situations. Consequently, this facilitates the generation of numerous options and a substantial reservoir of information. As a result, it becomes more effective in designing teaching and learning activities that effectively promote students' thinking competencies. Within communities where members have comparable backgrounds, there tends to be a merging of perspectives and concepts, which could potentially lead to a biased approach when designing activities. This lack of variety could result in less effective teaching and learning practices. This aligns with the principle that important components of successful practitioner communities are their ability to exchange knowledge, share experiences, and collaborate to find solutions while fostering good practices among their members (Baker & Beames, 2016; King, 2016; Lieberman & Wood, 2002; Väättäjä, 2023; Wenger, 1998; Wenger & Traynee, 2015). Furthermore, having members with more extensive experience in the community allows individuals to take on various roles, including leadership and being good followers. This nurtures a feeling of shared dedication, establishing an environment characterized by trust and empowerment. Members feel comfortable and assured, as they have access to individuals with greater expertise who can offer valuable insights and suggestions. This cultivates a culture of organizational collaboration aimed at development, where members learn from each other, creating a robust practitioner community (Wenger, 1998). Ultimately, this positively impacts the effectiveness of students learning from teachers within the practitioner community, leading to their full development.

CONCLUSION

One of the significant and clearly visible impacts of the COVID-19 pandemic on Thailand's education system is the condition where students experience learning loss in many aspects. This includes language skills, academic performance, and most importantly, essential thinking abilities that need rapid recovery. This is crucial to prepare students for the rapidly changing global landscape of today. Therefore, the role of teachers after the COVID-19 outbreak must adapt to accelerate the development of students' capabilities, particularly their thinking skills. However, small-scale school contexts may have many limitations, such as resources, teaching tools, teacher expertise, and a wide range of workloads, which can be obstacles in designing teaching methods that focus on promoting critical thinking skills.

From the results of this study, it can be observed that the use of activities following the Community of Practice approach along with Lesson Study can help create a community of shared learning among teachers. It provides a safe space for teachers with similar goals to come together, exchange knowledge, share experiences, collaboratively

design effective learning activities suitable for their contexts, and implement them in practical teaching. Additionally, it involves classroom observations, reflection on teaching practices, and joint problem-solving to enhance the effectiveness of learning activities. The significant outcome of this study is the noticeable promotion of students' thinking competency, including analytical, problem-solving, and creative thinking. This thinking competency is essential for contemporary life and remains crucial to advance towards the creation of thinking literacy that is well-suited for the intricacies of the future world. However, it's worth mentioning that this study did not delve deeply into the development of students' thinking abilities. Therefore, to gain a deeper understanding and plan for the earnest development of students and to achieve the best long-term results, it is advisable to conduct in-depth studies, gather qualitative data, and potentially assess developmental progress periodically. This will provide more useful information for designing teaching and learning activities that align with the context and needs of the students, ultimately fostering continuous and sustainable development.

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