

Article

Learner-Centered Teaching Catalyzed by Teacher Learning Communities: The Mediating Role of Teacher Self-Efficacy and Collaborative Professional Learning

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Abstract: Although there is evidence suggesting that teacher learning communities can improve instructional practices, the underlying mechanism is not well-understood. This study aimed to investigate the mediating role of self-efficacy and collaborative professional learning in the relationship between teachers' experiences in learning communities and learner-centered teaching practices. The study surveyed 226 teachers from 28 schools in Taiwan and used structural equation modeling to analyze the data. The findings indicate that participation in teacher learning communities did not directly predict student-centered teaching practices, but, rather, its effect on learner-centered teaching was fully mediated by teacher self-efficacy. Additionally, a mediation path was found from teacher learning communities to teacher self-efficacy to collaborative professional learning and, ultimately, to learner-centered teaching. The study highlights the importance of developing teacher self-efficacy to achieve the desired outcomes of learner-centered teaching programs.

Keywords: collaborative professional learning; learning communities; learner-centered teaching; teacher learning communities; self-efficacy



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1. Introduction

The professional quality of teachers is a crucial factor in sustainable school development. Through continuous learning, teachers can enhance their professional knowledge and skills to teach in a learner-centered way, which is especially essential in preparing students with higher order thinking and analytical skills for the 21st century. To promote teachers' competence, effective professional development that links curriculum, assessment, and standards, and is context-based, is required as part of school reform efforts [1]. This type of professional development has now been reconceptualized as "professional learning".

Traditional professional development, which often focuses on the transmission of external ideas through workshops or courses, has been criticized for inhibiting teacher learning progress [2,3]. In contrast, professional learning, which is seen as a more inclusive term, can take different forms, and learning communities are one such example. Learning communities are collaborative, job-embedded, and sustained in nature, providing opportunities for open discussions among teachers about how student learning takes place. These communities are considered more effective because they are tailored to the specific learning needs of teachers and provide opportunities for day-to-day professional interaction with colleagues in the context of teachers' work, allowing teachers to receive tailored advice and feedback [1,4].

Research has focused on various aspects of learning communities, including conceptualizing the critical components of professional learning communities [5–9], and examining the associations between learning communities and instructional practice [10–12], teacher efficacy [13,14], teacher commitment [15,16], and student achievement [17,18]. However, more studies on teacher professional learning are needed to understand under what conditions teachers learn [19]. How can teacher participation in learning communities result

in the desired outcome? Is there a potential mechanism by which learning communities influence teachers' instructional practices? Understanding how learning communities can lead to the expected results is worth further study.

Previous studies have established a link between teacher self-efficacy and instructional practices [20–23]. Teachers with higher efficacy tend to experiment with innovative teaching. Additionally, professional learning communities or lesson study can positively impact teacher learning [4,24], which also contributes to changes in their teaching practices [12,25]. Given this evidence, self-efficacy and collaborative professional learning were considered crucial mediators for the relationship between experiences in teacher learning communities and learner-centered teaching, in this study.

To investigate the research questions, this study collected data from teachers who participated in the Ministry of Education-supported program of “Learning Community under Leadership for Learning” in Taiwan. The program consists of two main components, teacher learning communities and operating classrooms as learning communities [26–29]. The focus of this study is on the former. In teacher learning communities, teachers work collaboratively in authentic situations by planning lessons together, opening their classrooms, and observing and discussing teaching practices. They share, discuss, and learn how to implement learner-centered pedagogy and operate classrooms as learning communities. This study utilized survey data from teachers in the program to investigate the mediating roles of teacher self-efficacy and collaborative professional learning in the relationship between participation in learning communities and implementing learner-centered teaching.

2. Literature Review

2.1. Teacher Learning Communities and Professional Learning

Following a paradigm shift, continuous learning in the workplace has become more prevalent in literature and school practice. Professional learning communities (PLCs) have been confirmed as one of the most effective strategies for teacher development and school change, as evidenced by studies [30–33]. Several characteristics of PLCs are identified, such as shared values and vision, collective responsibility, reflective professional inquiry, promotion of group and individual learning, supportive and shared leadership, and supportive conditions within the school [34,35]. Since PLCs have been promoted since the 1990s, the configurations of PLCs vary in local settings [36,37]. In Asia, a Japanese scholar, Sato, proposed a “learning community” (*xue xi gong tong ti*) approach to transform schools.

Based on the theories of Dewey and Vygotsky, Sato [38,39] advocated for his “learning community” approach, which subsumes two substantial components: building collegiality among teachers and creating classrooms as learning communities through collaborative learning. For collegiality building, “lesson study” is used as a strategy, which is a traditional form of professional development in Japan where teachers collaborate to study and improve classroom lessons [40]. Teachers go through an “action-inquiry cycle”, including three steps: working together to plan the lesson; conducting the lesson with one teacher teaching and others observing; and discussing the lesson that was taught based on the data collected [41,42]. This process is used as a means of professional development, allowing teachers to collaboratively analyze, improve, and share their teaching practices.

In Taiwan, Sato's [38,39] approach was introduced during the reform to extend Basic Education from nine to twelve years. To support this reform, Pan and colleagues [26,28] developed an indigenous learning community model called “Learning Community under Leadership for Learning”. It integrates Sato's conceptualizations with western theories and place-based discourses and practices. The model aims to develop the school as a learning community and specifies two main activities to trigger teacher change: operating classrooms as learning communities and creating teacher learning communities. These activities are based on three critical components of learner-centered practices: inquiry, collaboration, and expression. Teachers facilitate student inquiry, collaborative work, and communication of ideas in the classroom. In addition, they use an indigenous model of lesson study in learning communities to promote collaborative professional learning. As

lesson study has spread worldwide, it has undergone cultural adaptations [43]. Pan and colleagues [28,29] integrated the concept and practice of “understanding by design” [44] into lesson planning. Teachers clarify the big ideas of teaching content and use expected learning outcomes as guidelines for lesson planning. During class observation, teachers attend to student learning, such as how learning occurs and what student misconceptions are. Meanwhile, teachers also discuss and observe how other teachers operate classrooms as learning communities through learner-centered teaching. The relationship between operating classrooms as learning communities and teacher learning communities can be viewed as symbiotic, as they support each other.

Although lesson study provides a collaborative structure that supports teachers’ professional learning, it does not guarantee positive learning outcomes for teachers [45]. Previous studies have suggested that lesson study promotes teacher learning [4,24] and that collaborative professional learning improves teaching practice [12,25], but only with the condition of teachers’ continuous involvement. Therefore, this study aimed to investigate whether teachers who learn how to operate indigenous lesson study in teacher learning communities would engage in collaborative professional learning in their daily work and, subsequently, enhance their use of learner-centered teaching.

2.2. Learner-Centered Teaching

Traditional process-product research on effective teaching emphasizes the outcome rather than the teaching process. A deviation from the conventional conceptualization is the primary concern in teaching subject matter for understanding and generating new knowledge [46,47]. It leads to a new role for the teacher, who is expected to scaffold and respond to students’ learning, not merely present information, and a new role for the student, who is expected to actively make sense of and construct meaning.

Based on social constructivism, social interaction plays a crucial role in an individual’s cognitive development. Vygotsky [48] posits that cognitive development is not solely a result of social interaction, but the internalization of knowledge is an essential element in forming higher mental functions. He emphasizes the interconnection between people and the sociocultural context, and development based on collaboration and imitation. From this perspective, the role of the teacher is not to simply transmit knowledge but to create opportunities for dialogue and to encourage peer collaboration, which supports the internalization of knowledge and cognitive development. In this study, teachers in the communities collectively learn how to enact constructivist learner-centered teaching by enabling students to inquire, collaborate and express what they know and think.

2.3. Self-Efficacy

Self-efficacy in teaching is defined as a belief in one’s ability to bring about desired outcomes of student engagement and learning [23,49,50]. In the discussion of self-efficacy, it is generally accepted that self-efficacy is a multidimensional construct [51–53]. Prior studies have identified two factors of self-efficacy: general teaching efficacy and personal efficacy [54–57]. General teaching efficacy refers to the belief that teaching can impact student learning, while personal teaching efficacy represents the belief in one’s ability to affect student learning. Teachers with a high sense of efficacy are more likely to persist and exert effort in teaching, be receptive to new practices, and be less controlling in managing student behavior [21,22,58].

Self-efficacy, proposed by Bandura’s self-determination theory, is associated with essential outcomes for teachers, such as teacher engagement [59], career optimism [60], job satisfaction [61], and occupational commitment [62]. Studies have also identified self-efficacy as a determinant of instructional behavior and practice, with constructivist practices being a specific example [21,22]. Building on this research, the current study aimed to examine how self-efficacy mediates the relationship between teacher participation in learning communities and practices of learner-centered teaching.

As noted earlier, professional learning communities or lesson study are beneficial for teacher learning [4,24], which can also lead to a change in teaching practices [10,12,25,63]. Given the prior literature, collaborative professional learning is considered a feasible second mediator for this study. In addition, self-efficacy also motivates teachers to engage in professional learning activities [64]. This literature supports the inference of the relationship between self-efficacy and collaborative professional learning in this study. Specifically, the following research questions are addressed, and the hypothesized model is presented in Figure 1.

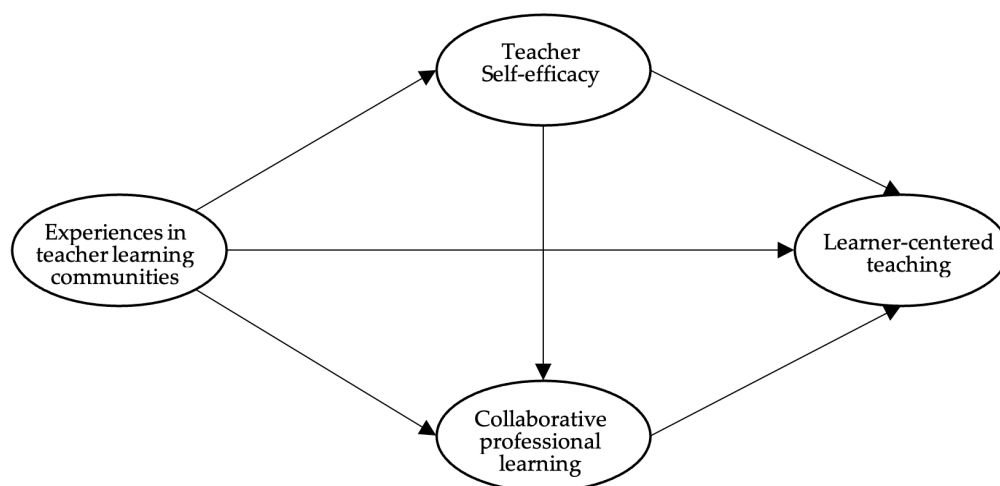


Figure 1. Hypothesized model of experiences in teacher learning communities and learner-centered teaching.

1. How are experiences in teacher learning communities associated with self-efficacy, collaborative professional learning, and learner-centered teaching?
2. To what extent do experiences in teacher learning communities link to collaborative professional learning and learner-centered teaching?

3. Methodology

3.1. Participants and Procedures

This study collected data from a survey of the “Learning Community under the Leadership for Learning” program, which was supported by the Ministry of Education in Taiwan. In the third year of the program, there were 33 pilot schools, consisting of 15 elementary schools, 16 junior high schools, and two senior high schools, located in five cities/counties. Teacher data from elementary and junior high schools were analyzed. Teachers in the survey were school staff with teaching responsibilities, including homeroom teachers, subject teachers, office directors, and office section chiefs. A total of 226 valid responses were obtained through an online questionnaire, resulting in a response rate of 72%. The study describes the characteristics of the respondents as follows.

- Gender (33.2% male, 66.8% female)
- Years of experience at the school (29.2% below 6 years, 15.5% 6–10 years, 24.3% 11–15 years, 19% 16–20 years, 11.9% over 20 years)
- Duty (17.2% office directors, 20.3% office section chiefs, 44.7% homeroom teachers, 17.7% subject teachers)
- School level (58% elementary school, 42% junior high school)

3.2. Measures

The instrument development process consisted of several steps. Initially, a research team consisting of seven members drafted the instruments based on a review of the literature and document analysis. The draft was then reviewed by experts, including five university faculty members and ten school practitioners. Subsequently, the questionnaire

was examined by several school practitioners to ensure its readability and appropriateness, and feedback was incorporated. A pilot test was conducted, which resulted in 218 valid responses from school teachers. The survey was then revised based on expert and practitioner feedback and the results of factor analyses, leading to the final version.

Four self-report scales were used in this study to evaluate participation in teacher learning communities, teacher self-efficacy, collaborative professional learning, and learner-centered teaching. Various techniques, such as item analysis, reliability tests, and exploratory and confirmatory factor analyses, were employed to ensure the instruments' quality. The study reports values for composite reliability (CR) and average variance extracted (AVE) in confirmatory factor analysis. The CR measures the internal consistency of the latent variables with a cut-off value of 0.60 [65]. The AVE indicates the average explanatory power of each observed variable to the latent variable it belongs to, with a preferable value greater than 0.50 [66]. The CR and AVE values of the four scales are listed in Table 1.

Table 1. The latent constructs summary.

| Variables | Items | Model Parameter Estimation | | | Convergent Validity | | | |
|-------------------------------------|-------|----------------------------|-------|------------|---------------------------------|-------|-------|-------|
| | | Regression Weights | S.E. | C.R. | Standardized Regression Weights | SMC | CR | AVE |
| Experiences in TLCs | TLCs1 | 1.000 | | | 0.894 | 0.800 | 0.899 | 0.751 |
| | TLCs2 | 1.036 | 0.054 | 19.208 *** | 0.946 | 0.895 | | |
| | TLCs3 | 0.861 | 0.062 | 13.846 *** | 0.747 | 0.558 | | |
| Teacher self-efficacy | TSE1 | 1.000 | | | 0.836 | 0.699 | 0.820 | 0.605 |
| | TSE2 | 0.924 | 0.070 | 13.115 *** | 0.798 | 0.636 | | |
| | TSE3 | 0.956 | 0.095 | 10.049 *** | 0.692 | 0.479 | | |
| Collaborative professional learning | CPL1 | 1.000 | | | 0.831 | 0.691 | 0.879 | 0.709 |
| | CPL2 | 1.040 | 0.065 | 15.965 *** | 0.901 | 0.812 | | |
| | CPL3 | 0.904 | 0.068 | 13.238 *** | 0.790 | 0.624 | | |
| Learner-centered teaching | LCT1 | 1.000 | | | 0.853 | 0.727 | 0.876 | 0.703 |
| | LCT2 | 0.976 | 0.063 | 15.614 *** | 0.880 | 0.775 | | |
| | LCT3 | 0.877 | 0.065 | 13.492 *** | 0.779 | 0.606 | | |

*** $p < 0.001$.

- Teacher learning communities. The scale was used to evaluate teachers' participation in learning communities. Five items were designed for teacher experiences within schools; two items were deleted with lower factor loading after confirmatory factor analysis. The retained three items are: "participating in class observations in learning communities at my school", "participating in discussions after class observations in learning communities at my school" and "participating in joint lesson planning in learning communities at my school". Participants were asked to indicate the frequency of their participation in each activity, ranging from "never", "one to two", "three to four", "five to six", to "seven and more" times. The five responses corresponded to the degree of their participation and were coded as a five-point scale. The CR value for the scale was 0.90, and the AVE value was 0.75. The scale exhibited high internal consistency, with a Cronbach's α value of 0.89.
- Teacher self-efficacy. The scale used to measure teacher self-efficacy was based on the work of Soodak and Podell [54], Hoy and Woolfolk [57], and Tschannen-Moran and Hoy [53]. It included three items: "I can motivate those students who are not interested in academic learning to be devoted to learning", "My teaching can facilitate every student to fulfill their potential" and "I feel energetic when I operate classrooms as learning communities". Participants responded to the survey using a six-point Likert-type scale, indicating their level of agreement with each statement. The CR value was 0.82, and the AVE value was 0.61. The Cronbach's α of the scale was 0.80, indicating the scale's satisfactory internal consistency.

- Collaborative professional learning. This study evaluated teachers' collaborative professional learning using a three-item scale with a six-point Likert-type scale. Another designed item was deleted with lower factor loading after confirmatory factor analysis. The items reflect behaviors that are encouraged in teacher learning communities [28,29]; they are: "I discuss with my peers how to design learning activities, such as big ideas, key questions, and what students are able to know and do", "I discuss with my peers whether and where student learning is happening" and "I discuss the multifaceted nature and particularity of student learning with peers through class observation". The CR value of the scale was 0.88, and the AVE value was 0.71. The scale's Cronbach's α was 0.88, indicating high internal consistency.
- Learner-centered teaching. The assessment of teacher practice of learner-centered teaching was based on constructivist theories, specifically Vygotsky's [48] theory and Sato's [39] and Pan et al.'s [26,28] analysis of learning communities. It aimed to measure how teachers promoted student engagement in inquiry, cooperation, and expression in their classrooms. The scale was designed with four items, but one was deleted with lower factor loading after confirmatory factor analysis. In the retained three items, participants responded to the survey using a six-point Likert-type scale, indicating their level of agreement with the statements. The items are: "When students are having learning difficulties, I probe students to think rather than giving the answer directly", "In the classroom, I attend to the arrangement of learning activities to incorporate collaborative learning" and "I let students explain their viewpoints or the answer to the question". The scale's CR value was 0.88, and the AVE value was 0.70. The scale's reliability was also established through Cronbach's α , which was 0.88.

To sum up, the CR values for teacher learning communities, self-efficacy, collaborative professional learning, and learner-centered teaching were 0.90, 0.82, 0.88, and 0.88, respectively, which exceeded the cut-off level of 0.60 [65]. Additionally, the AVE of the three latent variables ranged from 0.61 to 0.75, above the desired value of 0.50 [66]. The findings indicate that the model had adequate convergent validity. The Fornell–Larcker criterion stipulates that the square root of the AVE of each latent variable in the diagonal should be greater than its contrasting correlation coefficients [66]. Table 2 shows that the model had favorable discriminant validity.

Table 2. Discriminant validity of the main constructs.

| | AVE | 1 | 2 | 3 | 4 |
|--|------|------|------|------|------|
| 1. Experiences in TLCs | 0.75 | 0.87 | | | |
| 2. Teacher self-efficacy | 0.61 | 0.33 | 0.78 | | |
| 3. Collaborative professional learning | 0.71 | 0.26 | 0.66 | 0.84 | |
| 4. Learner-centered teaching | 0.70 | 0.25 | 0.74 | 0.68 | 0.84 |

3.3. Data Analysis

The statistical analysis was conducted using AMOS 24.0. Confirmatory factor analysis was conducted, then structural equation modeling was used to assess the relationships among teachers' experiences in learning communities, self-efficacy, collaborative professional learning, and learner-centered teaching. The model fit was determined using several indexes such as root mean square error of approximation (RMSEA), comparative fit index (CFI), Tracker–Lewis index (TLI), and standardized root mean squared residual (SRMR). Data fit was considered acceptable if $CFI \geq 0.90$, $TLI \geq 0.90$, $RMSEA \leq 0.08$, and $SRMR \leq 0.08$ [67]. The significance of the indirect effect was confirmed using bootstrapping, where the data was resampled 5000 times to yield a parameter estimate for indirect and total effects. The significance of the mediating effect was determined by examining the 95% bias-corrected confidence interval for the parameter estimate if it did not contain zero [68,69].

4. Results

4.1. Preliminary Analysis

Table 2 presents the descriptive statistics for all variables. The mean score for teachers' experiences in teacher learning communities within schools by operating the steps of lesson study was 3.35 on a five-point scale. The mean scores for collaborative professional learning and learner-centered teaching were 4.74 and 4.88, respectively, on a six-point scale. Those scores indicate teachers' high-intermediate level of engagement in the related variables. Finally, teacher self-efficacy had a mean score of 4.39, indicating a moderately high confidence level in their ability to facilitate student learning. Prior to conducting the structural equation modeling, the study examined the correlations among the four variables. Table 3 presents the Pearson correlation coefficients, which indicate that all four variables are positively correlated. Given the significant and positive correlations between the independent (exogenous) and dependent (endogenous) variables, the study proceeded to employ the structural model to assess which variables are most strongly related to the outcome variables.

Table 3. The means and correlation matrix.

| | M | SD | 1 | 2 | 3 |
|--|------|------|----------|----------|----------|
| 1. Experiences in TLCs | 3.35 | 1.15 | | | |
| 2. Teacher self-efficacy | 4.39 | 0.70 | 0.33 *** | | |
| 3. Collaborative professional learning | 4.74 | 0.76 | 0.30 *** | 0.59 *** | |
| 4. Learner-centered teaching | 4.88 | 0.67 | 0.27 *** | 0.65 *** | 0.60 *** |

*** $p < 0.001$.

4.2. The Linkage of Experiences in Teacher Learning Communities with Self-Efficacy, Collaborative Professional Learning, and Learner-Centered Teaching

Figure 2 displays the standardized estimation of the structural model, which suggests a good model fit, with the following values: RMSEA = 0.06, TLI = 0.97, CFI = 0.97, and SRMR = 0.07. The model controlled for school level, but it was found that school level did not have a significant role.

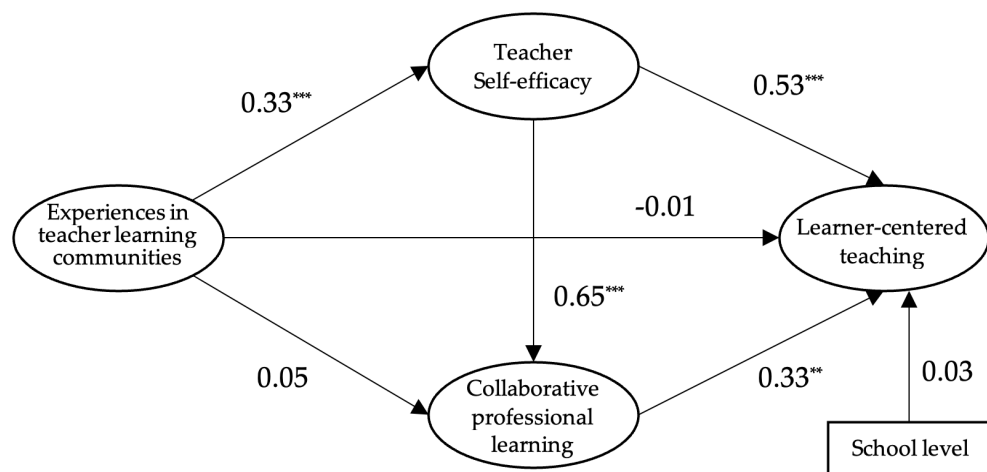


Figure 2. SEM model of participation in teacher learning communities and learner-centered teaching. Note: ** refers to $p < 0.01$, *** refers to $p < 0.001$.

A full mediation model was observed in terms of the relationships between experiences in teacher learning communities (TLCs), self-efficacy, and learner-centered teaching (LCT). TLCs did not directly predict LCT ($\beta = -0.01$, $p > 0.05$), but they were positively associated with self-efficacy ($\beta = 0.33$, $p < 0.001$), which, in turn, predicted LCT ($\beta = 0.53$, $p < 0.001$). Thus, the effect of TLCs on LCT was mediated by teacher self-efficacy (TSE).

Regarding the linkage between experiences in teacher learning communities and collaborative professional learning (CPL) and learner-centered teaching, TLCs were not associated with CPL ($\beta = 0.05$, $p > 0.05$) or LCT. However, CPL directly predicted LCT ($\beta = 0.33$, $p < 0.01$). To establish the relationship between TLCs and teaching practice through CPL, self-efficacy played a critical role. Specifically, TLCs were positively associated with self-efficacy ($\beta = 0.33$, $p < 0.001$), which, in turn, predicted CPL ($\beta = 0.65$, $p < 0.001$), and then predicted LCT ($\beta = 0.33$, $p < 0.001$). In sum, there are two identified mediation paths: “TLCs–TSE–LCT” and “TLCs–TSE–CPL–LCT”.

To validate the influence of mediation effects, the study employed the bootstrapping method. Significance tests for specific indirect effects of the mediators were conducted using bootstrapping procedures with a 95% percentile interval. Table 4 indicates that although the direct effect was insignificant, teachers who participated in learning communities showed enhanced learner-centered teaching through self-efficacy. In the full mediation model, teacher self-efficacy played a vital role as a mediator. Another mediation path was observed from teacher learning communities to teacher self-efficacy to collaborative learning and finally to learner-centered teaching.

Table 4. Bootstrapping results of mediated effects.

| | Point Estimates | Product of Coefficients | | Bootstrapping | | <i>p</i> |
|---------------------------------|-----------------|-------------------------|-------|-------------------|-------|----------|
| | | | | Percentile 95% CI | | |
| | | SE | Z | Lower | Upper | |
| Indirect effects | | | | | | |
| Experiences in TLCs→TSE→LCT | 0.10 | 0.04 | 2.89 | 0.05 | 0.20 | 0.000 |
| Experiences in TLCs→CPL→LCT | 0.01 | 0.02 | 0.60 | −0.02 | 0.05 | 0.475 |
| Experiences in TLCs→TSE→CPL→LCT | 0.04 | 0.02 | 2.28 | 0.02 | 0.09 | 0.001 |
| Total indirect effects | 0.15 | 0.04 | 4.05 | 0.08 | 0.23 | 0.000 |
| Direct effects | | | | | | |
| Experiences in TLCs→LCT | −0.00 | 0.04 | −0.08 | −0.08 | 0.07 | 0.947 |
| Total effects | 0.15 | 0.05 | 3.27 | 0.06 | 0.24 | 0.001 |

Note: Experiences in TLCs: Experiences in teacher learning communities, TSE: Teacher self-efficacy, CPL: Collaborative professional learning, LCT: Learner-centered teaching

5. Discussion

This study involved a program intervention where teachers participated in teacher learning communities, implementing the indigenous model of lesson study. The study utilized structural equation modeling to evaluate the extent to which the program intervention may promote learner-centered teaching. The results revealed two paths of direct and indirect effects of experiences in teacher learning communities on learner-centered teaching. The first path was from teacher learning communities to teacher self-efficacy to learner-centered teaching, while the second path was from teacher learning communities to teacher self-efficacy to collaborative professional learning and, finally, to learner-centered teaching. These findings highlight several crucial issues to be discussed.

First, self-efficacy plays a critical role in the mediation models. Bandura [70] posits that teachers’ sense of efficacy can greatly impact their thoughts, feelings, and actions. Teachers with a higher sense of teaching efficacy may put in as much effort or persist as long as they believe their teaching effectively influences student learning. Several studies indicate that teachers who rate themselves as highly self-efficacious report an increased level of instructional quality or innovation [20–22]. In the context of Taiwan, learner-centered teaching, which stresses transforming teachers’ roles from knowledge transmitters to learning facilitators, presents a challenge for most teachers. Constructivist pedagogy requires a paradigm shift in teaching and learning, which can be difficult for teachers. However, teachers who believe in their competence are more likely to try the new teaching

approach. Efficacious teachers frequently engage in professional learning activities, such as keeping up to date with the profession, trying out new approaches to improve their practices, and changing their practice to promote process-oriented student learning [64]. In this study, it was found that self-efficacy promoted teachers' engagement in collaborative professional learning, such as discussing with peers how to design learning activities, big ideas, key questions, and whether and where student learning is happening.

Second, participation in learning communities also contributed to the enhancement of self-efficacy. Teachers in this study worked collaboratively to plan lessons, conduct the lesson in the classroom, and observe and discuss teaching [28,29]. This professional learning approach occurs in authentic situations where individuals deprivatize instructional practices and link discussion with curriculum and assessment [1]. By seeing how colleagues teach, teachers in this study had opportunities to learn how to operate student-centered classrooms. The collaborative process might enhance teacher efficacy to facilitate student learning and confidence in practicing classrooms as learning communities. Choi et al.'s [71] study suggests that teacher self-efficacy was positively affected by an intervention program of project-based learning, which is in-line with our findings.

However, experiences in learning communities did not directly result in teacher adoption of innovative teaching, possibly because the shift in the pedagogical paradigm takes time. In addition, teacher participation in learning communities did not always result in collaborative professional learning in their daily work life, which might be due to factors such as complexities of context, prior learning experiences, and participants' persistence [72].

In summary, this study reveals that self-efficacy is an outcome that an intervention program can prompt and is a more immediate outcome than a change in teaching practice or teachers' continuous collaborative learning. Achieving the desired result, specifically, learner-centered teaching, requires the development of self-efficacy. Teachers with higher self-efficacy are more likely to apply the knowledge and skills acquired in learning communities to their classroom practice.

6. Conclusions

The previous literature suggests that learning communities are effective in improving teaching [10,12,25]. However, more research is needed to fully understand the mechanism by which learning communities contribute to instructional practices. This study examined teacher self-efficacy and collaborative professional learning as mediators to investigate how they mediate the relationship between teachers' experiences in learning communities and their practice of learner-centered teaching. Structural equation modeling was conducted using data from elementary and junior high school teachers attending the "Learning Community under Leadership for Learning" program in Taiwan. The study found that the relationship between experiences in teacher learning communities and the teaching practice of student-centeredness was mediated by teacher self-efficacy. Additionally, experiences in teacher learning communities connected with self-efficacy, which, in turn, predicted collaborative professional learning, and then predicted learner-centered teaching.

Based on the results, several suggestions are proposed. First, the learning community with collaborative, job-embedded, and sustained features is an effective approach to teacher professional learning. School leaders may promote the implementation of lesson study as it is a powerful tool for teacher professional development. Through the cycle of action-inquiry, teachers can systematically reflect on their teaching, and the community of practice offers opportunities for teachers to reframe their cognition about pedagogy [73]. This approach is conducive to the realization of teachers as researchers. Second, self-efficacy plays an essential role in innovative teaching. It is a mechanism by which teacher learning communities affect teacher change in instructional practice. Interventions that aim to improve teaching practices should not only provide teachers with new knowledge and skills but also develop their self-efficacy, as it is a key factor in teachers' ability to apply new knowledge and skills in the classroom. Therefore, program implementers should focus on

enhancing teacher self-efficacy to catalyze the effect of learning communities. Third, this study utilized a cross-sectional design to assess the program effect. However, longitudinal data is suggested for a more comprehensive understanding of changes in teacher outcomes and how teachers' participation in learning communities affects their self-efficacy and practice of learner-centered teaching over time. Student outcome is also essential for future studies to explore.

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