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REGULAR ARTICLE

Development and Validation of Cross-School Professional Learning Community Scale

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Abstract Professional learning communities across schools facilitate teacher collaboration while fostering professional development. These can be created in virtual, offline, or blended settings. To measure the success of these efforts, this study developed and validated the Cross-School Professional Learning Community Scale (CSPLCS). Conducted in three stages, the study focused on teachers in remote public elementary schools in Taiwan. Relevant literature was reviewed to establish the conceptual framework of the scale. The developed scale was distributed to a small sample, with 350 valid responses collected for item analysis, exploratory factor analysis, and internal consistency. Once the factor structure was established, we collected 1021 valid responses for confirmatory factor analysis, composite reliability, average variance extracted, convergent validity, and cross-validation. The correlated factors model was selected to validate the CSPLCS through model competition strategies. In the final stage, 2995 valid responses were collected for current status analysis and repeated measures ANOVA to understand the effectiveness of the developed CSPLCS in remote public elementary schools.

Keywords Cross-school professional learning community · Professional learning community scale · Remote elementary schools

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Introduction

Professional learning communities (PLCs) are communities of learners seeking to continue building their body of professional knowledge and relevant skillsets (Hord, 1997). The core concepts of PLCs in the field of education include ensuring student learning, fostering a collaborative culture, committing to continued effort, and focusing on outcomes (DuFour, 2005). PLCs emphasize shaping team vision, promoting team learning and professional growth, enhancing team collaboration, sharing teaching practices, establishing supportive learning environments, and creating team values (Battersby & Verdi, 2015; Heggen et al., 2018; Soebari & Aldridge, 2016). Through engaging in high-quality collaborative learning and adopting innovative practices within PLCs, educators can improve instructional effectiveness and enhance student learning performance (Turcotte et al., 2010), and such collaboration is critical to promoting overall quality of teachers' learning and teaching experiences (De Jong et al., 2022). For teachers in rural and remote schools, access to PLCs is crucial as these educators are more likely to experience professional isolation (Panizzon, 2011). Teachers and students in rural schools struggle with limited resources and inadequate teacher training (Akram et al., 2020).

The creation and management of cross-school PLCs are complex due to organizational, geographic, and professional constraints, and the outcomes are influenced by factors such as leadership, the perception of shared goals, collaboration, and facilitation and support (Prenger et al., 2021). For remote schools, the challenges of establishing cross-school PLCs include difficulties in initiating efforts, sharing teacher expertise, designing and preparing curriculum, and integrating resources across schools (Chao & Liu, 2017; Szeto et al., 2021; Warley et al., 2012). Thus, many schools are limited

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to developing communities within their own premises and fail to foster learning and collaboration across schools or districts. However, lateral connections between schools are essential to realizing cultural changes within the educational system at the regional level (Fullan, 2007). Researchers and practitioners are thus shifting the focus from within-school to cross-school PLCs to facilitate teacher development and school improvement. Szeto et al. (2021) followed six teachers participating in a cross-school PLC for two years and found that the teachers increased not only their technological, pedagogical, and content knowledge but also their collaboration skills. Prenger et al. (2021) interviewed teachers participating in a cross-school PLC and found that leadership, the perception of a shared goal, structured activities, and collaboration produced positive outcomes; however, the teachers faced difficulties in transferring the knowledge gained back to their own schools.

Existing assessments for PLCs include the School-Level Reading Instrument (Williams et al., 2008), Professional Learning Community Assessment (Huffman & Hipp, 2003), and Professional Learning Community Assessment-Revised (Hipp & Huffman, 2010; Olivier & Hipp, 2010). These are all within-school measures. The present study aimed to develop a cross-school PLC scale. As such, we proposed the following questions:

1. What dimensions and items are relevant to measuring of the effectiveness of cross-school PLCs?
2. Is the developed scale reliable and valid?

Cross-School Professional Learning Communities

The effective utilization of PLCs is essential for teacher collaboration and professional development because schools that can successfully implement PLC are more likely to become learning organizations (Cibulka & Nakayama, 2000). The core mechanism of PLCs lies in learning the content of school operations. In PLCs, community members collectively explore knowledge and engage in practical applications (Hord & Hirsh, 2008). PLCs should include shared learning, communication, and shared governance to lead to positive changes in schools (Fred, et al., 2019; Wilson, 2016). PLCs provide an environment that actively encourages teacher development, collaboration, and innovation (Brown et al., 2018). Members of these communities focus on shared interactions and supporting growth (Admiraal et al., 2021; Olivier & Huffman, 2016).

Moreau et al. (2013) interviewed teachers who had participated in PLCs for three years and found indications that literacy-teaching knowledge and personal self-efficacy had increased. Through inter-school collaboration and learning, schools can enhance their internal professional learning and collaborative culture. The reciprocal relationship between intra-school and inter-school collaboration can promote a cycle of inquiry learning that results in the accumulation of practical experience and new knowledge (Jackson & Temperley, 2006). In the dynamic development of PLCs, initiating professional dialogue, responding to community needs, and promoting professional development are crucial considerations (Huffman & Hipp, 2003). PLCs aim to facilitate teacher and student learning through collaborative efforts among group members (Hairon, et al., 2015). Furthermore, the teaching expertise gained by teachers within PLCs can improve students' academic performance in social and scientific subjects (Phillips, 2003). Successful PLCs require shared performance responsibilities, trust, open communication, collaboration, high expectations, teacher empowerment, and positive working relationships (Green, 2017).

Schools with a strong learning culture can share their experiences with other schools through cross-school community activities. The willingness of teachers to engage in continuous learning, participate in cross-school communities, and take part in school-based learning activities, by applying their acquired knowledge to curriculum transformation and practical teaching, is a crucial issue in educational reform (Fullan, 2007; Hargreaves & Shirley, 2009). The effective operation of cross-school PLCs provides teachers with opportunities for communication, collaborative learning, experience sharing, and cooperative inquiry, promoting both teacher professional development and effective student learning (Dudley, et al., 2020; Stoll, et al., 2006). In remote elementary schools in Taiwan, teachers with teaching expertise actively participate in cross-school PLCs and consequently break down barriers between subject areas, grade levels, or individual schools. By actively shaping a shared learning vision, sharing leadership practices, and co-creating team values, these teachers can uphold correct teaching beliefs and values. They establish mutual trust, collaborate, and embody the positive energy of team learning through continuous dialogue, communication, sharing, and reflection on practical experiences in teaching and student learning. This collaborative process helps to identify and effectively solve problems, all the while enhancing professional competence, promoting professional development, achieving teaching goals, and continually improving teacher instructional capabilities and student learning outcomes. Team learning among cross-school PLCs is beneficial for enhancing teaching expertise. The interaction and communication among cross-school teachers enable the co-creation of visions and goals, fostering not only the sharing of learning outcomes but also improvements in teaching practices (Ye et al., 2021; Dudley et al., 2020). Teachers actively participating in PLCs tend to display a high level of concern for student learning outcomes, including ensuring student learning, fostering a collaborative culture, and focusing on results (Roberts, 2011). PLCs contribute to the construction of a

learning culture and create a school culture of teacher mutual assistance, team learning, willingness to share, professional values, and sustainable development. Through teachers' collective efforts, student learning outcomes are enhanced, and teachers continuously improve and grow through team learning (Battersby & Verdi, 2015; Thompson, et al., 2004).

Cross-School Professional Learning Community Scale

To aid in the establishment of PLCs in varied contexts and varying developmental phases, researchers around the world have developed reliable tools to assess PLC development. The Canadian School-Level Reading Instrument (SLRI) was developed by Williams et al. (2008). This instrument measures four attributes: culture, leadership, teaching, and professional development. Louis et al. (1995) developed a survey of professional communities in the United States of America (USA). Bolam et al. (2005) examined PLCs in the United Kingdom (UK). Huffman and Hipp (2003) developed the Professional Learning Community Assessment (PLCA) for the USA. Subsequent revisions produced the Professional Learning Community Assessment-Revised (PLCA-R) (Hipp & Huffman, 2010; Olivier & Hipp, 2010).

The PLCA-R has been utilized in a range of studies worldwide. Its internal consistency, reliability, and validity are thus well-established. For example, the PLCA-R was translated and adapted for use with teachers in Turkey. After evaluating four alternative confirmatory factor analysis (CFA) models to validate the internal structure of the Turkish version of the PLCA-R, the six-factor model with correlated residuals was retained (Dogan et al., 2017). The PLCA-R is one of the most widely used instruments for assessing professional learning and collegiality in elementary and secondary schools. It has been found suitable for schools as professional communities in the Spanish context (Domingo-Segovia, et al., 2020) and has been used to assess the degree of teachers' participation in PLCs in Chili (Ruz, 2023), Iceland (Bjornsdóttir et al., 2021), Spain (Domingo-Segovia, et al., 2020), and Turkey (Dogan et al., 2017). Ruz (2023) highlighted the constraints associated with formal classroom observation, feedback or peer mentoring practices, and informal dialogues among teachers. Bjornsdóttir et al. (2021) found that shared values and vision were the most significant for preschool teachers. Dogan et al. (2017) used the PLCA-R to demonstrate that organizational capability is a statistically significant predictor of interpersonal abilities.

Although the effectiveness of PLCs has been confirmed in many contexts, remote schools are subject to relative disadvantages in geography, spatial concepts, culture, society, and the economy compared to their urban counterparts (Szeto et al., 2021). In the case of a remote elementary school with lower student academic achievement, PLCs with strong team learning, enhanced teaching capabilities, and a focus on outcomes can significantly improve teacher instructional efficacy and student learning outcomes (Berry, et al., 2005).

Influenced by various contextual factors, the dynamic process of teacher learning in a cross-school environment manifests different learning cultures. However, some organizational learning mechanisms remain common (Ye et al., 2021). In cross-school communities, through cycles of discourse and texts in collective activities, a cross-text understanding gradually forms. Cross-school PLCs primarily focus on the co-creation of goals and values, team learning and collaborative assistance, teacher professional development and growth, and the establishment of supportive systems and contexts. When the education system enables teachers to engage in professional development, teaching practices can be improved (Akram et al., 2022). The effective operation of cross-school PLCs can help teachers to continually enhance their teaching expertise, thereby promoting effective student learning (Hadar & Brody, 2021; Szeto, et al., 2021). Based on the above literature and research findings, this study developed an initial draft of a cross-school PLC scale. It consisted of four dimensions: (1) constructing goals and values together, (2) team learning and cooperation, (3) the advancement of the teaching profession, and (4) administrative support.

Methodology

This study employed three phases of questionnaire surveys and focused on teachers from remote public elementary schools in Taiwan to explore the effectiveness of cross-school PLCs.

Instrument Development

Based on the research objectives and relevant literature, a preliminary version of the Cross-School Professional Learning Community Scale (CSPLCS) consisting of 32 items was developed. Expert validation was conducted using purposive sampling to select fifteen experts, including five professors, three principals, two directors, two team leaders, and three teachers. The content validity ratio (CVR) was calculated using the method proposed by Grant and Davis (1997). A CVR of at least 0.78 was required to deem an item as valid (Rutherford-Hemming, 2018). Four dimensions were rated on a five-point Likert scale. "*We shape common teaching beliefs and construct a culture of cross-school teacher collaboration*" is an example of 'constructing goals and values together'. "*We actively participate in workshops and training organized by the community, expanding our professional capabilities*" is an example of 'team learning and cooperation'. "*We arrange cross-school teaching demonstrations*

and observations, inspiring teachers to enrich and refine teaching skills" is an example of 'the advancement of teaching profession'. "*We actively seek external resources and funding to enhance community operational efficiency*" is an example of 'administrative support'.

Data Analysis

Statistical analysis was conducted using *SPSS 13*.0 for Windows and *IBM SPSS Amos 22.0*. We applied the following analyses: item analysis, exploratory factor analysis (EFA), internal consistency reliability, confirmatory factor analysis (CFA), composite reliability, average variance extracted (AVE), convergent validity, cross-validation, and repeated measures ANOVA.

Study 1

A total of 917 public elementary schools are located in remote areas in Taiwan. This study employed stratified random sampling. In the first phase of the research, 45 remote elementary schools were randomly selected. Ten questionnaires were distributed to teachers in each selected school, resulting in a total distribution of 450 questionnaires. A total of 359 questionnaires were collected, representing a response rate of 79.78%. After invalid responses were eliminated, 350 questionnaires were deemed valid for analysis.

Item Analysis

To understand the discrimination and homogeneity of the CSPLCS questions, an item analysis was conducted. This is a process in which the quality of individual items is reviewed and analyzed by sorting out the good items from the weak ones and revising them to improve them (Hartati & Yogi, 2019) was used. Item analysis mainly involves comparisons of extreme groups (Shiffler, 1988) and homogeneity tests (DeVellis, 2003). The average scores for each item range from 3.39 to 3.67, meaning that they all fell within the range of the overall mean $\pm$ 1.5 standard deviations, which was between 2.16 and 4.90. The standard deviations for all items ranged from 0.87 to 0.96 (i.e., all exceeded 0.667). For extreme group analysis, the entire sample was divided into high and low groups based on the top and bottom 27% of the total scale scores. A comparison of the mean scores between the two groups for each item showed significant differences, with *t*-values reaching the 0.001 significance level, indicating that each item demonstrated discriminative power. Regarding homogeneity, as the items all measured the same construct, there should be a high correlation between each item and the total score.

Exploratory Factor Analysis

To determine the construct validity of the CSPLCS and to understand the components and factor loadings of the CSPLCS questions, EFA was used to assess data suitability, factor extraction method, factor retention method, rotation method, and interpretation and labeling (Taherdoost et al., 2014). The Kaiser–Meyer–Olkin (KMO) measure, the sphericity test (Kaiser, 1974), and principal component analysis were used to examine the underlying structure, each question behind the CSPLCS questions, and the appropriateness of the factor loadings (Tabachnick & Fidell, 2013). For EFA, we employed principal component analysis with an orthogonal rotation using the varimax method as the rotation axis. Items with factor loadings greater than 0.40 were retained. After five items with lower loadings or cross-loadings were removed (Items 9, 16, 17, 21, and 22), we performed analysis with the remaining 27 items. The results indicated an Appropriateness of Sampling (KMO) value of 0.98, and the chi-square value from the sphericity test was 13,121.94, thereby reaching statistical significance.

The most important dimension was administrative support. This included eight items with factor loadings ranging from 0.59 to 0.79, explaining 26.22% of the variance. The second was constructing goals and values together, with eight items with factor loadings between 0.59 and 0.76 explaining 23.85% of the variance. The third dimension was team learning and cooperation, with six items with factor loadings ranging from 0.62 to 0.73, explaining 20.92% of the variance. The fourth dimension, advancement of the teaching profession, comprised five items with factor loadings between 0.54 and 0.68, explaining 12.76% of the variance. The factor loadings for all 27 scale items exceeded 0.50, and the cumulative explained variance reached 83.75%. The overall Cronbach's α coefficient was 0.99, while the Cronbach's α coefficients for the four dimensions ranged from 0.95 to 0.97, indicating good stability for the scale.

Study 2

For the second phase of the study, 135 remote elementary schools were randomly selected. Ten copies of the questionnaire were distributed to each school, resulting in 1350 distributed questionnaires. The collected samples amounted to 1021, representing a response rate of 75.63%. Out of these, 998 questionnaires were deemed valid. To meet the needs of subsequent data analysis, the 998 valid samples were randomly divided into two groups, each consisting of 499 samples: the validation samples (N_1) and the verification samples (N_2).

Descriptive characteristics

We first conducted an analysis of the descriptive characteristics of the two sample groups. The results are shown in Table 1. According to Kline (2005), data can be considered normally distributed if the absolute skewness is within 2 and kurtosis is within 7. With normal distribution confirmed, we applied the maximum likelihood method for model estimation.

Validation of Test Model

To further test the stability of the CSPLCS structure and verify whether the CSPLCS is consistent with the theoretical model, CFA was used to analyze the preliminary fit criteria, overall model fit, and fit of the internal structure of the model, including individual item reliability (Bagozzi & Yi, 1988), composite reliability, average variance extracted (Hair et al., 2010), convergent validity, and discriminant validity (Anderson & Gerbing, 1988).

We conducted a model comparison using the validation group ($N_1 = 499$), as shown in Table 2. In terms of the uncorrelated factors model, the fit indices such as χ^2, χ^2 /*df*, RMSEA, CFI, NNFI, SRMR, and GFI did not meet the acceptable standards. Additionally, ECVI, AIC, and BIC values were relatively large (7.79, 3877.63, and 4105.11, respectively). For the correlated factors model, although χ^2 was significant, χ^2 /*df* was only 3.66, meeting the acceptable standard of less than 5. Other indices, including RMSEA, CFI, NNFI, and SRMR, showed good fit, and GFI was within an acceptable range. Moreover, ECVI, AIC, and BIC values were relatively small (2.58, 1285.23, and 1537.99, respectively). In the second-order factor model analysis, although χ^2 was significant, the χ^2 /*df* was only 3.73. Other indices, including RMSEA, CFI, NNFI, SRMR, and GFI, all indicated acceptable levels of fit, and the ECVI, AIC, and BIC values were relatively small (2.63, 1308.76, 1553.09). These results suggest that both the correlated factors model and the second-order factor model provide a good fit. However, since the correlation coefficients among the four factors in the correlated factors model range from 0.85 to 0.95, indicating high correlations, the presence of higher-order factors is suggested. Therefore, using the second-order factor model as the validation model for CSPLCS is more appropriate.

Reliability and Validity

In terms of the reliability of individual measurement items, an examination of the squared multiple correlations (SMC) values for each first-order factor and its corresponding measurement items revealed values ranging from 0.74 to 0.97. This indicates that the variance explained by the first-order factors and their items exceeds the error variance. Accordingly, the reliability of both the first-order factors and the individual items in this scale is demonstrated to be good. Additionally, the composite reliability of the second-order factor (cross-school interaction and assistance) was found to be 0.974, with an average variance extracted (AVE) of 0.905. The composite reliability values for the four first-order factors were 0.969, 0.968, 0.961, and 0.975, while their AVE values were 0.797, 0.837, 0.833, and 0.829, all meeting the required standards. This demonstrates that the reliability of the validated model is good. The parameter estimates for the model are presented in Fig. 1.

Cross-Validation

Cross-validation using random sampling, achieved through moderate replication (Lee & Jan, 2017), can be tested with loose replication (fixed factor structure) and tight replication (fixed structure, factor loadings, and residuals) (MacCallum et al., 1994). The analysis was conducted using the verification sample ($N_2 = 499$) as shown in Table 3. In the loose replication model, all parameters were freely estimated, and the overall model fit, represented by the minimum fit function χ^2 (MFFχ^2), was 2792.07. For the tight replication, the

Table 1 Descriptive statistics for Study 2

Sample	Mean		SD		Skewness		Kurtosis	
	Min	Max	Min	Max	Min	Max	Min	Max
Validation group ($N_1 = 499$)	3.379	3.617	.863	1.000	− .237	.078	− .634	− .266
Verification group ($N_2 = 499$)	3.267	3.537	.848	.961	− .297	.114	− .404	.021

Table 2 Analysis of competing model fit

Fit index Model	$\chi 2(df)$	χ^2/df	RMSEA	CFI	NNFI	SRMR	GFI	ECVI	AIC	BIC
Uncorrelated factors model	3769.63 (324)	11.64	.15	.83	.81	.63	.67	7.79	3877.63	4105.11
Correlated factors model	1165.23 (318)	3.66	.07	.96	.95	.02	.85	2.58	1285.23	1537.99
Second-order factor model	1192.76 (320)	3.73	.07	.96	.95	.02	.85	2.63	1308.76	1553.09

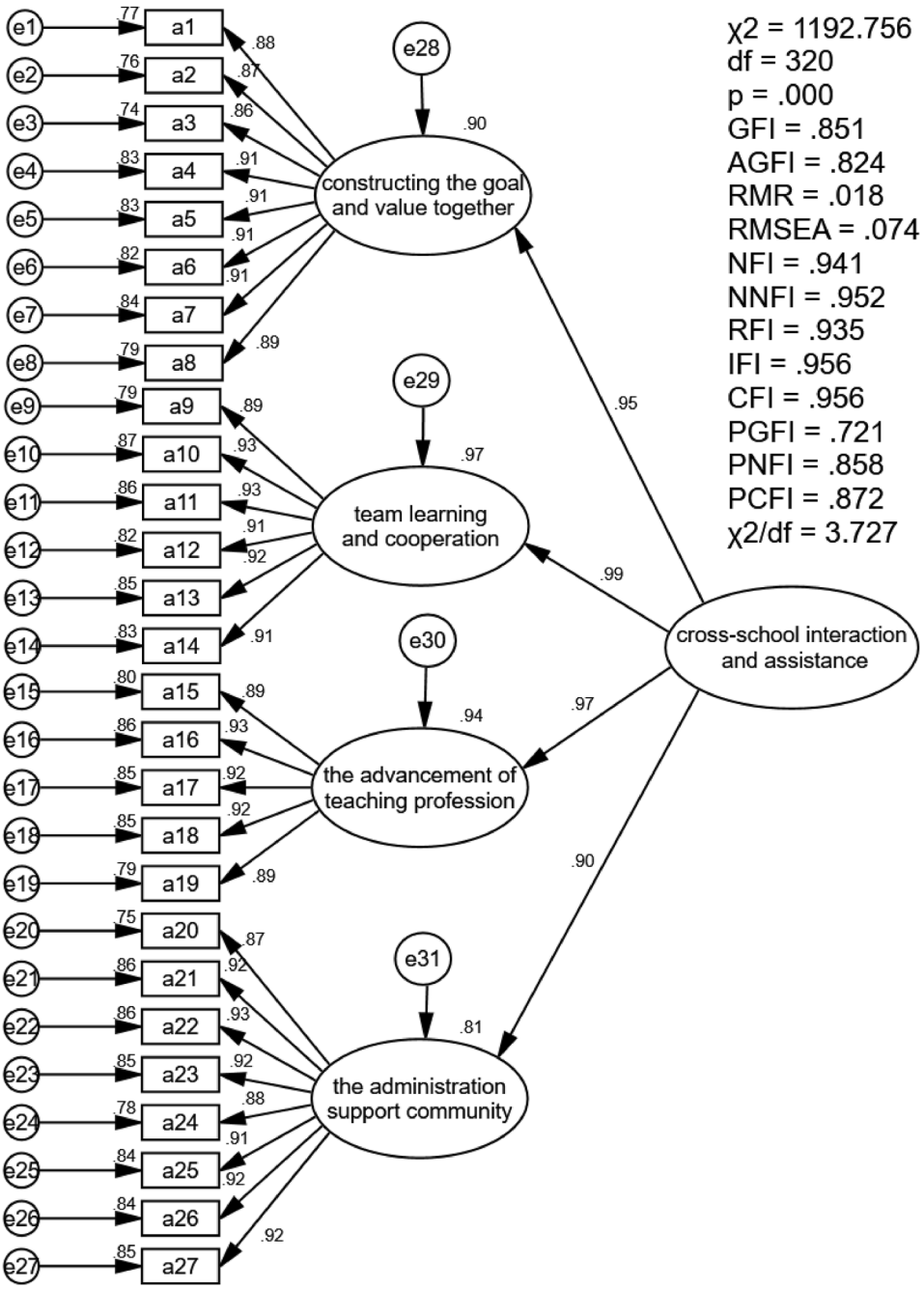

Fig. 1 Structural equation modeling of CSPLCS

Table 3 Cross-validation of model

Strategy	Overall model fit MFFχ^2 (*df*)	ΔMFF χ^2	Validity sample MFFχ^2 (*df*)	χ^2 contribution ratio
Loose replication	2792.07 (640)	22.48 (*df* = 27)	1599.31 (320)	57.28%
Tight replication	2814.55 (667)		1645.38 (347)	58.46%

MFFχ^2 was 2814.55, with a difference of 22.48 (*df* = 27), which did not reach the 0.05 significance level, indicating that the cross-validation was supported in this study.

Furthermore, under the loose replication, the MFFχ^2 for the verification sample was 1599.31, with a χ^2 contribution ratio of 57.28%. Under the tight replication, the

MFFχ^2 of the verification sample was 1645.38, and χ^2 contribution ratio was 58.46%. These results suggest that the model can be generalized to different group samples within the same population, supporting the cross-validation of the verification model in this study.

Study 3

The third phase of the study involved a sample of 400 remote elementary schools in Taiwan. Ten questionnaires were distributed to teachers in each school, resulting in a distribution of 4000 questionnaires. The collected sample consisted of 3062 responses, representing a response rate of 76.55%. After screening, 2995 questionnaires were deemed valid for analysis.

As shown in Table 4, regarding the overall and specific operational aspects of CSPLC in remote elementary schools, the overall mean was 3.45, with a standard deviation of 0.79. Across the four dimensions, the highest mean score was observed for advancement of the teaching profession ($M = 3.50$, $SD = 0.83$), followed by team learning and cooperation ($M = 3.45$, $SD = 0.85$) and administrative support ($M = 3.44$, $SD = 0.84$). The lowest mean score was for constructing goals and values together ($M = 3.43$, $SD = 0.81$). To assess whether there were significant differences in these dimensions, a repeated measure one-way analysis of variance (ANOVA) was conducted. The results indicated a significant Mauchly's $W = 0.82$ ($p < 0.001$), and with Greenhouse–Geisser correction, the F value was 33.14 ($p < 0.001$). Pairwise comparisons revealed that the score for advancement of the teaching profession ($M = 3.50$) was significantly higher than team learning and cooperation ($M = 3.45$) and administrative support ($M = 3.44$). Additionally, the scores for advancement of teaching profession ($M = 3.50$), team learning and cooperation ($M = 3.45$), and administrative support ($M = 3.44$) were significantly higher than constructing goals and values together ($M = 3.43$).

Discussion

Based on relevant literature and research, a preliminary version of the CSPLCS with 32 items was developed. To establish the content validity of the scale, fifteen experts (including five professors, three principals, two directors, two group leaders, and three teachers) were engaged to review the questionnaire items. Two studies were then conducted to verify the reliability and validity of the scale, utilizing item analysis, EFA, internal consistency reliability, CFA, composite reliability, AVE, convergent validity, cross-validation, and repeated measures ANOVA. In Study 1 ($N = 350$), item analysis results indicated that the correlation coefficients between individual items and the total score were all above 0.30, meeting the standard proposed by DeVellis (2003) and suggesting high homogeneity. After EFA, five items with low loadings or cross-loadings were removed. The four dimensions cumulatively explained 83.75% of the total variance, with internal consistency ranging from 0.95 to 0.97. In Study 2 ($N_1 = 499$, $N_2 = 499$), most of the model fit indices met the standards proposed by Bagozzi and Yi (1988), Hu and Bentler (1998, 1999), and Hair et al. (2010). SMC, composite reliability, and AVE values all met the criteria set by Bagozzi and Yi (1988). The factor loadings for all items reached the 0.05 significance level, meeting the standard proposed by Anderson and Gerbing (1988). Through an iterative process, the final CSPLCS comprised four latent dimensions: constructing goals and values together (eight items), team learning and cooperation (six items), advancement of the teaching profession (five items), and administrative support (eight items). A total of 27 items were confirmed as valid and stable. In Study 3 ($N = 2995$), the aim was to apply the developed scale to measure the effectiveness of an operating cross-school PLC. The teachers felt that the PLC successfully helped to advance the teaching profession and promoted team learning and cooperation. This echoes the results of Admiraal et al. (2021) and Olivier and Huffman (2016), who found that PLCs could enhance the professional development of community members, foster interactive sharing, and support mutual growth. Dogan et al. (2017) and Domingo-Segovia et al. (2020) also found that team collaboration and professional development among

Table 4 Descriptive statistics of CSPLCS

Dimension	Mean	SD	Mauchly W	F	Pairwise comparison
Constructing goals and values together	3.43	0.81	.82***	33.14***	C > B, D > A
Team learning and cooperation	3.45	0.85			
Advancement of the teaching profession	3.50	0.83			
Administrative support	3.44	0.84			
CSPLCS	3.45	0.79			

$N = 2995$

***$p < .001$

community members contributed to teachers' teaching and students' learning.

Conclusion and Recommendations

Through statistical analyses, this study confirmed the reliability, validity, and fit of the developed scale. The item structure conforms to the correlated factors model, and the model exhibits stability. In remote elementary schools in Taiwan, the effectiveness of each dimension was ranked as follows: advancement of the teaching profession, team learning and cooperation, administrative support, and constructing goals and values together. Based on these findings, this study suggests that teachers in remote elementary schools could use the developed CSPLCS for self-assessment to understand the effectiveness of their cross-school PLCs. Additionally, school administrators in remote elementary schools should actively establish platforms for resource sharing within their respective domains. This can facilitate smooth communication and resource exchange among community members. Planning dedicated time for cross-school community learning and discussions as well as instituting recognition or reward mechanisms for outstanding performance in cross-school communities can enhance the willingness and momentum for team learning among teachers. Finally, remote elementary schools should leverage the teaching expertise of individual teachers from different schools through collaboration, discussion, and interaction among cross-school community members to establish common teaching goals and learning values. This collaborative effort will contribute to the concrete development of distinct features for remote elementary schools.

Although the present study focused exclusively on remote public elementary schools in Taiwan, the developed CSPLCS with good reliability and validity could also be used in urban schools or within-school PLC at different educational levels, as the items of the scale are not limited to cross-school PLCs. By adapting the CSPLCS, teachers can assess their professional development and then improve inadequate aspects of their teaching. In addition, the CSPLCS can serve as a guide to help schools formulate goals and values and examine whether administrative support is adeqate. It is worth noting that policymakers can utilize the CSPLCS to identify the needs of schools in different PLCs and encourage schools to develop their own distinctive characteristics, goals and values to improve instructional quality.

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