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Instructional leadership scale for high school principals: Development and validation

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Abstract

Principal instructional leadership (PIL) refers to the management of school curriculum, instruction, and assessment by the principal of a school. It is essential to measure the extent of the instructional leadership provided by principals and to propose means of improving instructional leadership. The principal instructional leadership scale (PILS) has been put forward to achieve these goals. In the current study, we validated the PILS on a sample of Taiwanese teachers using a multilevel approach involving expert reviews and three studies. Following two stages in confirmation of content validity by 20 experts, the initial 30-item PILS with five core concepts was subjected to discrimination analysis, exploratory factor analysis, and internal consistency reliability analysis utilizing *SPSS 13.0* for Windows and *AMOS 22.0* ($n = 339$). This resulted in the deletion of nine items. In the second study, the individual item reliability of the remaining 21 items was examined, and the composite reliability, convergent validity, and discriminant validity confirmed the selection of the optimal model ($n = 672$). The results of the third study ($n = 1438$) supported metric invariance, scalar invariance, and factor variance-covariance invariance and confirmed scalar measurement invariance across genders. Finally, cross-validation analysis verified that the scale was stable and well-constructed.

Keywords

Principal instructional leadership, instructional leadership scale, high-quality high schools

Introduction

Since 1994, the shift from a 9-year to 12-year compulsory education has contributed to significant education reforms, which continue to reshape the value and context of the education system in Taiwan (Chen et al., 2020a). The definition of learning performance has transformed from a focus on academic achievements to multiple competence-based comprehensions. Transitioning policy has impacted the implementation of curriculums, learning paradigms, and principal

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leadership. To cultivate global human resources, the School Actualization Program (SAP) was established in 2007 to facilitate the implementation of a 12-year compulsory education through the provision of financial subsidies (Chen et al., 2020b). Many senior high schools were encouraged to apply for SAP and devote themselves to enhancing their curriculum, instruction, teacher professional development, and student attainment. The reformation of these schools motivated student creativity as well as performance and promoted instructional innovation associated with principal instructional leadership (PIL) (Ismail et al., 2018; Tan, 2019). These benefits highlighted the fact that principals are a key factor influencing teacher professional development, teaching effectiveness, student learning achievements, and even school education quality (Lochmiller and Mancinelli, 2019).

PIL is a significant factor in school performance. Over the past few decades, researchers have collected evidence that principal leadership indirectly influences student achievement (Hallinger and Heck, 1996) and mediates the relationship between teacher practices and student learning (Al-Mahdy et al., 2022; Goddard et al., 2019) as well as the relationship between the emotional intelligence of a principal and teaching strategy (Chen and Guo, 2020). The role of school principals is multifunctional, not only in physical but also in mental dimensions, significantly influencing teacher professional development and organizational commitment (Sukarmin, and Sin, 2022).

PIL is positively correlated with different types of teacher professional development, including peer observation, mentoring, and coaching (Kim and Lee, 2020) and enhances teacher proficiency and student learning effectiveness (Marks and Printy, 2003). It seems that a high level of clarity in a principal's vision and mission creates the conditions for instructional leadership to establish a positive work climate (Leaf and Odhiambo, 2017).

However, there exist gaps in the conceptual framework of PIL (Hallinger, 2011), and studies differ in their definition of the concept (Boyce and Bowers, 2018; Hallinger et al., 2017). While the principal instructional management rating scale (PIMRS) has been widely applied across countries (including Ghana (Abonyi et al., 2022), Fiji (Lingam et al., 2021), Indonesia (Sukarmin, and Sin, 2022), and Iran (Hallinger, and Hosseingholizadeh, 2020)) and languages (including Chinese (Antoniou and Lu, 2018; Chen, and Guo, 2020) and Malay (Thien, 2022)), its reliability and validity have yet to be confirmed for varying demographic and cultural contexts.

Antoniou and Lu (2018) confirmed the construct validity, reliability, and internal consistency of the PIMRS in the Chinese education system using the confirmatory factor analysis (CFA). That study removed 6 out of the 50 items based on satisfactory fit indices. Thien (2022) removed 4 items to ensure construct validity in the Malay version of the PIMRS. As the PIMRS explores PIL in general, the current study sought to develop and validate a principal instructional leadership scale (PILS) to explore the extent of PIL implemented in high-quality high schools.

Principal instructional leadership

Principals are school leaders who play crucial roles in the management of school curriculum, instruction, and school climate. Thus, they are not only administrative managers but also active instructional leaders. This demands awareness of their own professional knowledge and ability, teachers' teaching effectiveness, and students' learning effectiveness. High-performing principals tend to spend a large amount of time and resources on promoting the effectiveness and quality of school management (Shaked and Schechter, 2020). Instructional leaders observe teaching activities, give suggestions to facilitate teaching practice and effectiveness (Murphy, 1988; Yasin and Hamzah, 2018), and are directly and indirectly involved in improving teacher professional development

and cooperation between teachers (Kim and Lee, 2020; Marks and Printy, 2003). Principals also have to cooperate with teachers through communication, sharing, and support to establish high-quality learning environments in order to achieve learning goals while raising teaching effectiveness and school education quality (Aas and Paulsen, 2019; Catano and Stronge, 2006).

Principals set school development goals, provide resources to meet students' learning needs, and are responsible for forming relationships with teachers to encourage professional development, student effective learning, school reformation, and teaching creativity (Shengnan and Philip, 2018; Urick and Bowers, 2014). High-performing principals mediate the relationship between teachers' professional growth and student learning (Tul et al., 2019) and even directly impact student outcomes (Robinson et al., 2008). Through PIL, principals can help teachers to improve their professional competence, contribute to creating a positive teaching environment, improve teaching capacity, and foster students to reach their potential (Bogotch et al., 2017).

PIL was conceptualized in Western contexts and adopted by researchers in Asian countries from the 1970s (Pan et al., 2015). Cultural and social differences in these educational settings necessitate the adaptation of relevant conceptual frameworks and instruments (Hallinger, 2011; Hallinger et al., 2017). For example, principals from Asian countries such as Taiwan or China tend to employ more indirect behaviors such as *developing a supportive work environment* as opposed to directly emphasizing the quality of teaching (Walker et al., 2012). The Asian conceptualization of PIL differs from the Western perspectives due to the expectations of and functions that principals play in schools. Thus, the general model of PIL is applicable only following adjustment and expansion to accommodate the cultural and social contexts of PIL (Widiyan et al., 2020).

Significant educational reforms in the 1990s and the implementation of SAP in 2007 in Taiwan resulted in the enhancement of teaching quality and student performance, especially for senior high schools. However, in a review of 80 empirical studies on PIL in Taiwan, Pan et al. (2015) found that 75% of the studies focused on elementary school while only 8% investigated senior high schools. Furthermore, most of those studies validated the conceptual development of the Western model of PIL, neglecting local contexts. Pan et al. (2017) interviewed 32 high-performing elementary and junior high school principals to confirm the importance of cooperation and engagement among teachers, stakeholders, and the community. Although PIL is correlated with positive teacher behaviors and attitudes (Heck and Hallinger, 2014) and is key to shaping school culture, specifically the cultures of teaching and learning (Aas and Paulsen, 2019; Dobrodeevaa et al., 2008), PIL research has failed to contribute to educational reform due to its neglect of high school contexts as well as the socio-cultural perspectives unique to Taiwan. Indeed, with regard to the latter, Kim and Lee (2020) compared the effects of PIL on teacher participation in various professional development activities in Japan, Singapore, and South Korea, finding that the effects of PIL differ based on the types of learning activities as well as countries.

Principal instructional leadership scale

As described above, contemporary research on school leadership provides strong evidence that PIL is correlated with teacher professional development (Kim and Lee, 2020). It also shows that support from principals for teachers' continuous learning is important (Akiba et al., 2015) and affects students' learning outcomes (Sebastian and Allensworth, 2012). Thus, many researchers have sought to develop a conceptual framework to better understand the role that PIL plays in education contexts (Hallinger and Murphy, 1985; Porter et al., 2010).

The framework proposed by Hallinger and Murphy (1985) comprises the following three dimensions: defining the school mission (school goal framework and delivery), managing teaching

programs (teaching supervision and evaluation, curriculum coordination, and student progress monitoring), and creating a positive school climate (maintaining instructional time, enhancing teacher professional development and learning motivation, and promoting school visibility). The PIMRS was based on this framework and consists of 50 items measuring these three dimensions and 10 functions on a Likert-type scale (ranging from (1) almost never to (5) almost always) (Hallinger, 2011; Hallinger and Wang, 2015). This scale has been widely applied to empirical studies in many countries. Alig-Mielcarek (2003) proposed a 23-item five-point Likert-type instructional leadership scale (ILS) based on the following three dimensions: providing professional development opportunities, introducing shared goals, and giving feedback during the learning and teaching process. The reliability and validity of this scale were verified in subsequent studies (Atalay et al., 2019), including Bozkurt et al. (2021), who removed the variable "feedback" dimension for improved validity.

Incorporating qualitative and quantitative methods, Porter et al. (2010) utilized interviews and pilot studies to develop the Vanderbilt Assessment of Leadership in Education (VAL-ED). The VAL-ED is a pen-and-paper and online assessment focusing on an evaluation of support for student learning as well as teacher professional enhancement and leaders' management. Widiyan et al. (2020) also used a mixed method to develop an instructional leadership scale by involving 238 principals from public elementary schools in Indonesia, confirming the construct, convergent, and discriminant validity of the scale. That scale used 25 items to measure the following five dimensions: defining school mission, adopting curriculum, supplying professional development opportunities, promoting a positive learning climate, and conducting supervision activities. However, when Manaseh (2016) found evidence that teaching quality and student learning effectiveness are key to successful school management, these two dimensions were also added to the scale.

The PIMRS, VAL-ED, and ILS are based on Western perspectives. Nonetheless, these have been globally implemented, including in Asian countries, since the 1970s. The role of a principal is conceptualized in terms of socio-cultural norms, which impose different expectations for leader behavior. Bajunid (1996) pointed out the need for an Asian conceptualization of PIL, and Widiyan et al. (2020) emphasized the necessity of evaluating instructional leadership based on socio-cultural perceptions. Pan et al. (2015) highlighted not only the influences of socio-cultural differences but also those of indigenous needs. Educational contexts differ most notably in terms of system structure and social culture; the validity and reliability of research instruments in different contexts must thus be confirmed. Therefore, we propose the following research questions:

1. What are the factors and items of the principal instructional leadership scale (PILS) implemented in high-quality high schools?
2. What are the reliability and validity of the PILS?

Research method

The current paper applied the quantitative approach of a survey questionnaire to explore high-performing and dominant leadership strategies.

Instrument development

The questionnaire items were generated in three phases. In Phase 1, the first draft of the questionnaire was drawn up based on a synthesis of relevant literature. Next, to increase the semantic

accuracy and content validity of the items, 10 professors were invited to review the questionnaire. The second version of the questionnaire was created based on their suggestions; this draft was verified by three high-school principals, two school directors, two section chiefs, and three teachers. To test the content validity of the items obtained in Phase 1, the content validity ratio (CVR) was calculated using the method proposed by Grant and Davis (1997): a CVR of at least 0.78 is required to deem an item as valid (Rutherford-Hemming, 2018). This draft covered the following five factors using 30 indicators on a five-point rating: developing school instructional characteristics (No. 1-6) (e.g. *Discusses academic goals and curriculum with teachers to develop school features*), improving curriculum and instruction quality (No. 7-12) (e.g. *Encourages teachers to use multiple measures for student evaluation*), stimulating teachers' professional growth (No.13-18) (e.g. *Supports professional community to enhance teaching ability*), enhancing adaptive learning effectiveness (No. 19-24) (e.g. *Provides incentives and opportunities to inspire adaptive learning*), and optimizing teaching support (No. 25-30) (e.g. *Incorporates the community and other schools to enhance teaching resources*). The 30 indicators explore the extent of PIL as perceived by their teachers. We also collected demographic information such as the gender, academic level, and years of teaching experience of each participant.

Data analysis

The current paper employed a sequential method comprising three studies. Each applied *SPSS 13.0* for Windows, *AMOS 22.0*, to item analysis, exploratory factor analysis, internal consistency reliability, individual item reliability, composite reliability (CR), average variance extracted (AVE), convergent validity, discriminant validity, cross-validation, and measurement invariance.

Study 1

The five identified domains were measured in 253 high-performing high schools, including 115 in northern Taiwan, 71 in central Taiwan, and 67 in southern Taiwan. These high schools were accredited as excellent by the Ministry of Education of Taiwan in 2021. Six teachers were randomly selected from each of the 71 schools in central Taiwan for the survey. We thus distributed 426 questionnaires, 339 of which were returned and 326 were deemed valid, representing a response rate of 79.6% and recovery rate of 76.6%. Voluntary participation, informed consent, anonymity, and confidentiality were implemented, and the obtained data were analyzed holistically rather than individually.

Discrimination

For principal component analysis on the 30 items, the Kaiser–Meyer–Olkin value ($KMO = 0.98$) and Bartlett's test of sphericity ($\chi^2 = 13519.78$, $P < 0.000$) confirmed the appropriateness of the data analysis (Tabachnick and Fidell, 2013). Nine items were removed based on the following criteria: eigenvalue lower than 1, loading below 0.4 onto a factor, cross-loadings above 0.4, and item intercorrelations below 0.5. Specifically, one item was removed from "developing school instructional characteristics" (i.e. five retained), one item was removed from "improving curriculum and instruction quality" (i.e. five retained), three items were removed from "stimulating teachers' professional growth" (i.e. three retained), two items were removed from "enhancing adaptive learning effectiveness" (i.e. four retained), and two items were removed from "optimizing teaching support" (i.e. four retained). The cumulative percentage of coefficients with eigenvalues of ≥ 1

was 85.09%. The most dominant PIL strategy was "developing school instructional characteristics," which had a high variance value of 20.88% compared with other factors. Reliability analysis was conducted to determine the internal consistency of dimensions; results ranged from 0.93 to 0.97.

Study 2

Descriptive characteristics of sample

In the Study 2, the factor structure of the scale and its convergent and discriminant validity were determined through the CFA. Thirteen teachers were randomly selected from each of the 67 high schools in the southern area of Taiwan. Thus, a total of 871 questionnaires were distributed, of which 697 questionnaires were deemed valid, representing a recovery rate of 77.15%. These were randomly divided into two sets, including a validation sample ($N_1 = 336$) for the CFA and a verification sample ($N_2 = 336$) for cross-validation of the best model to assure the stability of the factorial structure. The data were considered normal based on a range of skewness from −2 to +2 (Garson, 2012) and kurtosis from −7 to +7 (Byrne, 2010), as shown in Table 1. Individual item reliability, CR, convergent validity, and discriminant validity were examined to choose the best model.

Validation of test model

Structural equation modeling (SEM), specifically CFA, was used to evaluate the competing models. An uncorrelated-factors model, a correlated-factors model, and a hierarchical model were examined; the results indicated that the correlated-factors model possessed the best convergent validity, discriminate validity, and reliability. As shown in Table 2, the expression of PIL was a good fit for

Table 1. Descriptive statistics for Study 2.

	Mean		SD		Skewness		Kurtosis	
Sample	Min	Max	Min	Max	Min	Max	Min	Max
Validation sample ($n_1 = 336$)	3.899	4.292	0.878	1.013	−1.236	−0.677	−0.193	1.274
Verification sample ($n_2 = 336$)	3.866	4.262	0.915	1.058	−1.382	−0.803	0.170	1.789

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	2922.64 (189)	15.46	0.21	0.71	0.68	0.66	0.55	8.98	3006.64	3166.96
Correlated factors model	404.81 (231)	2.26	0.06	0.98	0.97	0.02	0.90	1.52	508.81	707.30
Hierarchical model	457.46 (184)	2.49	0.07	0.97	0.97	0.02	0.89	1.65	551.46	730.86

the data: $\chi^2 = 404.81$, root mean square error of approximation (*RMSEA*) = 0.06, *CFI* = 0.98, *NNFI* = 0.97, *SRMR* = 0.02, *GFI* = 0.90, *ECVI* = 1.52, *AIC* = 508.81, and *BIC* = 707.30.

Reliability and validity

The squared multiple correlations (SMC = 0.67–0.87) indicated good reliability. To test the validity of the measurement model, indicator loadings, CR, and AVE were utilized: CR = 0.966, 0.936, 0.932, 0.941, and 0.942, and AVE = 0.850, 0.746, 0.821, 0.800, and 0.803. For indicator loadings, CR (λ) was between 0.82 and 0.93, which were higher than the recommended 0.70 (Bagozzi and Yi, 1988). All AVE values were higher than the recommended 0.50. These results indicate that the measurement items were good representations of each research variable in the model (Hair et al., 2014). The resulting model is shown in Figure 1.

Convergent validity and discriminant validity

Table 3 presents the five factors comparing 10 times: $\triangle\chi^2$ was between 20.17 and 155.89, $\triangle df = 1$, $P < 0.05$. Thus, the test model with good discriminant validity had five different constructs. For cross-validation, the stability of the model passed the statistical tests from loose to tight replication strategies. Cross-validation analysis verified that the scale was stable and well-constructed. Thus, the 21-item PILS with a five-factor structure had good construct validity in the form of a single-factor model.

Study 3

In the Study 3, we applied a stratified random sampling to 1800 teachers from 253 high-performing high schools: 48 from the northern area, 71 from the middle area, and 67 from the southern area. The researchers utilized *SPSS 24.0* to obtain more straightforward data. Following the deletion of invalid responses, the collected data from 1438 teachers were examined by measuring the invariance of PILS across male teachers ($n = 582$) and female teachers ($n = 856$).

Measurement invariance analysis

It is necessary to employ measurement invariance to evaluate how well the specified model fit and to use multiple fit statistics to assess the model fit (Kline, 2005). The model fits in CFA analyses were tested by utilizing the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the RMSEA. Results indicated that for male teachers, $\chi^2 = 681.062$, $P < 0.001$, *CFI* = 0.971, *RMSEA* = 0.069, *TLI* = 0.965, and *GFI* = 0.899, and for female teachers, $\chi^2 = 994.120$, $P < 0.001$, *CFI* = 0.963, *RMSEA* = 0.073, *TLI* = 0.957, and *GFI* = 0.891. Thus, the model fit the data well. As shown in Table 4, χ^2 difference testing indicated that the metric-invariance model fit the data no worse than the configural-invariance model ($\Delta\chi^2 = 22.924$, $P = 0.348$, ΔCFI = 0.000), thus providing support for weak invariance. The more restrictive scalar-invariance model fit the data just as well as the metric-invariance model ($\Delta\chi^2 = 60.442$, $P = 0.000$, ΔCFI = −0.001), thus supporting the strong invariance hypothesis. The results thus supported metric invariance, scalar invariance, and factor variance-covariance invariance and indicated that the five factors were valid across genders ($\chi^2 = 1281.01$, $P < 0.001$, *CFI* = 0.972, *RMSEA* = 0.065, *TLI* = 0.967, *GFI* = 0.916).

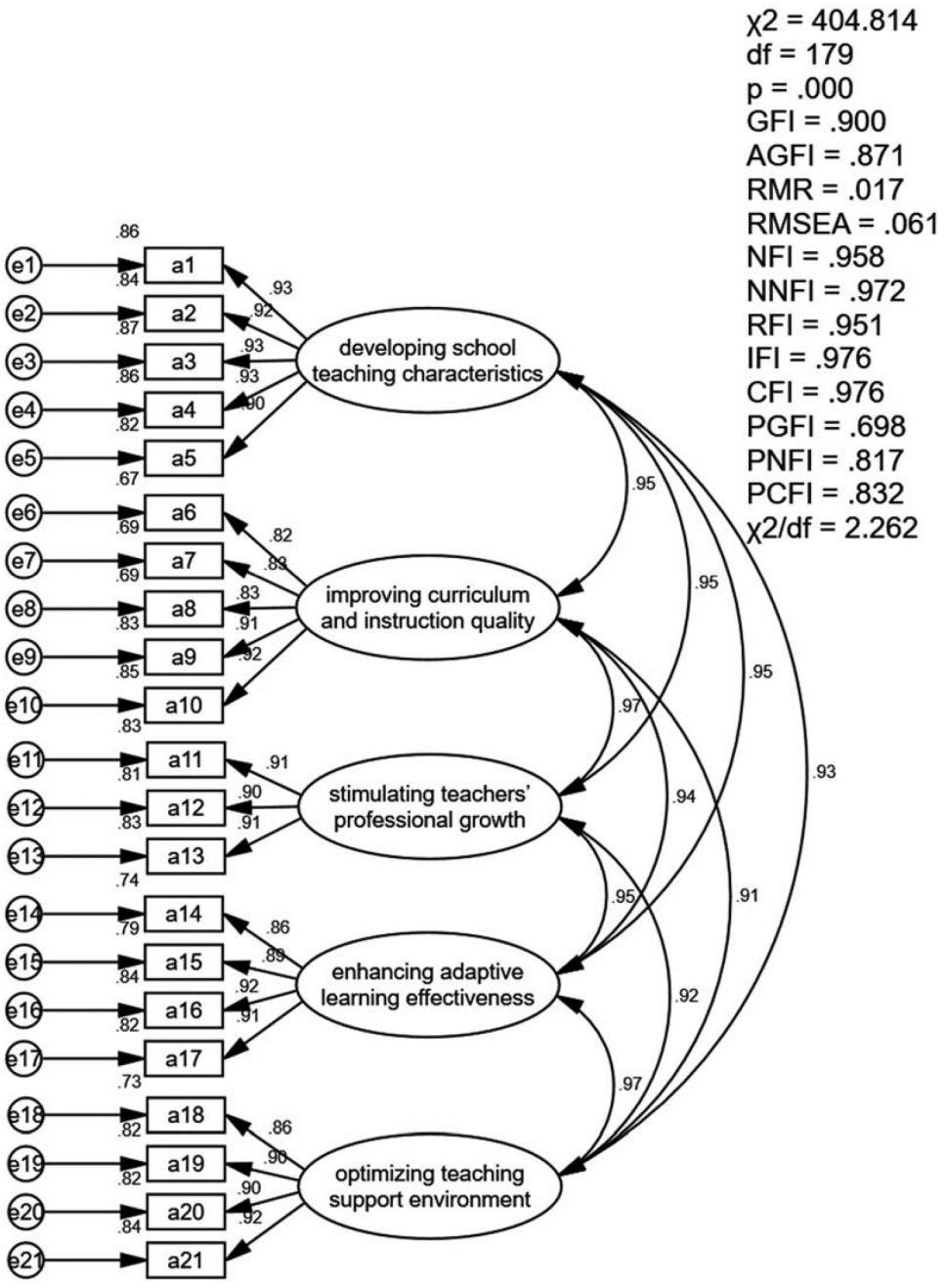

Figure 1. The structural equation modeling of PILS.

Table 3. Cross-validation of model.

Strategy	Overall model fit MMFχ^2 (*df*)	△MFFχ^2	Contribution to χ^2 MFFχ^2 (*df*)	χ^2
Loose replication	1013.18 (358)	32.11 (31)	608.36 (179)	60.04%
Tight replication	1045.29 (389)		678.21 (210)	64.88%

Table 4. Model fit statistics for test of measurement invariance.

Model	$\chi^2(df)$	CFI	$\Delta\chi^2$	Δdf	*P*	ΔCFI
M1: Configural invariance	1675.183 (358)	.966	—	—	—	—
M2: Metric invariance	1698.108 (379)	.966	22.924	21	.348	.000
3. Scalar invariance	1758.550 (400)	.965	60.442	21	.000	-.001
4. Factor variance-covariance invariance	1787.104 (410)	.965	28.554	10	.000	.000

Table 5. Descriptive statistics of principal instructional leadership $N = 1438$.

Factor	Mean	SD	Mauchly *W*	*F*	Pairwise comparison
Developing school teaching characteristics	4.03	0.89	0.84***	130.88***	E > D > C
Improving curriculum and instruction quality	3.94	0.88			A > B
Stimulating teachers' professional growth	4.06	0.87			
Enhancing adaptive learning effectiveness	4.11	0.86			
Optimizing teaching support	4.19	0.82			
PILS	4.06	0.82			

Employing one-way ANOVA to further examine the performance of principal instruction leadership ($n = 1483$), significant differences were found in five factors (Mauchly $W = 0.84$, $P < 0.001$). Finally, Greenhouse–Geisser correction was utilized ($F = 130.88$, $P < 0.001$). The results of pairwise comparison showed the factor *Optimizing teaching support* significantly outperformed the other four factors as shown in Table 5. *Improving curriculum and instruction quality* was the least identified factor.

Discussion

The present study developed a research-based PILS with a focus on validity and reliability for use in high schools. The first draft of the questionnaire was based on a synthesis of relevant literature. To increase the semantic accuracy and content validity of the items, 20 experts (10 professors, three high school principals, two school directors, two section chiefs, and three teachers) were invited to review the first draft. After three phases of generating and content validation of questionnaire items, three studies for testing the 30-item inventory were conducted, using item analysis, exploratory factor analysis, internal consistency reliability, individual item reliability, CR, AVE, convergent validity, discriminant validity, cross-validation, and measurement invariance by which to develop an appropriate inventory of PIL. In Study 1 ($n = 339$), exploratory factor analysis

supported the five-dimensional structure of the developed PILS after deleting nine items. The Kaiser–Meyer–Olkin value ($KMO = 0.98$) and Bartlett's test of sphericity ($\chi^2 = 13519.78$, $P < 0.000$) confirmed the appropriateness of the data analysis (Tabachnick and Fidell, 2013). The cumulative percentage of coefficients with eigenvalues of ≥ 1 was 85.09%. The internal consistency of five factors ranged from 0.93 to 0.97. In Study 2 ($n = 672$), CFA confirmed the scale's factor structure as well as its convergent and discriminant validity. These results indicate that the measurement items were good representations of each research variable in the model (Hair et al., 2014). Metric invariance, scalar invariance, and factor variance-covariance invariance indicated that the five factors were valid across genders ($\chi^2 = 1281.01$, $P < 0.001$, $CFI = 0.972$, $RMSEA = 0.065$, $TLI = 0.967$, $GFI = 0.916$).

After an iterative process, the developed PILS including five latent factors: *developing school teaching characteristics* (5 items), *improving curriculum and instruction quality* (5 items), *stimulating teachers' professional growth* (3 items), *enhancing adaptive learning effectiveness* (4 items), *and optimizing teaching support* (4 items) and a total of 21 measurement items were verified as effective and stable. Distinct from the previous measurements of PIL, such as PIMRS, VAL-ED, and ILS, the PILS added the domains of *improving curriculum and instruction quality* and *enhancing adaptive learning effectiveness*, both of which are currently regarded as significant features of PIL.

Outstanding PIL requires a comprehensive approach including managing the school and helping teachers and students in instruction and learning (Kim and Lee, 2020; Lochmiller and Mancinelli, 2019). PIL has direct and indirect influences on factors related to schools, teachers, and students, including school climate (Leaf and Odhiambo, 2017), teaching practice (Chen and Guo, 2020), teaching effectiveness (Yasin and Hamzah, 2018), teacher professional development (Kim and Lee, 2020), and even student achievement (Hallinger and Heck, 1996). However, there has yet to be a consensus on its definition and conceptual framework (Boyce and Bowers, 2018; Hallinger, 2011; Hallinger et al., 2017). Previous assessment scales tended to evaluate external issues related to school mission, school climate, teaching practice, and professional development (Hallinger and Murphy, 1985; Alig-Mielcarek, 2003; Porter et al., 2010), but teaching quality and student learning effectiveness are essential for successful school management (Manaseh, 2016). Internal features such as teaching quality and student learning effectiveness are thus important aspects of the assessment of PIL (Aas and Paulsen, 2019; Marks and Printy, 2003).

Our results indicated that teachers in high-quality high schools regarded the assistance from principals in enhancing teaching quality as insufficient. Unexpectedly, the teachers perceived a high level of *optimizing teaching support* and a low level of *improving curriculum and instruction quality*. That means their principals predominately utilize relevant sources to support teachers' professional development (Fatih, 2020), but provide less support with regard to enhancing the quality of teaching and curriculum. It seems that Asian principals tend to utilize indirect supervision rather than direct support (Lingam et al., 2021; Pan et al., 2015). Indeed, past research shows that principals in elementary and junior high schools in Taiwan were low performers in terms of *ensuring teaching quality* (Pan et al., 2015), while the principals of Japanese secondary schools scored the lowest on *protecting instructional time while supervising and evaluating instruction* (Lingam et al., 2021). Correspondingly, the results of the present study indicate that high-quality PIL in senior high schools in Taiwan does not seem to include efforts to improve the teaching curriculum and instructional quality. Socio-cultural factors might encourage Asian principals to lead in ways that are more conservative and implicit. However, due to ongoing educational reform, teachers expect their principals to provide more direct guidance, such as teaching demonstrations, observations, and positive feedback in teaching evaluations, to refine teaching quality.

Conclusion and recommendations

In the present study, we theorize PIL as a multi-dimensional construct and describe the development and validation of a behavioral measure of PILS. Our results confirmed good reliability and validity, and the best fit for the item structure of the inventory was a corrected-factors model. PILS is thus a valuable tool for measuring the effectiveness of school principals. Additionally, the results showed that outstanding principals searched for external resources, such as *applying for educational subsidizes* or *incorporating the community and other schools to enhance teaching resources*, but neglected internal factors such as conducting curriculum reform, constructing teaching evaluations and consulting systems for teachers, or even observations and teaching demonstrations. As in Japan, Korea, and Singapore (Kim and Lee, 2020; Lingam et al., 2021), principals in Taiwan need more training on how to explicitly guide teachers in improving teaching quality.

Based on our results, the following suggestions are proposed. First, it is recommended that school principals utilize the developed scale in conducting self-evaluations and in gathering feedback from teachers to improve their instructional leadership. Additionally, teachers should be invited to analyze the implementation of PIL and propose effective strategies for enhancing the school teaching climate. Second, the PILS can be utilized to construct an indicator system to establish standards for PIL, including factors, domains, and indexes, to serve as reference in the continual monitoring of leadership in practice. Third, future studies could extend the research scope to elementary schools, junior high schools, or even colleges and employ in-depth interviews, observations, or case studies to further explore PIL. Moreover, it would be worth examining the correlations between PIL and variables such as psychological capital, teaching beliefs, teacher leadership, and class management.

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Appendix

Table A1. Dimensions of principal instructional leadership scale.

Factor	Item
Developing school instructional characteristics	1. Discusses academic goals and curriculum with teachers to develop school features
	2. Plans curriculum and teaching methods based on school features
	3. Designs course plans based on curriculum objectives
	4. Develops school features based on educational trends and reformed policy
	5. Adopts teachers' suggestions about curriculum and instructional methods
	6. Coordinates consensus among teacher and students about teaching features
Improving curriculum and instruction quality	7. Participates in curriculum and teaching workshops in various fields
	8. Encourages teachers to use multiple measures for student evaluation
	9. Walks around to observe teaching in classrooms
	10. Participates in teaching demonstrations to provide positive feedback
	11. Arranges flexible learning time to assist teachers in curriculum planning
	12. Constructs teaching evaluations and consulting system to help teachers to examine their teaching
Stimulating teachers' professional growth	13. Conducts teaching professional development workshops
	14. Rewards excellent teaching publicly to motivate teachers
	15. Supports professional community to enhance teaching ability
	16. Encourages teachers to share teaching sources
	17. Conducts planning of teacher professional development with teachers
	18. Shares educational knowledge and teaching experiences with teachers
Enhancing adaptive learning effectiveness	19. Promotes multiple learning systems to enhance students' learning motivation
	20. Provides incentives and opportunities to inspire adaptive learning
	21. Monitors student learning to track the progress of adaptive learning
	22. Communicates effectively with teachers and students to promote adaptive learning
	23. Emphasizes team learning and resource sharing to motivate adaptive learning
	24. Outlines various learning activities for student learning
Optimizing teaching support	25. Provides support and assistance for teachers to solve teaching-related problems
	26. Increases instructional technology based on school needs and features
	27. Distributes and adjusts teaching assignments and workload for teachers appropriately
	28. Incorporates the community and other schools to enhance teaching resources
	29. Actively applies for educational subsidies and cooperative resources
	30. Leads the school teaching teams to assist in teaching activities