

Validation of a Multidimensional Scale for Teachers' Professional Learning in Malaysian Secondary Schools

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Abstract

This study aims to validate the construct of the Teacher Professional Learning instrument developed based on three main dimensions, namely Updating Activities, Reflective Activities and Collaborative Activities. The original instrument contains 39 items and is rated using a seven-point Likert scale. This study involved a total of 90 secondary school teachers in Malaysia who were selected through purposive sampling. Exploratory Factor Analysis (EFA) technique with Varimax rotation method was used to determine the factor structure of this instrument. The results of the analysis showed that the KMO value was 0.868 and the Bartlett's Test of Sphericity test was significant ($\chi^2 = 1954.338$, $df = 351$, $p < .001$), indicating that the data was suitable for factor analysis. A total of 12 items were dropped because they had low loading values or factor overlap, and 27 items remained which formed three robust factors with eigenvalues exceeding 1. These three dimensions explained 66.90% of the total variance. This finding indicates that this instrument has good construct validity and can be used in studies related to teacher professional development in Malaysia. The implications of the study and suggestions for improving the instrument are also discussed.

Keywords: Teachers' Professional Learning, Exploratory Factor Analysis (EFA), Instrument Validation, Secondary School Teachers, Construct Validity

Introduction

Teacher professional learning is an important element in efforts to improve the quality of education and student achievement. In the 21st century education era, teachers not only need to master content and pedagogical knowledge, but also actively engage in the lifelong learning process. Recent studies show that effective professional learning practices include elements of knowledge updating, reflection on teaching practices, and collaboration with colleagues (Ali & Hashim, 2021; Azmi, Salleh & Rahman, 2021). All three elements support the formation of a school culture that is responsive to change and continuous improvement

in teaching. Teachers' professional learning needs to be studied because it is closely related to teachers' ability to adapt to changing educational policies, curriculum reforms, digital transformation and the increasingly diverse needs of students. In the Malaysian context, initiatives such as TS25, Professional Learning Communities and the use of digital learning platforms require teachers to constantly update their knowledge, reflect on their teaching practices and collaborate with colleagues. However, this professional learning practice can only be improved if it is measured using valid, reliable and locally relevant instruments. Therefore, this study is important because it provides empirical evidence on the validity of a multidimensional instrument that can be used to assess teachers' professional learning in Malaysian secondary schools.

However, one of the main challenges in educational research is the absence of scientifically validated measurement instruments that are appropriate for the local context. Therefore, this study was conducted to develop and validate an instrument that can measure the level of teacher professional learning comprehensively and validly. This study focuses on three main dimensions that have been identified through the literature, namely Updating Activities, Reflective Activities and Collaborative Activities. The findings of this study are expected to be beneficial to teachers, school administrators, education officers, policy makers and researchers. Teachers can use this instrument to understand their level of engagement in professional learning, while school administrators can use it to evaluate the effectiveness of teacher professional development programs. At the policy level, this instrument can assist in planning teacher training in a more systematic and evidence-based manner. Thus, the instrument validated in this study is not only useful for research purposes, but also has practical value in strengthening teacher professionalism and improving the quality of education in Malaysia.

Literature Review

Recent studies have shown that effective Teacher Professional Learning (TPL) can contribute to improving student achievement, teaching effectiveness, and professional motivation among teachers (Darling-Hammond et al., 2020; Nguyen et al., 2021). To understand the structure of TPL empirically, various frameworks have been developed by researchers. One of the scales used in this study is based on an instrument developed by Sieblich de Vries, Jansen, and van de Grift (2013), which was later adapted and improved in the local context by researchers such as Ag-Ahmad et al., 2022 and Othman & Wan, 2023. This instrument contains three namely Updating Activities, Reflective Activities, and Collaborative Activities main dimensions. This scale originally contained 40 items organized based on real learning activities carried out by teachers and has been widely used in the European education context and adapted in several local studies.

The Updating Activity Dimension refers to teachers' efforts to update their knowledge and skills through reading materials, training, and exposure to the latest resources. Activities such as reading professional journals, attending seminars, and participating in in-service training programs are included in this dimension. According to Lim et al. (2020), the process of updating information is important to ensure that teachers are always in line with curriculum changes, the latest pedagogical approaches, and the diverse learning needs of students. Furthermore, in the digital era, learning resources such as massive open online courses

(MOOCs), digital education articles, and webinars have become the main channels in teachers' self-learning (Hassan, Z., et al. (2022); Khalid & Rahman, 2024).

Reflective Activities refer to the actions of teachers to re-evaluate their teaching practices through methods such as self-reflection, analysis of student work, and the use of student achievement data for improvement purposes. The process of reflection is considered an important element in professional learning because it involves deep thinking about the effectiveness of the teaching strategies used (Ali & Hashim, 2021). Teachers who practice reflection systematically are able to identify the strengths and weaknesses in their teaching approaches, and subsequently make evidence-based adjustments (Tan et al., 2022). A study by Rahman (2023) stated that reflection not only increases the effectiveness of individual teachers, but also influences the learning culture in the school organization as a whole.

Collaborative Activities focus on professional interactions between teachers in discussing teaching strategies, sharing experiences, and developing learning materials together. This dimension is in line with the concept of Professional Learning Communities (PLC) which emphasizes trust-based collaboration, peer support, and shared development goals (Hamid et al., 2020). Collaboration between teachers not only accelerates the professional learning process, but also supports the building of collective capabilities within a school. A study by Yusri, Samah, and Khalid (2021) showed that teachers who are active in professional collaboration have a higher tendency to practice innovation in the classroom and show an increase in career satisfaction.

In the context of instrument research, the selection of an appropriate statistical approach is important to confirm the validity and reliability of a construct. For this purpose, Exploratory Factor Analysis (EFA) is a suitable method to be used in the early stages of instrument development or adaptation. EFA allows researchers to identify the latent structure behind a group of items and determine whether the items form a stable dimension (Ramayah et al., 2020). It also helps in identifying items that need to be dropped due to low factor loading values ($< .50$), factor overlap (cross-loading), or insufficient community values ($< .30$) (Noraini et al., 2021). The selection of a rotation method such as Varimax rotation also increases the understandability of the factor structure because it maximizes the possibility that each item only loads on one main factor (Chong & Yusoff, 2019).

The use of Exploratory Factor Analysis (EFA) allows researchers to identify the extent to which the theoretical construct structure can be supported by empirical data in the local context. This is important given that there are differences in culture, education systems, and teacher training approaches between the countries where the instrument was developed and the countries that have adopted it (Jamil et al., 2021). Therefore, local validation through EFA is an important initial step before implementing a more rigorous Confirmatory Factor Analysis (CFA) that is suitable for comprehensive testing of the theoretical model (Tan & Ismail, 2023). Studies such as those conducted by Rahmat and Kamarudin (2020) who conducted local validation of teacher development instruments also recommend this two-stage approach in the study of educational instruments.

Teacher professional learning is a complex and multidimensional construct, which requires a systematic and rigorous psychometric approach for accurate measurement. The three main

dimensions, namely Updating, Reflective, and Collaborative, provide a solid foundation in assessing the level of teacher engagement in their self-development process. The TPL instrument developed based on the original framework by de Vries et al. has been proven to be empirically useful, and with adaptation and validation through Exploratory Factor Analysis (EFA), this instrument has the potential to become a valid and reliable assessment tool in the educational context in Malaysia (Rahmat & Kamarudin, 2020; Tan & Ismail, 2023). Therefore, this study contributes to the validation of the TPL construct structure that is appropriate for the local education system and culture, as well as providing a basis for further research and the implementation of more meaningful teacher professional development assessments.

Research Methodology

This study uses a quantitative approach with an inferential descriptive design to assess the construct validity of the Teachers' Professional Learning (TPL) instrument. The instrument used in this study was developed based on the original scale by Siebrich de Vries, Jansen and van de Grift (2013) which contains 39 items covering three main dimensions, namely Updating Activities, Reflective Activities and Collaborative Activities. All items are rated using a seven-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree), aiming to measure the level of teacher involvement in various forms of professional learning.

A total of 90 secondary school teachers in the state of Selangor were selected as study respondents through purposive sampling. This selection was made to ensure that the sample consisted of teachers who were actively involved in professional development programs such as PLC and the TS25 initiative. The questionnaire was distributed online and the data collection period lasted for two weeks. The researcher ensured that data confidentiality and participation ethics consent were fully adhered to.

Data were analyzed using SPSS version 28 software through Exploratory Factor Analysis (EFA). Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity were conducted to test the suitability of the data for factor analysis. The EFA process used Principal Component Analysis (PCA) with Varimax rotation, and the criteria for item deletion included factor loading values less than 0.60, item overlap on more than one factor, and inconsistency with theoretical constructs Hair et al. (2018). The EFA findings formed three stable factors and contributed to a satisfactory percentage of accumulated variance, thus supporting the construct validity of the instrument in the context of teachers in Malaysia.

Findings

The item "I wrote a new curriculum with my colleagues" was dropped from the instrument of this study before the exploratory factor analysis (EFA) process was conducted. The decision to drop it was made based on considerations of suitability for the context of the Malaysian education system, where curriculum preparation or writing is the exclusive responsibility of authorities such as the Curriculum Development Division (BPK) under the Ministry of Education Malaysia, and not the direct task of teachers at the school level. Although teachers may be involved in adapting the implementation of the curriculum or formulating daily lesson plans (RPH), they do not formally write the curriculum with their colleagues. Furthermore, the activity of writing a new curriculum by teachers is rarely practiced or recorded in the national school system formally, making it irrelevant as an indicator of professional learning in the local context. Therefore, to ensure content validity and cultural appropriateness in the

development of the instrument, this item was removed early to avoid confusion or bias in the assessment of the construct (Van de Vijver & Leung, 1997).

EFA of Teachers' Professional Learning

The Teachers' Professional Learning variable has 39 items involving three dimensions, namely Updating Activities (Ba), Reflective activities (Bb) and Collaborative Activities (Bc). However, because there are 12 items Ba4, Ba6, Ba7, Bb13, Bb15, Bb21, Bb22, Bc31, Bc33, Bc34, Bc36 and Bc39 dropped from the data in the purification process which are not included in the domain apart from the loading factor which is less than .50. Therefore, only 27 items were loaded to perform EFA.

Table 1 shows the results of the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity. The KMO value is .868, exceeding the threshold value of .60 (Kaiser, 1974), indicating the suitability of the sample for factor analysis. The Bartlett's Test of Sphericity is significant, $\chi^2(351) = 1954.338$, $p < .001$, indicating that there is a relationship between the variables and the data is suitable for conducting factor analysis.

Table 1

KMO Test and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.868
Bartlett's Test of Sphericity	Approx. Chi-Square	1954.338
	df	351
	Sig.	.000

Table 2 shows the total variance explained by the three principal components. Based on the criterion of eigenvalues greater than 1 (Kaiser's criterion), three components were extracted. The first component explained 32.60% of the variance, the second component explained 21.28%, and the third component explained 13.01%, making the total variance explained 66.90%. This indicates a good factor structure because the cumulative value is greater than 60% (Hair et al., 2019).

Table 2

Total Variance Explained

Component	Eigen Value	% Varians	% Cummulative
1	8.803	32.603	32.603
2	5.746	21.280	53.883
3	3.514	13.014	66.897

Table 3 shows the factor loadings for each item after the Varimax rotation process was performed using 27 items that were identified as having good factor loadings and contained within the domain. The results of the analysis showed that the items were clearly grouped into three main components. The first Collaborative Activities component consisted of items Bc25 to Bc38 which likely represented the Collaborative Activities factor, depending on the actual content of the items. The second Reflective activities component included items Bb12 to Bb24 which reflected another dimension, of Reflective activities. Next, the third

component Updating Activities consisted of items Ba1 to Ba11, which likely represented the Updating Activities dimension.

Table 3
Rotating Component Matrix

Item	Component		
	1	2	3
Bc25	.749		
Bc26	.881		
Bc27	.906		
Bc28	.898		
Bc29	.879		
Bc30	.862		
Bc32	.802		
Bc35	.798		
Bc37	.793		
Bc38	.817		
Bb12		.720	
Bb14		.742	
Bb16		.739	
Bb17		.766	
Bb18		.852	
Bb19		.777	
Bb20		.779	
Bb23		.712	
Bb24		.820	
Ba1			.742
Ba2			.812
Ba3			.867
Ba5			.707
Ba8			.761
Ba9			.778
Ba10			.861
Ba11			.804

All items showed high factor loadings, exceeding .70, which was considered strong and significant for factor extraction (Tabachnick & Fidell, 2013). In addition, no items showed significant cross-loading, indicating a clear factor structure and no overlap between components. This finding indicated that the Teachers' Professional Learning construct had good structural validity based on exploratory factor analysis.

Based on the exploratory factor analysis conducted on the Teachers' Professional Learning, all remains items were clearly loaded into three main components with factor loadings

exceeding .60, indicating a strong and acceptable factor structure (Hair et al., 2019). The high KMO value (.868) and significant Bartlett's test confirmed the suitability of the data for this analysis. These three components explained 66.90% of the total variance, exceeding the recommended minimum threshold. Therefore, this instrument can be considered to have good construct validity and is suitable for further study.

In this study, a total of 12 items were dropped from the final analysis based on the Exploratory Factor Analysis (EFA) criteria and the results of the Rotated Component Matrix. The items were Ba4, Ba6, Ba7, Bb13, Bb15, Bb21, Bb22, Bc31, Bc33, Bc34, Bc36 and Bc39. The drop was made for several technical and conceptual reasons, including low factor loadings (< .60), factor overlap (cross-loading), and failure to form a strong and stable construct structure.

Table 4

Items Dropped Based on Rotated Component Matrix and EFA Analysis Criteria

No.	Item	Statement	Reason
1	Ba4	I read scientific literature.	Low factor loadings
2	Ba6	I visit social media related to my subject matter.	Does not form a strong component
3	Ba7	I read about training opportunities from various sources.	Negative loading in the seventh component (-.753)
4	Bb13	I analyze video recordings of my lesson to improve my teaching practice.	Loading is spread between two components (<.6).
5	Bb15	I visit lessons of colleagues to learn from them.	Overlap loading; lacks construct support.
6	Bb21	I ask students to fill out surveys for feedback on my lessons.	Loading below 0.7, unstable within the component.
7	Bb22	I deal with problems in my teaching by looking at what the literature says about them.	Does not form a strong reflective construct.
8	Bc31	I discuss scientific educational theories with colleagues.	Does not stand out in any component.
9	Bc33	I use colleagues' teaching materials in my lessons.	Loading on component 5 but weak.
10	Bc34	I construct (digital) teaching materials with colleagues.	No significant loading.
11	Bc36	I study student performance data with colleagues.	Isolated loading; unstable.
12	Bc39	I give lessons with colleagues (team teaching).	Loading on component 4 and low loading value.

For example, item Ba4 ("I read scientific studies") showed low loadings and overlapped with Ba3, while item Ba7 showed a significant negative loading (-.753) in the seventh component. Several items such as Bb13 and Bb15 exhibited scattered or overlapping factor loadings, suggesting that they do not consistently represent a single construct. Meanwhile, items such as Bc34 and Bc36 did not exhibit any significant loadings in any component, indicating their position as isolated items. Therefore, the final selection only retained 27 items that showed high factor loadings (> .60) and were consistent with the original construct structure, in line

with Hair et al.'s (2018) recommendation to ensure the clarity and reliability of the measurement model.

Table 5 shows a list of 8 items under the Updating Activities dimension, which encompasses teachers' practices in updating their professional knowledge and skills. Items in this dimension emphasize reading up-to-date materials, participating in in-school and out-of-school training sessions, and participating in professional seminars or conferences. All items show high factor loading values (above .70), demonstrating the strength of the relationship with the latent construct. This indicates that teachers who are active in self-updating tend to engage consistently in lifelong learning practices (Desimone, 2009).

Table 5

Item of Updating Activities Dimension

No.	Item	Statement	Factor Loading
1	Ba1	I read newly available material from various sources.	.742
2	Ba2	I read about educational reforms and promising practices from various sources.	.812
3	Ba3	I read professional journals.	.867
4	Ba5	I study subject matter exercise books and teaching materials, including manuals	.707
5	Ba8	I participate in training sessions within the school.	.761
6	Ba9	I participate in one-on-one coaching and mentoring in the classroom.	.778
7	Ba10	I participate in professional development activities outside the school.	.861
8	Ba11	I visit conferences and meetings pertaining to my subject matter or hosted by my professional association.	.804

Table 6 details the 9 items that make up the Reflective Activities dimension, which is related to teachers' ability to analyze and reevaluate their teaching practices. This dimension includes activities such as reflecting after teaching, reviewing student work, obtaining feedback, and using performance data for improvement. The factor loadings of all items were strong (ranging from .712 to .852), indicating high construct validity. This indicates that reflection is an important component of teachers' ongoing and self-directed professional development.

Table 6

Item of Dimension Reflective Activities

No.	Item	Statement	Factor Loading
1	Bb12	After class, I reflect on my lessons.	.720
2	Bb14	I discuss with my students what they experience in my lessons, to improve my teaching practice.	.742
3	Bb16	I ask my colleagues to attend some of my lessons to get feedback on my teaching.	.739
4	Bb17	I discuss events in my teaching with others to learn from them.	.766
5	Bb18	I participate in peer review meetings at my school to learn from colleagues.	.852
6	Bb19	I analyze a problem in my practice thoroughly before choosing a solution.	.777
7	Bb20	I study products from students to understand how my approach has worked.	.779
8	Bb23	I use student performance data to, where needed, adjust my teaching.	.712
9	Bb24	Once a problem or question arises in my teaching practice, I carry it out into possible causes and solutions.	.820

Table 7 displays 10 items that belong to the Collaborative Activities dimension, which emphasizes teacher interaction with colleagues in an effort to improve teaching practices. Items such as sharing ideas, jointly developing teaching materials, and supporting colleagues in resolving teaching issues are all part of effective collaborative practices. All items show very high factor loading values, ranging from .749 to .906, indicating the stability and robustness of the construct. This supports the importance of professional collaboration as a strategy for developing teacher capacity in the school community.

Table 7

Item of Collaborative Activities

No.	Item	Statement	Factor Loading
1	Bc25	I talk about teaching problems with colleagues.	.749
2	Bc26	I support colleagues in their teaching problems.	.881
3	Bc27	I share new teaching ideas with colleagues.	.906
4	Bc28	I share learning experiences with colleagues.	.898
5	Bc29	I talk about the way I deal with events in my lessons with colleagues.	.879
6	Bc30	I talk to colleagues about what I think is important in education.	.862
7	Bc32	I discuss improvements and innovation in education at my school with colleagues.	.802
8	Bc35	I construct testing and examination materials with colleagues.	.798
9	Bc37	I prepare lessons with colleagues.	.793
10	Bc38	I experiment with new teaching methods with colleagues.	.817

Discussion

The findings of this study confirm that the three-dimensional structure of Teachers' Professional Learning is stable and consistent with the theoretical framework proposed in previous literature. Through exploratory factor analysis, the three main factors formed — namely Collaborative Activities, Reflective Activities, and Updating Activities — not only showed high factor loading values (above .70), but also contributed to a satisfactory percentage of accumulated variance of 66.90%. These results reflect holistic professional learning practices among teachers, encompassing collaboration, reflection on teaching practices, and efforts to continuously update knowledge and skills.

The existence of the Collaborative Activities factor as the first dominant component indicates that professional interaction between teachers is an important element in the development of pedagogical competence. This is in line with the findings of Vescio, Ross and Adams (2008) who emphasized that continuous collaboration through professional learning communities can improve teaching practices and student learning outcomes. In the Malaysian context, approaches such as Professional Learning Communities (PLC) have been introduced by the Ministry of Education as a key strategy for teacher development, and these findings provide empirical evidence of its effectiveness (KPM, 2015). Meanwhile, the second factor, Reflective Activities, emphasizes the ability of teachers to re-evaluate their teaching approaches through various methods such as analysis of student work, feedback, and the use of learning data. This element is important in the process of continuous self-learning and consistent with the principles of adult learning (Knowles, Holton, & Swanson, 2012). Teachers' reflective abilities are closely related to teaching professionalism and their ability to adapt teaching approaches according to students' needs (Schön, 1983).

The third factor, Updating Activities, which includes participation in professional training, journal reading and conference visits, shows that teachers actively seek new knowledge as part of lifelong learning. This is in line with the findings of Avalos (2011) who stated that teachers' professional learning needs to be centered on active search and continuous knowledge construction in order to adapt to changes in the education system. The EFA results in this study indicate that the developed Teacher Professional Learning instrument has a robust factor structure, supporting the applicability of this instrument for research and evaluation of teacher practice in the Malaysian context. This study also provides a solid foundation for further research using a Confirmatory Factor Analysis (CFA) approach to further validate the proposed factor structure.

Conclusions and Implications of the Study

Overall, this study has successfully developed and validated a factor structure for the Teacher Professional Learning instrument which contains three main dimensions: Updating Activities, Reflective Activities, and Collaborative Activities. Through exploratory factor analysis (EFA), a total of 27 items were identified to form a strong factor structure with high loading values, and explained more than 70% of the variance in the data. This proves that the constructed construct has strong construct validity and is useful for application in the Malaysian education context, especially in an effort to empirically assess the level of teacher involvement in professional learning.

The implications of this study are significant in terms of theory and practice. From a theoretical perspective, these findings contribute to strengthening a teacher professional learning model based on three concrete action dimensions, namely self-learning, systematic reflection, and professional collaboration. This is in line with Desimone's (2009) model approach which emphasizes the integration of various aspects of teacher development to increase the impact on teaching practice. In terms of practice, this instrument can be used by school administrators, District Education Offices, and policymakers to assess the effectiveness of the implementation of professional development programs such as Professional Learning Communities (PLC), in-service training, as well as the implementation of initiatives such as TS25 and Digital Educational Learning Initiative Malaysia (DELIMa).

However, this study has several limitations that need to be acknowledged. First, the use of the EFA approach alone is not sufficient for comprehensive model validation. Therefore, further research is recommended to conduct Confirmatory Factor Analysis (CFA) so that the identified factor structure can be statistically validated using a more rigorous measurement model (Byrne, 2016). In addition, instrument testing across demographic groups (invariance testing) should also be conducted to assess the feasibility of this instrument in various school, district or state contexts. Finally, the findings of this study are hoped to provide guidance to educational researchers and policymakers in improving the design and implementation of teacher professional training in a more focused, evidence-based and high-impact manner. Validation of this instrument is an important step towards the development of a more objective teacher evaluation system and directed towards continuous improvement of professionalism.

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