Confirmatory Factor Analysis of the Niche-Malaysian Teacher Leadership Measurement Model

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Abstract

Teacher leadership is an increasingly popular concept to be implemented and utilized by practitioners and researches in their studies. Thus, the study aimed to determine the relevancy and applicability of Niche-Malaysian Teacher Leadership (NMTL) measurement model in Malaysian context. The NMTL measurement model which was originally consisted of 34 items with 7 principles, may address an early indication of the teacher leadership standards in the Malaysian classrooms. It was generated through literature review and comprehensive discussions with a group of schoolteachers. The measurement model was then distributed to the 169 schoolteachers, who were required to respond to a 7-point Likert scale. The respondents were selected through purposive sampling procedure. The collected data were analyzed using the SPSS version 20.0 and Amos version 22.0 software packages. An exploratory factor analysis (EFA) was conducted prior to performing confirmatory factor analysis (CFA). Thus, the NMTL measurement model should be able to clarify the standard of teachers' leadership in Malaysian classrooms. Implications for the use of this instrument for further research are also explored.

1. Introduction

A new vision of teaching requires teachers to demonstrate leadership roles in classrooms and schools. As leaders in the classroom, teachers need to know the ways in which learning takes place, and the appropriate levels of intellectual, physical, social, and emotional development of their students [1]. In other words, teacher needs to have a deep understanding of instructional practices. They need to align their instruction relevant to their content areas or disciplines and students need, and utilize varieties of technology in their instruction. They also help students work in teams, develop critical thinking and problem solving skills, communication skills as well as effective leadership skills.

In fact, leadership in schools require teacher leaders to pose a positive attitude and all qualities of professionalism [2]. Teacher leaders must be able to lead and guide other teachers in various pedagogical and administrative matters, which align with the definition: "teacher leadership is the process by which teachers, individually or collectively; influence their colleagues, principals, and other members of the school communities to improve instructional practices with the aim of increased student learning and achievement. Such team leadership work involves three intentional development foci: individual development, collaboration or team development, and organizational development" [3].

Researchers have lately explored different measurement models of teacher leadership and delineated the variety of formal and informal roles exercised by teacher leaders. However, there was recognition that some distinguished teacher leaders have developed their leadership knowledge through professional experience and

mentoring. Some individuals choose to lead informally from the classroom or to assume leadership roles in their local or state teacher professional associations or in other professional contexts. Others have been selected by their principals to assume more formalized leadership roles in their schools and districts; and there were also those who might have pursued more formal training on teacher leadership. In fact, these studies have considered teacher leaders' reports journals and related documentation as important sources or detailed information about the teacher leaders under study and have investigated them through preliminary exploratory cross-sectional studies. Although some of the issues concerning the measurement of teachers' leadership standards to have been contradictory [4], researchers seemed to find important the attempt to validate the teacher leadership measurement model, especially in quantitative terms.

Consequently, measuring teacher leadership standards quantitatively provides teacher leaders with a new research direction. This study's findings should be explored further in order to accumulate information on teacher leadership standards in Malaysian classrooms. That information could then be used to design professional development activities compatible with the teacher leaders' leadership approaches, leadership experience and subject experts. Past researchers have distinguished different leadership practices in classroom and school. The evolution of leadership processes has contributed to variability in leadership practice [5]. The extension of leadership in schools, as well as ways to better engage teachers in school leadership, have taken a number of forms in the literature, including recommendations of "teacher leadership standards".

Teacher leadership standards which focused on the roles of teachers as leaders of instructional and pastoral sustain is supported by the work of [6], [7] and [8]. The concept of teachers as leaders is also linked to the question of whether teaching has gained recognition and acceptance as a profession [9]. Other research has focused on the roles of teachers as leaders of teaching and learning and pastoral support [10]. This type of leadership highlights the importance of two key factors focusing on the leadership of teachers, namely: (i) the values base in the work of teachers who seek to evaluate their schools and communities to enhance outcomes and quality of life; and (ii) the power of teaching and teachers to create new meaning in the lives of people in schools and communities [11]. They make an important distinction between teachers as leaders in specialized areas such as pedagogical and (subject) discipline leadership and leadership which contributes to whole school reform and improvement.

The reform and improvement requires a change from teachers building their own intellectual engagement and on-the-job teacher learning to teachers working collaboratively as leaders of the school site [12]. Thus, in order to enable teachers to work collaboratively for improved instructional practices, changes in school curricula could be a major step towards productive teacher collaboration. It would align the scope and sequence of what should be taught and learned, and teachers could collaborate with one another on daily lessons. Similarly, educational policymakers have also recognized the importance of organizational design and effective leadership in establishing and maintaining vibrant learning communities for both teachers and students [13]. Shared decision-making, collective actions regarding school policies and reflection on broader school reform issues are seen as promising ways to engage teachers, foster collegiality, and improve practice. A professional learning community can be a pre-condition for effective teacher leadership and also be sustained by the collegial practices of teacher-led schools [14].

One of the enduring tensions in efforts to involve teachers in leadership positions is what [15] referred to as the "Huberman Paradox". Researchers [16] and [17], studied teachers' career development and found that those teachers who became involved in school and district leadership roles tended to suffer greater "burn-out" than those who remained content to work only in their own classrooms with their students. As [13] summarize the paradox: "on the one hand, teachers were stimulated by their involvement in reform work and leadership in their school; on the other hand, that vary work load led to burnout, disaffection, pr. When professional conflict, and disappointment" (p.19). Other study come to similar conclusions i.e., [18].

Building a collaborative culture, therefore, became a goal of those seeking to engage teachers in

leadership roles in order to overcome "burn-out" [13], [18], and [19]. And a number of studies have examined the ways school and district administrators can create the conditions necessary for professional learning communities to flourish, for instance, by adjusting the school schedule so that teachers could have time to meet together [20] and [21]. Working within professional learning communities, reformers argue, teacher leaders can reinvigorate the work of teaching for themselves and their colleagues, making it collaborative, purposeful, and dynamic [22], [23], and [13]. Furthermore, the kind of teacher learning that occurs in schools where teachers take on leadership roles can serve as an additional counterforce to teacher burnout. When teachers experience professional growth, they are more likely to stay in teaching [24], [25], and [26].

Finally, measurement of Teacher Leadership Standards (TLS) must be made through reliable and valid scores. Therefore, it is important to validate the NMTL measurement model as measurement method. Hence, the researcher poses the following research questions:

- Does the measurement model for teacher leadership standards fit with the collected data?
- Does the measurement model for teacher leadership standards fulfil the construct validity?

2. Materials and methods

The researchers utilized a purposive sampling procedure to select the samples, amounting of 169 respondents. The respondents were secondary school teachers working in Malaysia. Most of the teachers 106 (63.7%) were female; only 63 (37.3%) were male. Out of 169 teachers, 64 (37.9%) had less than 5 years of experience; 48 (28.4%) of them had between six to ten years of experience; 27 (16.0%) of them had between sixteen to twenty years of experience; 20 (11.8%) of them had between eleven to fifteen years of experience and only 6 (3.6%) of them had between twenty-one to thirty years of experiences. In fact, 2 (1.2%) of them were senior teachers who had more than 30 years of teaching experience compared to another 2 (1.2%) respondents who were still novice in teaching profession. 74 (43.8%) of the respondents held Bachelor Degree in Education, while another 69 (40.8%) of them had their Diploma in Education and 18 (10.7%) of them obtained their Teacher's Certificate from the respective Teacher Training Colleges or Institutes. However, 8 (4.7%) of them refused to clarify their professional qualification. Details are shown in Table 1.

"Table 1. Respondent profiles"

Type	N	Factor	Frequency	Percentage (%)
Gender	169	Male	63	37.3
		Female	106	62.7
Years of experience	169	< 1 year	2	1.2
		1 – 5 years	64	37.9
		6 – 10 years	48	28.4
		11 – 15 years	20	11.8
		16 – 20 years	27	16.0
		21 – 30 years	6	3.6
		>30 years	2	1.2
Professional Qualification	169	Bachelor of Education	74	43.8
		Diploma in Education	69	40.8
		Teacher's Certificate	18	10.7
		Other qualification	8	4.7

2.1. Instrumentation

A set of 7-point Likert scale (ranging from 1 = "not at all relevant" and "7 – "very relevant") instrument, so-called Niche-Malaysian Teacher Leadership (NMTL) measurement model was administered to the samples. The samples were required to complete their demographic information and response to the 34 items which may address an early indication of the importance of each standard to develop teacher leaders in Malaysian classrooms. The Niche-Malaysian Teacher Leadership (NMTL) measurement model, comprised of 7 standards was adapted from [27]. Nonetheless, the 34 items were newly generated by a group of researchers based on literature review and comprehensive discussions with a group of schoolteachers. Five of its items measures the importance of teacher leaders to facilitate improvement in instruction and student learning (Standard 1); the following five items measures the importance of teacher leaders to demonstrate leadership attributes and skills (Standard 2); the next five items measures the importance of teacher leaders to develop the organization (Standard 3); six items measures the importance of teacher leaders to foster a collaborative culture to support educator development and student learning (Standard 4); five items measures the importance of teacher leaders to practice professional learning for continuous improvement (Standard 5); four items measures the importance of teacher leaders to improve outreach and collaboration with communities and other constituents (Standard 6) and the last four items measure the importance of teacher leaders to make exemplary contribution towards becoming referral leader (Standard 7).

3. Results

The data were analysed using SPSS 20.0 and Amos 22.0 and the instrument was validated through both exploratory and confirmatory factor analysis.

3.1. Exploratory Factor Analysis (EFA)

An exploratory factor analysis occurred prior to the confirmatory factor analysis. Experts, [28] claim that the EFA was intended to reduce the number of items in the instrument in order to maximize the explained variance and identify the appropriate number of items in each of the variables' factors. The eigenvalue greater than the 1-rule and the scree plot test are often used to extract the required number of factors.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value was equivalent to 0.902, which is considered great [29]. The correlation found in the R matrix for most of the items was higher than 0.3. The significant of Bartlett's Test of Sphericity (p=0.000) supported the evidence that the items can be factored through exploratory factor analysis. The Maximum Likelihood extraction method indicated 2 items were extracted lower than 0.5 (0.283 and 0.446), others loaded in the range of 0.504 to 0.834 which is considered as good extraction for newly developed items. The matrix also indicates 22% of non-redundant residuals which is acceptable value for exploratory factor analysis. The Pattern Matrix showed 5 items were loaded in Factor 1 (range of 0.521 to 0.868), 6 items were loaded in Factor 2 (range of 0.619 to 0.855), 5 items were loaded in Factor 3 (range of 0,542 to 0.764) and 3 items were loaded in Factor 4 (range of 0.573 to 0.689). Unfortunately, 8 items were not loaded anywhere, which also means that the items had negative loading. Fortunately, there was no cross loading items been analyzed. The loading coefficient for each item is above the cut-off point 0.5 since the instrument was newly developed.

Table 2 showed 4 out of 7 factors were extracted with cumulative value (63.122%), which exceeded the expectation of 60%. Similarly, four factors with a factor loading higher than 0.5 were formed through Promax

Orthogonal Rotation process. However, these four factors were then generated through confirmatory factor analysis (CFA) in order to test the fit indexes. The analyses were further elaborated in the next section.

"Table 2. Total Variance Explained"

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	14.739	54.587	54.587	14.369	53.219	53.219	11.867
2	1.621	6.003	60.590	1.236	4.577	57.796	10.460
3	1.242	4.598	65.188	.771	2.854	60.649	11.490
4	1.022	3.784	68.972	.668	2.472	63.122	8.832
5	.892	3.303	72.275				
6	.749	2.774	75.049				
7	.694	2.572	77.621				

3.2. Confirmatory Factor Analysis (CFA)

A Confirmatory Factor Analysis (CFA) was conducted to cross validate the findings of the Exploratory Factor Analysis. [30] study of confirmatory factor analysis stated that a confirmatory factor analysis with pre-specified loadings, is rejected and a sequence of the model is carried out in an attempt to improve fit. Multiple-group confirmatory factor analysis has been the most commonly used method in organizational research [31]. By utilizing data obtained from 169 samples, a four-factor measurement model for the importance of teacher leadership in Malaysian classrooms was tested using AMOS version 22.0 software. The four factors represent the importance of teacher leaders' role in "Improving Outreach", consisted of 3 items (Factor 1); "Developing Organization", consisted of four items (Factor 2); "Fostering Collaborative Culture", consisted of 3 items (Factor 3) and "Making Exemplary Contribution", consisted of 3 items (Factor 4). "Improving Outreach" had the highest loading ranging from 1.58 to 1.99; followed by "Developing Organization" with the loading ranging from 0.75 to 1.10; "Fostering Collaborative Culture" with the loading ranges from 0.99 to 1.26; and "making Exemplary Contribution" with the loading ranging from 0.62 to 1.00. However, there were very low covariances; ranging from 0.12 to 0.37.

3.3. Assessing Validity and Reliability of Niche-Malaysian Teacher Leadership Measurement Model

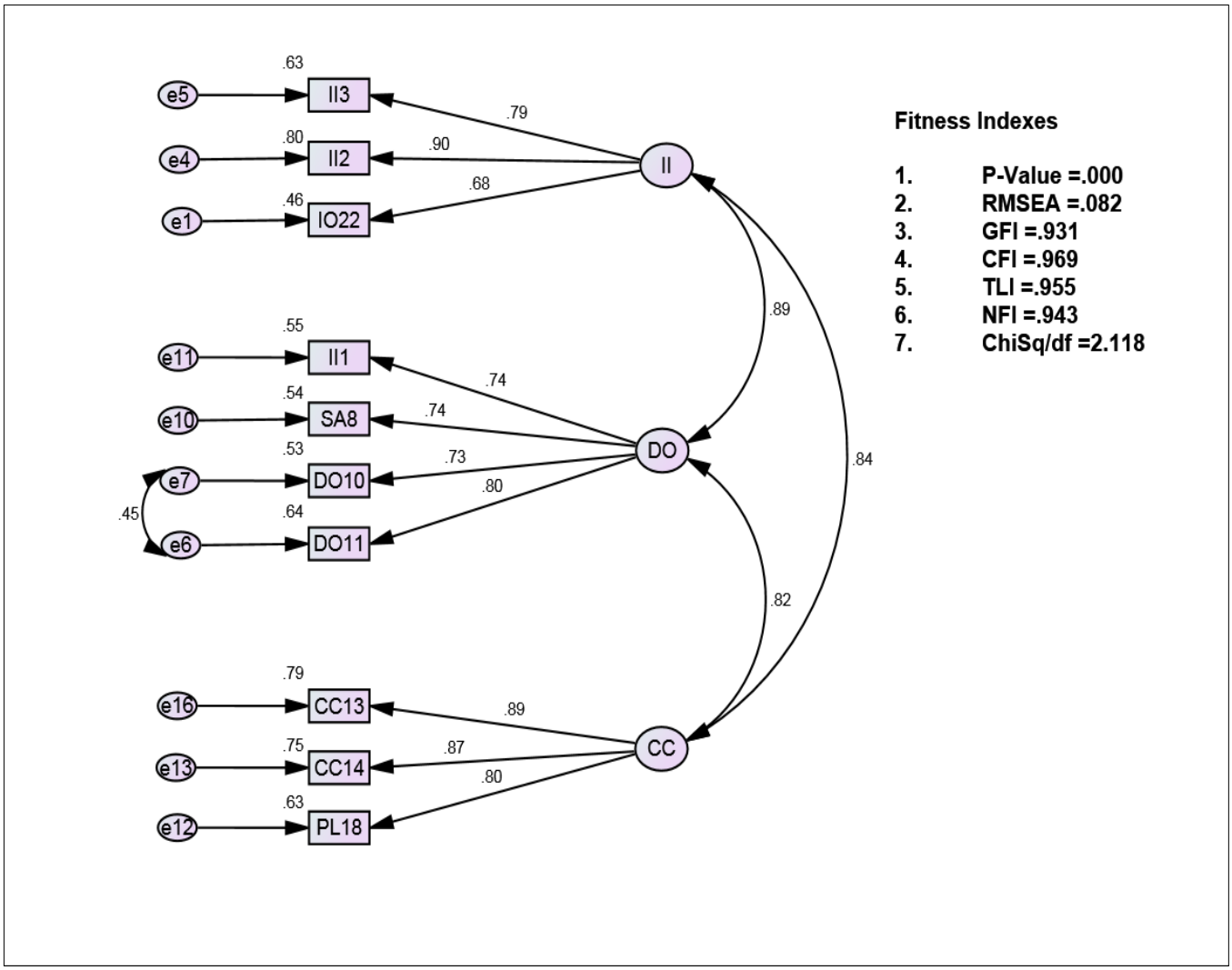
The assessment for unidimensionality, validity, and reliability for measurement models are required prior to modelling the structure model. Unidimentionality was achieved through the item deletion process for low factor loading items (SA6, PL21, SA5, II4, SA7, PL20, CC16, EC25, EC26, EC27, and PL19). The new model was ran and the item deletion process was repeated until the fitness indexes achieved the required level. Convergent validity was also achieved since the AVE of the three-factor were above 0.5 (refer Table 4). Discriminant validity was also achieved through the covariance of items DO10 and DO11 (refer Figure 1).

Table 4. The Summary of CFA for the Niche-Malaysian Teacher Leadership (NMTL) measurement model

Measurement Model							
Factor	Domain (Construct)	No. of Indicators Used	Included After EFA	Excluded After CFA	Value of Cronbach's Alpha	AVE (> 0.5)	CR (> 0.6)
1	II	5	3	3	0.823	0.632	0.836
2	DO	5	3	2	0.853	0.567	0.840
3	CC	6	4	2	0.884	0.730	0.890
4	EC	4	3	0	-	-	-
5	IO	4	3	1	-	-	-
6	PL	5	1	1	-	-	-
7	SA	5	1	1	-	-	-
	Total	34	18	1			

Source: Survey data (n = 169)

Note: AVE – Average Variance Extracted; CR – Construct Reliability



"Figure 1. Path Diagram for the Niche-Malaysian Teacher Leadership (NMTL) measurement model"

The Root Mean Square of Error Approximation [32]; the Goodness of Fit Index [33]; the Comparative Fit Index [34]; the Tucker Lewis Index [35]; Normed Fit Index [36]; and the chi-square/degree of freedom [37] were chosen to obtain a model fit.

Table 3 shows the assessment of fitness for the Niche-Malaysian Teacher Leadership (NMTL) measurement model. The RMSEA value (0.082) which fall in the range of 0.05 to 0.1 [38], as well as the respective CFI (0.969), TLI (0.955) and NFI (0.943) values indicate that the proposed Niche-Malaysian Teacher Leadership (NMTL) measurement model reflecting how fit the data at hand. Nonetheless, there was no agreement among researchers which fitness indexes to be utilized. [29] and [39] recommend the use of at least one fitness index from each category of model fit. There were three model fit categories, namely, Absolute fit, Incremental fit, and Parsimonious fit.

"Table 3. The Assessment of Fitness for the Niche-Malaysian Teacher Leadership (NMTL) measurement model"

Name of category	Name of index	Index value	Cut-off values based on model characteristics	Comments
1. Absolute fit	RMSEA	0.082	Range 0.05 to 0.1 is acceptable	The required level is achieved
	GFI	0.931	> 0.90	The required level is achieved
2. Incremental fit	CFI	0.969	> 0.96	The required level is achieved
	TLI	0.955	> 0.95 is a good fit	The required level is achieved
	NFI	0.943	> 0.90	The required level is achieved
3. Parsimonious fit	Chi square/df	2.118	< 5.0	The required level is achieved

Table 4 shows the final measurement of Niche-Malaysian Teacher Leadership measurement model. Two items from facilitating improvement in instruction (II) were dropped due to low factor loading; one item from developing organization (DO); all the three items were excluded from making exemplary contribution (EC); two items were deleted due to low factor loading in improving outreach (IO); while all the items from practicing professional learning (PL) and leadership skills and attributes (SA) remain. Each item of every construct for teacher leadership standards shows an acceptable factor loading, which is statistically significant. Besides, the model also creates covariances between DO10 and DO11 (MI=22.940) within the same factors. Item IO24 (factor loading = 1.21) was deleted.

Each factor of teacher leadership standard produces an acceptable value of construct reliability (CR) and average variance extracted (AVE). The values for construct reliability, i.e., composite reliability or CR, and average variance extracted (AVE) were needed in order to obtain the divergent validity [29]. The accepted value for CR should be at least 0.60 and 0.50 for AVE [29]. The formulae for CR and AVE are shown below; where

$$CR = (\Sigma K)^2 / [(\Sigma K)^2 + (\Sigma 1 - K^2)]$$

Note: K = *factor loading of every item*

where

$$AVE = \Sigma K^2 / n$$

Note: K = *factor loading of every item*

n = *number of items in a model*

Through the formulae, we found that the CR value for improving instruction (II) was 0.836, developing organization (DO) was 0.840, and that of fostering a collaborative culture (CC) was 0.890. All of the three constructs show an acceptable value (>0.50) for AVE. Hence, the Confirmatory Factor Analysis (CFA) shows

that the NMTL measurement model fit with the data collected and fulfilled the requirement for construct validity. Each item produced a factor loading value higher than 0.50. The NMTL instrument model, as set by the CFA, has therefore been validated.

Table 5 shows the items of the Niche-Malaysian Teacher Leadership measurement model, with factor loadings obtained from the CFA process. Three items (II3, II2 and IO22) with factor loading ranging from 0.68 to 0.79, were loaded for Factor 1 (II); items II1, SA8, DO10 and DO11 with factor loading ranging from 0.73 to 0.80, were loaded for Factor 2 (DO); and items CC13, CC14 and PL18 with factor loading ranging from 0.80 to 0.89 were loaded for Factor 3 (CC). All the items were loaded above the cut-off values of 0.5 (mainly for newly constructed items). In other words, the Niche-Malaysian Teacher Leadership (NMTL) measurement model fit with the data collected.

Table 5. Items of the Niche-Malaysian Teacher Leadership measurement model with factor loadings obtained from the CFA process

	Item	actor Loading
II3	Engage in establishing standards for student behavior and for school-wide classroom management policies.	0.79
II2	Help to develop and implement new instructional programs	0.90
IO22	Engage and work with diverse communities	0.68
II1	Take part in making decisions which shape the curriculum in a school.	0.74
SA8	Acquire entrepreneurship skills such as creative and innovative, productive, risk taking, opportunistic, optimistic and decision making.	0.74
DO10	Perform administrative functions involving physical resources, financial and ICT management.	0.73
DO11	Involve in setting direction: Shaping the future of the organization (strategically).	0.80
CC13	Collaborating and sharing responsibility with others for students' success.	0.89
CC14	Share expertise for student success and educator development-sharing new methods and opening their classrooms for other teachers to observe their practices.	0.87
PL18	Access and use research to improve practice and student learning.	0.80

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