

Validity and reliability: instruments of teacher competency in the context of small schools in Peninsular Malaysia

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ABSTRACT

A teacher competency instrument was developed to determine the level of teacher competency in small schools in Peninsular Malaysia. This study was conducted in Perak and Negeri Sembilan to determine the instrument's reliability and validity. Exploratory factor analysis (EFA) and item reliability analysis were used to determine the questionnaire's reliability and validity. Next, the average congruence percentage (ACP) is used to determine the reliability test between expert assessors. Experts approved the validity and reliability of the instrument before the EFA test was conducted. All four constructs have high-reliability index values between 0.82–0.92. Next, the EFA analysis shows four dimensions in the teacher competency instrument with factor loadings (FL) ranging from 0.60–0.88. The findings also show that the variance explained in the data is 58.46% with an Eigenvalue greater than 1. This result indicates that all items were received with high approval. In addition, a very high-reliability coefficient value, $\alpha=0.82$. The results prove that this teacher competency instrument has high validity and reliability and can measure the level of teacher competency implementation practices in small schools in Peninsular Malaysia.

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1. INTRODUCTION

In Malaysia, there are schools with a small number of students whose number is categorized as small schools, whose number, according to the Ministry of Education Malaysia, is 150 and below [1]. Small schools contribute to 30.75 % of all schools in Malaysia [2]. A total of 73% of the locations of small schools in Malaysia are in rural areas. While the academic achievement in this small school is lower compared to other schools, the average achievement score of the small school is 68%. This score is lower by 4% than at other schools [1]. Among the factors mentioned is the difficulty of finding and retaining teachers and placing quality headmasters to serve in the school.

Previous studies have found that rural students' low academic achievement is due to several factors, including socioeconomic and student background, school location and student placement, teacher teaching style, and student learning, with school leadership being the most important factor [3]. Several problems and constraints in small schools also contribute to the achievement of performance in small schools. Among the issues faced by small schools are school infrastructure, high teacher turnover, the location of the school, and the diversity of students in the implementation of combined classes, all of which require a high level of

preparedness on the part of school administrators [4]. One of the factors contributing to low performance in small schools compared to other schools is teacher efficiency [1].

To improve performance in small schools, one of the approaches implemented by the ministry is to implement an effective leadership model, the delivery of good teaching by teachers, as well as the involvement of parents and the community [1]. A good school is one that is effective, of high quality, and has the highest achievement [5]. In this era, the responsibilities of teachers are becoming more and more challenging, which causes work competencies to also change. According to [6] a study conducted in Malaysia showed that teachers are one of the factors that affect students academic achievement. [7] stated that in producing high-quality teachers, several things need to be focused on, among others, the level of knowledge and understanding, the value of professionalism, and the skills of teachers in teaching and learning. To ensure that teachers are capable of improving student achievement, effective aspects of teacher competency need to be emphasized in line with the development of education today.

Many studies conducted, including those by [8] and [9] found that students' academic achievement problems are caused by the approach or learning method implemented by teachers in schools, and student achievement is related to the quality and competency of teachers. Then the study by [4] found that one of the challenges faced in small schools is the low level of competency among teachers. Based on these statements, it is explained that the teacher's competency factor is one of the contributing factors to the quality of education in small schools. Therefore, this study focuses on the level of competency possessed by teachers in small schools. However, to what extent is the level of competency possessed by teachers in small schools? To ensure the level of competency of teachers in small schools in Peninsular Malaysia, it is necessary to measure the level of competency of teachers through instruments that will be developed based on the Malaysian Teacher Standards 2.0 (MTS 2.0) framework that has been introduced by [10] with four domains of teacher competency. The four domains are used as the basis for the study construct, namely knowledge orientation, instructional, community involvement, and personal quality.

In the context of a small school in Peninsular Malaysia, teacher competency items were developed for this study. Various instrument development processes were carried out before this test was made to ensure that each item is accurate and has a high validity and reliability value. This study aims to confirm the validity and reliability of the teacher competency instrument so that researchers or other educational stakeholders can use it to evaluate the level of competency of school teachers in Malaysia.

2. RESEARCH METHOD

2.1. Sample and data collection

This study was designed and conducted in two states in Peninsular Malaysia, namely Perak and Negeri Sembilan. The research design is a survey study using a questionnaire administered using Google's Forms application. After evaluating and selecting respondents for this survey, the researcher emailed them a link to a Google Form to answer. A total of 150 respondents were sent a link via email and WhatsApp involving 73 small schools in Perak and Negeri Sembilan, and only 102 questionnaires were answered correctly and then analyzed. This number is considered sufficient based on [11], the number of respondents conducting this exploratory factor analysis (EFA) is a minimum of 60 respondents, and according to [12], a study involving EFA was based on a suitable sample size of 100 people.

2.2. Instrumentation

This instrument was developed based on the MTS 2.0 framework by [10]. The four dimensions found in this framework are used to measure the level of competency of teachers in small schools. The dimensions are knowledge orientation, instructional, community involvement, and personal quality. The development of this theoretical questionnaire is also part of the process of analyzing the MTS, MTS 2.0, Education Quality Standard Wave 2, Integrated Assessment of Education Service Officers, and the Southeast Asia Teachers Competency Framework. The semi-structured interview process conducted by the researcher is to obtain more accurate additional information from the parties responsible for the small school and the respondents who will be studied as part of the process of constructing questionnaire items. The interview involved officials from the departments of the Ministry of Education Malaysia, such as the Teacher Professionalism Division, the Educational Planning and Research Division, the Inspectorate, headmasters, and teachers from small schools.

Next, to ensure the validity of the questionnaire, the researcher used the methods of face validity and content validity, referring to 10 experts to evaluate the questionnaire items. To determine the reliability between experts, the average congruency percentage (ACP) is used [13]. Meanwhile, Waltz suggested that the ACP value should reach 90 percent or above [14]. After receiving feedback from the experts, as shown

in Table 1, there is one item that needs to reach the level that has been set. The researcher has dropped the items, and subsequently, to ensure the reliability of the questionnaire, the researcher will conduct this study.

After the pilot is carried out, the data will be analyzed to determine the item's validity and reliability level through EFA and Cronbach's alpha. The final construct to perform EFA consists of four components, with 39 items, as shown in Table 2. The scale used in this study is (1 for strongly disagree to 5 for strongly agree). Using a five-point interval scale is used to increase the response rate and response quality, along with reducing the "frustration level" of respondents [15], increasing the response rate and response quality more effectively [16].

2.3. Exploratory factor analysis

After the EFA is carried out, the items that have been received will be grouped according to the constructs that have been set. The following process is to determine the reliability of each construct formed in this instrument as a result of the EFA produced. This reliability value determines the extent to which this instrument can be used in real-life studies [17]. If a high-reliability value is obtained on the instrument, it helps to obtain more accurate data in line with the objective requirements of the study [18].

3. RESULTS

The original item construct had 40 items from all four teacher competency constructs. After expert evaluation, 1 item was dropped, and only 39 items were made for the entire construct. The results of the EFA and reliability analysis, which included all of the items, are discussed in the next subsection.

3.1. Exploratory factor analysis for validity

There are 39 items in teacher competency that have been analyzed using EFA with a varimax rotation solution. However, the factor loading (FL) for some items is not under the factor from the EFA that has been done. In addition, there are also items with a FL value of less than 0.60. This is in line with the recommendation by [12]. These items that are less than the recommended value have been eliminated. Table 1 to Table 3 shows the results of the EFA conducted for the construct validity of the instrument tested. The variance values for each factor, eigenvalues, Kaiser-meyer olkin (KMO) values, and Bartlett's Test of Sphericity values will be explained in detail.

Based on the KMO and Bartlett's Tests, they are used to determine the appropriateness of items for factor analysis [19]. The KMO test is used to determine whether the study sample is suitable for conducting factor analysis. Factor analysis in statistics is about identifying factors or underlying causes that can be used in the relationship between two or more variables. In order to determine the multicollinearity of the items in this instrument, the KMO test was also conducted. Multicollinearity is a value that determines whether there exists a relationship between two or more items to measure the same thing. In contrast, Bartlett's Test of Sphericity identifies whether there is a correlation between items or a statistical test to see the correlation between variables, giving the statistical probability that the correlation matrix has a significant correlation between at least some variables. Based on Table 1, the appropriateness test of the use of factor analysis and uniformity of items for the teacher competency construct was found to be suitable because the KMO value that measures the adequacy of the sample showed a value of 0.77, which is above the minimum recommended value of 0.60 [20]. According to [12], and [21], a KMO value in the range of 0.80 is a value that is more than normal. The value of Bartlett's Test of Sphericity is significant ($p < 0.05$), which supports the factorization of the correlation matrix and provides evidence that the variables are independent and suitable for factor analysis [12].

Table 1. Appropriateness test using factor analysis and uniformity of KMO items and bartlett's test of teacher competency construct

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.771
Bartlett's Test of Sphericity	Approx. Chi-Square	2,307.077
	Df	741
	Sig.	.000

Next, the value of the explained variance (total variance explained) is the percentage of items important to the researcher in measuring the study variables. The analysis results of the teacher competency construct show that the items with the variance contribution weighting value of each factor are shown in Table 2. The amount of explained variance' to measure this teacher competency construct is 58.46%, which is

adequate and acceptable because it exceeds the 50% minimum set [21]. The four factors explain as much as 58.46% of the total variance in the construct. The variance value is 28.93%, which is less than 50%, showing that the data does not exhibit common method bias [22]. The results found four main factors extracted in the teacher competency construct and correspond to the results in Table 2.

Table 2. Total variants explained (n=102) for teacher competency instrument

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative (%)	Total	% of Variance	Cumulative (%)
1	11.281	28.925	28.925	11.281	28.925	28.925
2	6.350	16.282	45.208	6.350	16.282	45.208
3	2.818	7.225	52.433	2.818	7.225	52.433
4	1.634	6.023	58.456	1.634	6.023	58.456

A component matrix with varimax rotation (rotated component matrix) is conducted to show the correlation between the items and their factors after varimax rotation. All items from the four constructs of teacher competency were analyzed. Table 3 shows the weighting value of the rotated factor analysis for the teacher competency construct. A total of 39 items were constructed for the teacher competency construct after the factor analysis was tested, of the total, only 32 items met the conditions for teacher competency construct. On the other hand, as many as 7 items had to be dropped because they did not meet the conditions of having a factor weighting value of less than 0.60.

Table 3. Items of the teacher competency instrument after EFA: FL based on principal axis factoring and varimax (FL<.60 removed)

No.	No. Item	FL			
		1	2	3	4
Orientation Knowledge					
1	D1	.879			
2	D2	.868			
3	D3	.813			
4	D4	.805			
5	D5	.791			
6	D6	.733			
Instructional					
7	D7		.856		
8	D8		.842		
9	D9		.791		
10	D10		.825		
11	D11		.756		
12	D12		.723		
13	D13		.825		
14	D14		.698		
15	D15		.669		
16	D16		.646		
17	D17		.615		
Community Involvement					
18	D18			.817	
19	D19			.802	
20	D20			.795	
21	D21			.742	
22	D22			.709	
23	D23			.675	
24	D24			.652	
Personal Quality					
25	D25				.726
26	D26				.661
27	D27				.687
28	D28				.617
29	D29				.733
30	D30				.742
31	D31				.642
32	D32				.602

Refer to a rotated factor weighting analysis of the teacher competency construct. A rotated factor weighting analysis of the teacher competency construct is represented by knowledge orientation, instructional, community involvement, and personal quality. Factor analysis for the sub-construct of knowledge orientation indicates that all six items are accepted from D1 to D6, with factors ranging from .733 to .879. The analysis of the instructional sub-construct shows 11 accepted items out of 15 constructed items from D7 to D17, with factor weighting values ranging from .615 to .856. Next, in the factor analysis of community involvement sub-constructs, there are seven items received from eight constructed items from D18 to D24, with factor weighting values ranging from .652 to .817. In the analysis of the sub-construct for personal quality, there are eight items received out of 10 constructed items, which are from D25 to D32, with factor weighting values ranging from .602 to .726.

3.2. Item analysis for reliability

The data obtained from the findings of the study were analyzed using IBM SPSS Statistics version 26 with the internal consistency method (internal consistency approach). The method often used in measuring the reliability of a questionnaire instrument is the calculation of the reliability coefficient index (Cronbach's alpha). According to [23], reliability refers to the concept of the consistency and stability of an instrument. Consistency means that the same item has been tested repeatedly at different times and on the same subject, but the result score or answer given is still the same, while stability means freedom from error and being able to produce consistent results [24].

Next, Cronbach's alpha coefficient index test was conducted to determine the reliability of this research instrument, and the sufficient and adequate alpha value of the index is between .00 and 1.00 [23]. For [12], an alpha value between 0.7 and 0.8 is acceptable, and a lower alpha value means the reliability of the instrument is also lower. An alpha coefficient value of around .90 is considered "excellent", around .80 is "very good", and a value of around .50 to .79 is adequate. While values less than .50 are considered unacceptable [24]. Cronbach's alpha classification is as in Table 4.

Table 4. Cronbach's alpha reliability index for teacher competency construct

	No. Items	Cronbach's Alpha value
Orientation Knowledge	6	.917
Instructional	11	.922
Community Involvement	7	.854
Personal Quality	8	.821
Total	32	.818

Table 4 shows Cronbach's alpha value coefficient index for the teacher competency constructs. Cronbach's alpha value coefficient index analysis for the element of orientation knowledge is .917, instructional is .922, community involvement is .854, and for personal quality, Cronbach's alpha value index is .821. Overall, Cronbach's alpha value (α) for the whole instrument of teacher competency was 0.818. Thus, this shows that the items in the construct of teacher competency have high and consistent reliability values.

4. DISCUSSION

Various empirical studies have been carried out related to teacher competency, including [25], [26] and [27], showing in their studies that teachers who have high competency in schools have a positive effect on student achievement and school organizational excellence, as well as increasing the professionalism of teachers in the profession. However, there are studies related to the competency of teachers in small schools that are still at a low level [4]. Teacher competency is an important matter in improving the quality of teachers and, subsequently, the quality of national education [1]. Based on the statement, there is a need to develop an instrument that will be used to measure the level of teacher competency, especially in small schools.

Therefore, the teacher competency instrument was developed based on the "MTS 2.0 framework" that has been introduced by [10]. Based on the MTS 2.0 framework, it was adapted to be used for research in small schools in Malaysia, and factor analysis was first conducted on the instrument to ensure its validity and reliability. High reliability and validity values show the high quality of the study instrument. Value on the score Reliability explains that the instrument used is consistent and stable [18]. Consistency on the instrument is when the researcher receives almost the same score after conducting the test repeatedly and at different times [28]. Factor analysis is used to reach that level of excellence. Factor analysis is a statistical approach for identifying and reducing a large number of survey items into particular dimensions or constructs under the variables found in the study. This method is also a solution to remove items that overlap and have

the same meaning [20]. Explain the relationship between all variables and all extracted factors in factor analysis [12]. Appropriate use of EFA requires intelligent and informed researchers to make decisions.

Therefore, an EFA analysis using the varimax rotation solution was done on the 39 teacher competency items. This research found that seven items are within the required minimum value for the loading factor, which is 0.6. This situation required the researcher to drop items that did not reach the minimum factor fit value, and only 32 items were accepted. According to the eigenvalue, all of the components recorded values of 1.63 or above, which is above 1.0. The eigenvalue is an indication that determines the formation of the required number of components in the actual research instrument [18]. It can be concluded that all items in the dimension have a high degree and that all study components should be maintained [12]. Next, look at the results of Bartlett's Test for Sphericity; the KMO value is 0.77, indicating that the sample size is suitable. The use of factor analysis is suitable if the KMO value is greater than 0.70 [12], [28]. While the cumulative variance of the formation of EFA is 58.46%, it shows that these four [12] components of 58.46% account for the variance change. This value is sufficient to determine the composition of the research instrument because it is limited, exceeding the minimum amount of 50% [12].

A reliability analysis makes up the second analysis. In addition to fulfilling the established objective criteria, high instrument reliability helps in the acquisition of more accurate data [18]. Findings show the reliability value of the components formed in the study instrument. Overall, the instrument's Cronbach's alpha value (α) is 0.82, which is very high. Four of the produced components also have a very high value, which ranges from 0.82 to 0.92. The discovery shows that the item has very good reliability. To determine the reliability of this research instrument, a Cronbach Alpha value between 0.7 and 0.8 is acceptable, and a lower Cronbach Alpha value means the reliability of the instrument is also lower [12]. A Cronbach Alpha coefficient value of around .90 is considered "excellent," around .80 is "very good," and a value of around .50 to .79 is adequate. While values less than .50 are considered unacceptable [24]. As a result, this instrument has a high level of credibility and reliability, making it suitable for future research to be used in further studies to measure the level of teacher competency in small schools in Malaysia.

5. CONCLUSION

This study is intended to increase the contribution to the field of measurement in the development of teacher competency instruments, especially in the context of small schools in Malaysia. The results of the research conducted have successfully developed 32 items that can measure the level of competency of teachers in Malaysia, especially in small schools. Based on the findings obtained in this research, it can be concluded that teacher competency instruments have been developed and can be used to determine teacher competency in schools. This is based on testing each item, which shows reliability. The results of the EFA analysis test have also proven that the four dimensions of teacher competency, with 32 items, have met the criteria of a good and reliable instrument, and have a good level of content validity and construct validity. Next, the KMO values obtained in this study show suitable items according to their dimensions. The findings of this study are also supported by Cronbach's alpha value of 0.82 for this teacher competency instrument. This finding explains that this teacher competency instrument has excellent consistency and high reliability.

In conclusion, the findings of this study have produced a teacher competency instrument, especially in Malaysia. The method to evaluate teacher competency in schools, especially in small schools, can be implemented using teacher competency instruments that have been developed. To measure the level of competency of teachers in small schools, school leaders, decision makers or other stakeholders can use valid instruments. According to the excellent reliability and validity of the instrument, it is recommended to be used as the best instrument to measure the level of teacher competency in Malaysian schools. This instrument can also be used as a reference and guide for the development of assessment instruments related to the practice, competency, and continuous development of teachers in the future.

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