FACTOR ANALYSIS OF TEACHER' PERCEPTION ON CONTINUING PROFESSIONAL DEVELOPMENT (CPD) QUESTIONNAIRE

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Abstract

The main purpose of this study was to verify the structural construct validity which is called factor analysis of Teachers' Perception on Continuing Professional Development (CPD) Questionnaire. For Teachers' Perception on CPD Questionnaire, four instruments were used with 87 items. This questionnaire included four subscales such as updating activities, reflective activities, collaborative activities and benefits of attending CPD activities. There were altogether 87 items. The total of 1391 teachers from Mon State, Nay Pyi Taw Region and Magway Region were examined. After exploratory factor analysis (EFA), 37 items were left and 50 items were removed. After confirmatory factor analysis (CFA), next 6 items were removed and so only 31 items remained. Moreover, both convergent and discriminant validity was also accepted. In order to obtain the information which items are appropriate for teachers, an IRT parameter estimation procedure was carried out with two parameter logistic model (2 PLM) by utilizing BILOG-MG 3 software. It was observed that the test is discriminating well among examinees with the range of ability level -3 to +1.5 appropriately. The maximum amount of information was I (ɵ) = 19.5 is at ɵ = -1. Therefore, it was concluded that this test composed of 31 items could be suitable for teachers whose ability level range is – 1.

Keywords: updating activities, reflective activities, collaborative activities and benefits of attending CPD activities

Introduction

As democracy develops in Myanmar, it is essential for all sectors to upgrade to meet the standards required of a democratic system. With the aim of developing human resources, Myanmar's education reform began in 2011. In education reform, the curriculum reform is pivotal. The new curriculum focus on 21st century skills, soft skills (including personal development and employability skills) and higher order thinking skills. To keep abreast with the international standard, the new curriculum of basic education in Myanmar was introduced in the 2016-2017 academic year.

In response to globalization, as well as higher accountability demands, expectations of teacher's roles are changing. Communities place lofty expectations upon their educators. Today's educators are expected to be knowledgeable of their profession, maintain high academic standards, teach all types of learners through a variety of teaching strategies, and be accountable for each student's academic progress. Teachers need to be knowledgeable of their respective areas and the content that encompasses their subject area. Due to greater demands on teacher's requirements, many academics have called for a reform of professional development as a precursor to curriculum reform (Glickman & Sparks, 2002). Therefore, teacher preparedness and participation in curriculum change is very important.

Teachers, in the process of change in school, and generally in classrooms specifically play key roles. Therefore, they should participate in training and development programs to become ready to accept changes and implement appropriate methods in classrooms. Craft (2000) stressed that teachers are under immense pressure to undertake specific development courses for

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improved quality teaching. CPD thus bears significance not only for the teachers involved but also for the learners, the institutions and subsequently for society at large.

Purpose of the study

The main purpose of this study was to verify the structural construct validity which is called factor analysis of Teachers' Perception on Continuing Professional Development Questionnaire.

Definition of Key Terms

Updating Activities - a practitioner knowledge that enables them to integrate experiential knowledge, formal knowledge, and beliefs, across subject matter, general pedagogical knowledge, and pedagogical content knowledge fields (Hiebert et al, 2002).

Reflective Activities - a specialized form of thinking, applied to deal with a puzzling or curious situation (a problem) to make better sense of the situation. Reflection is a critical professional activity and vitally important to CPD (Cheetham & Chivers, 2001).

Collaborative Activities - provide (1) supportive and therapeutic benefits, which can reduce stress and help improve confidence (2) feedback, new ideas, and challenges (3) greater enthusiasm for collaborative working (4) a greater commitment to changing practice and (5) a framework for shaping the learning environment and thus directly and indirectly affecting student performance (OECD, 2009).

Benefits of Attending CPD - having significant positive effect on students' performance and pedagogical skills of the teacher and develop students' collaboration, communication, critical thinking and problem solving, creativity and innovation and citizenships (Day, 1999).

Review of Related Literature

Having examined different types of CPD, O'Sullivan et al (1988) suggests three ways in which CPD may be perceived in society. From a political point of view, CPD may be perceived as a professional duty or obligation where knowledge is for practice to meet required expectation or qualification (Cochran-Smith and Lythle, 2001). An example is what happens in countries where teachers have a requirement to gain masters qualification within a few years into the profession (for example USA, Canada and Finland). This is referred to as knowledge for practice.

Secondly, the professional element builds on the concept of the reflective practitioner, where teachers take responsibility for their professional learning (Helsby, 1995). Teachers are conceived as reflective practitioners who enter a profession with a certain knowledge base and who will require new knowledge and experiences on their basic knowledge. Cochran-smith and Lythle (2001) described this form of CPD when teachers reflect on their practice, as knowledge of practice i.e. using enquiry based on reflective practice (for example action research). This constitutes professional development since it aids teachers in building new pedagogical theories and practices and develops their expertise in the field. Clarke (2002) argues that a practitioner is reflective when he or she is curious about some aspects of the practice, frames and reframes that aspect in the light of previous experience or past knowledge and then develops a plan for future action.

Thirdly, the pragmatic element considers the knowledge and understanding of CPD in practice. Cochran-Smith and Lythle (2001) refer to this as knowledge in practice where practical knowledge is embedded in practice. It involves practical and learning on the job experience. The

professional and pragmatic elements of CPD appear to be more common and effective with regards to teacher's professional development. All forms of CPD considered in this study reflect the pragmatic, political and professional views outlined above.

Method

Sample of the Study

Firstlly, basic education teachers from Mon State, Kayin State, Nay Pyi Taw Region, Magway Region and Yangon Region were selected by using random sampling technique. Secondly, to collect required data, total numbers of 1391 teachers (65 male teachers and 1326 female teachers) were selected as the sample of this study. They are 404 teachers from Mudon, 400 from Chaungsone, 387 from Nay Pyi Taw, 64 from Warzi, 65 from Kayin and 71 from Yangon. Among them, 308 selected participants were senior assistant teachers, 746 selected participants from junior assistant teachers and 337 participants were primary assistant teachers.

Instrumentation

Teachers' Perception on Continuing Professional Development (CPD) Questionnaire was used in this study. This questionnaire was adapted from four standardized questionnaires, Teachers' Perception on CPD Questionnaire developed by Dijkstra (2009), Mwita (2012), Baustita et al (2017) and Sywelem & Witte (2013). It includes four subscales such as updating activities (21 items), reflective activities (20 items), collaborative activities (24 items) and benefits of attending CPD activities (22 items). Therefore, there are altogether 87 items with two-point likert scale (1= agree and 0= disagree).

Procedure

First of all, literature review concerned with research title and purpose of the study was made from several available boos, journals, reports and theses. Next, research instruments were prepared under the guidance of the supervisor to collect data. Experts review was requested to validate the instruments. After getting the validity of the instrument, pilot study was conducted. After the pilot study, the reliability analysis of the questionnaire was done by calculating the Cronbach alpha. Therefore, the reliability coefficient of updating activities, reflective activities, collaborative activities and benefits of attending CPD activities were 0.76, 0.76, 0.78 and 0.69 respectively. The reliability of the total test was 0.81. So, this questionnaire was satisfactorily high reliable to measure teachers' perception on CPD.

Result and Findings

Exploratory Factor Analysis of Teachers' Perception on CPD Questionnaire

Firstly, exploratory factor analysis was used to discover dimensions of the scale and the number of items. It was also used to postulate that there is a smaller set of unobserved (latent) variables or constructs that underlie the variables that actually were observed or measured. Exploratory factor analysis was conducted with 1391 teachers from Basic Education in Myanmar.

Firstly, Kaiser-Meyer-Olkin (KMO), and Bartlett's test were utilized. According to Buyukozturk (2006), the EFA would be run when KMO coefficient was greater than 0.60 and the Bartlett's test was significant (as cited in Yuce & Onel, 2018). The results of KMO and Bartlett's test were expressed in Table 1.

Table 1. KMO and Bartlett's Test of Teachers' Perception on CPD

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.770
Bartlett's Test of Sphericity	Approx. Chi-Square	17526.883
	df	703
	Sig.	000

According to Table 1, the KMO value of 37 items was 0.770 so that it was greater than 0.60 and the Bartlett's test was found to be significant (Chi-square= 17526.883, df=703, p<0.05). This meant that the variables were correlated highly enough to provide a reasonable basis for factor analysis. These tests of normality and sampling adequacy indicated that the correlation matrix was of acceptable quality. Thus, the data for teachers' perception on CPD were appropriate to run EFA.

According to Kaiser (1960), one must consider whether a measure is more than an attribute value of one in factor selection. Only factors that have eigenvalues greater than one are retained for interpretations. According to Zaman (2011), a Kaiser eigenvalue criterion is used to decide in choosing the factors (as cited in Navaneetha & Bhaskar, 2018). To calculate eigenvalue, a scree plot method was used. Figure 1 showed the maximum number of factors and the scree plot of Teachers' Perception on CPD.

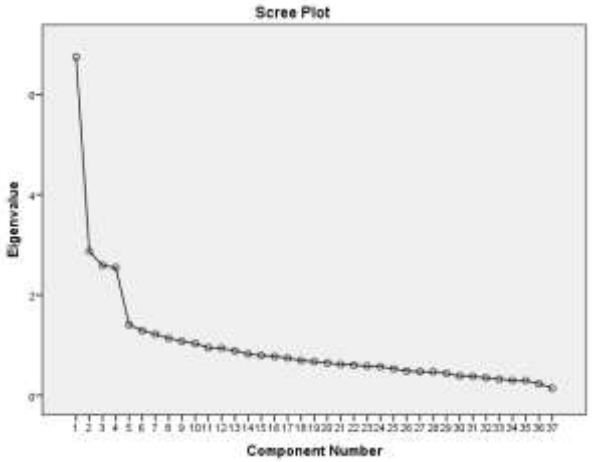

Figure 1. Scree Plot of Teachers' Perception on CPD

Based on Figure 1, eigenvalues of four factors were found to be greater than two. Four extracted factors were identified in the exploratory factor analysis. Each subscale measured only one construct about Teachers' Perception on CPD. Four factors were requested and according to these factors, the items were designed to index four constructs, namely collaborative activities, reflective activities, updating activities and benefits of attending CPD activities. Table 3 displays factor loading for Teachers' Perception on CPD Questionnaire.

Table 2. Factor loading for Teachers' Perception on CPD Questionnaire

	Factor				
	First factor	**Second factor**	**Third factor**	**Fourth factor**	
Item 68	.799				.540
Item 86	.721				.559
Item 78	.668				.467
Item 79	.620				.386
Item 83	.596				.410
Item 64	.526				.330
Item 76	.451				.335
Item 72		.754			.306
Item 61		.719			.314
Item 53		.609			.243
Item 33		.593			.296
Item 29		.593			.234
Item 32		.538			.320
Item 21		.518			.617
Item 25		.515			.497
Item 19		.494			.437
Item 24		.280			.523
Item 67		.467			.416
Item 26		.455			.307
Item 12		.453			.316
Item 57			.775		.582
Item 65			.678		.461
Item 15			.672		.439
Item 47			.579		.393
Item 54			.521		.289
Item 46			.510		.331
Item 81			.508		.395
Item 31			.507		.292
Item 63			.460		.316
Item 34				.696	.488
Item 85				.664	.467
Item 20				.624	.511
Item 17				.578	.399
Item 10				.576	.375
Item 7				.543	.296
Item 38				.538	.341
Item 73				.472	.327

After factor rotation, the number of items for each factor was determined. The first factor, reflective activities included seven items with factor loadings ranging from 0.8 to 0.45, the second factor, collaborative activities included thirteen items with factor loadings ranging from 0.76 to 0.45, the third factor, updating activities included nine items with factor loadings ranging from 0.78 to 0.46 and the fourth factor, benefits of attending CPD activities included eight items with factor loadings ranging from 0.7 to 0.47. With these factor loading values of the items,

Teachers' Perception on CPD Questionnaire indicated a good result because according to Buyukozturk (2002), if the factor loading value of the item is 0.45 or higher, it is an indicator of a good result (as cited in Qrcan, 2018).

Confirmatory Factor Analysis of Teachers' Perception on CPD

Confirmatory factor analysis (CFA) is a multivariate statistical procedure that is used to test how well the measured variables represent the number of constructs. CFA was conducted to determine the existing structure of the scale and to test how the variables are related to underlying constructs. Confirmatory factor analysis was conducted for teachers' perception on CPD. It consisted of 1391 teachers from Basic Education in Myanmar. The data of goodness of fit of the models of teachers' perception on CPD were summarized in Table 3 to compare the alternative models.

Table 3. Model Fit Indices of Perception on CPD Factors

Chi-square	p-value	Df	CMIN/df	CFI	NFI	GFI	AGFI	RMSEA
5067.305	p<0.001	428	11.839	0.654	0.634	0.655	0.634	0.088

Note; CMIN (chi-square statistics), GFI (Goodness-of-fit index), AGFI (Adjusted Goodness-of-fit index, RMSEA (root mean square error of approximation), CFI (comparative fit index)

If the CFI, NFI, GFI and GFI values are higher than 0.90 (Hooper, Coughlan, & Mullen, 2008; Sumer, 2000) and RMSEA value range from 0.05 to 0.1 (Awang, 2012) and CMIN/df (Chi-square/df) was not exceeded 3, the data fit to the model (as cited in Al-Mamary, Shamsuddin, 2015). Because of the above values of CFI, NFI, GFI and GFI were low; the data is not fit to the model. However, Hooper, Coughlan and Mullen (2008) expressed that it is good to remove the items with low R^2 values (less than 0.2) from the analysis to improve a better model fit. In the present analysis, six items that R^2 value was less than 0.1 were removed from the study. Therefore, teachers' perception on CPD questionnaire included 31 items.

Table 4. Model Fit Indices of Perception on CPD Questionnaire after deleting six items

Chi-square	p-value	Df	CMIN/df	CFI	NFI	GFI	AGFI	RMSEA
5121.342	p<0.001	1020	2.343	0.923	0.938	0.908	0.913	0.008

According to the results of Table 4, the values of CFI, NFI, GFI and AGFI were greater than 0.9, CMIN/df (Chi-square/df) was not exceeded 3 and RMSEA value was 0.008. Therefore, it was determined that teachers' perception on CPD questionnaire consisted of four subscales with 31 items and it was accepted as a good measuring instrument. Moreover, model fit was also high. The confirmatory factor analysis after deleting six items was expressed in Figure 2.

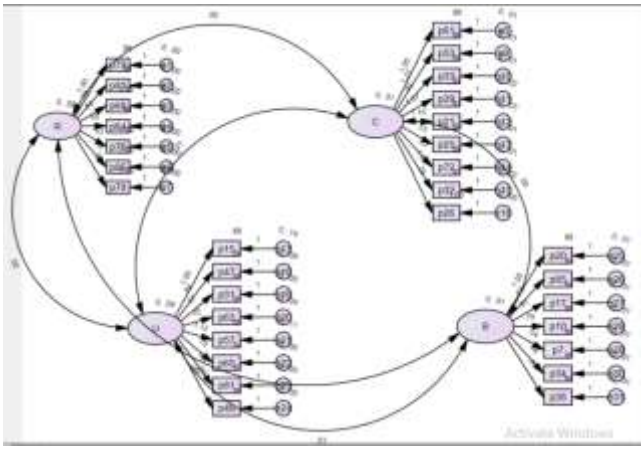

Figure 2. The confirmatory factor analysis after deleting six items

Convergent Validity of Teachers' Perception on CPD Questionnaire

Convergent validity is also an evidence to test construct validity**.** To establish convergent validity, factor loadings of the indicator variables, composite reliability (CR) and average variance extracted (AVE) should be used. AVE and CR values were computed by the formula using Microsoft Excel. Table 5 showed the results of average variance extracted (AVE) and composite reliability (CR) of Teachers' Perception on CPD Questionnaire.

Table 5. Composite Reliability (CR) and Average Variance Extracted (AVE) ofTeachers' Perception on CPD Questionnaire

Factors	Number of Items	CR	AVE
Reflective activities	7	1.17	0.33
Collaborative activities	9	1.95	0.33
Updating activities	8	1.08	0.31
Benefits of attending CPD activities	7	1.08	0.31

The AVE values for four factors model ranged from 0.31 to 0.33. The CR values ranged from 1.08 to 1.95. According to Hunang et al., (2013), AVE should be above 0.5 and CR should be 0.7 and above. Fornell and Larcker (1981) stated that if AVE values were below the acceptable minimum cutoff point of 0.5, convergent validity may be adequate because all latent factors had CR values above 0.7 (as cited in Hamid, Samiz & Sidek, 2017). Furthermore, Malhotra and Dash (2011) also expressed that AVE is often too strict and validity can be established through CR alone (as cited in Chakrabouty & Sengupta, 2014). According to Table 5, although AVE values of teachers' perception on CPD were lower than 0.5, CR values were above 0.7 so that convergent validity was achieved for this construct. Teachers' Perception on CPD Questionnaire was assumed that it was a valid instrument to measure teachers' perception on CPD.

4.2.2 Discriminant Validity of Teachers' Perception on CPD

Discriminant validity was used to show that the construct is actually differing from one another empirically. Discriminant validity was evaluated with square root of AVE with correlations of latent constructs. The results were shown in Table 6.

Table 6. Square Root of AVE with Correlations of Latent Factors of Teachers' Perception on CPD

Factors	R	C	U	B
Reflective activities (R)	***0.58***			
Collaborative activities (C)	0.161	***0.57***		
Updating activities (U)	0.209	0.091	***0.56***	
Benefits of attending CPD activities (B)	0.251	0.131	0.165	***0.56***

The diagonal numbers in *italic* are the square root of AVE values.

According to Table 6, all the square root of AVE values was greater than 0.5 and these values were greater than all the inter-latent factor correlations for all factors in the relevant rows and columns. According to Fornell and Larcker (1981), the square root of AVE should be above 0.5. Then, according to Hair et al., (2011), square root of AVE values was greater than the inter-latent factor correlations (as cited in Hamid, Samiz & Sidek, 2017). Thus, the results of the discriminant validity of teachers' perception on CPD questionnaire were congruent with Fornell and Larcker (1981) and Hair et al., (2011) according to Table 6. Overall, discriminant validity can be accepted for the measurement model and the discriminant validity between the constructs.

Checking the Confirmatory of Model and Test Data

To investigate how well a model accounts for a set of data, the closeness of model-data was explored by comparing model prediction and actual observed data. Figure 3 clearly shows expected and observed test score distributions for two parameter model. The evidence was clear that the inclinations of the distributions are generally the same although there were some points of disagreement with the model distribution. It indicated that actual observed data score distribution was fairly close to the theoretical distribution. Therefore, it was concluded that model-data fit was adequate enough to apply IRT model for this test.

In order to apply an IRT analysis, assumption of unidimentionality should be held. To investigate this assumption, a principal factor analysis was conducted. The values of eigenvalue 1,2,3,4,5,6,7 was 6.98, 3.04, 2.65, 2.56, 1.65, 1.42, 1.27 and so on and thus eigenvalue 1 was larger enough than other eigenvalues to determine that the test data satisfy the assumption of unidimentionality. It can be said that the test data satisfy the assumption of local independence. Therefore, the test items were unidimentional.

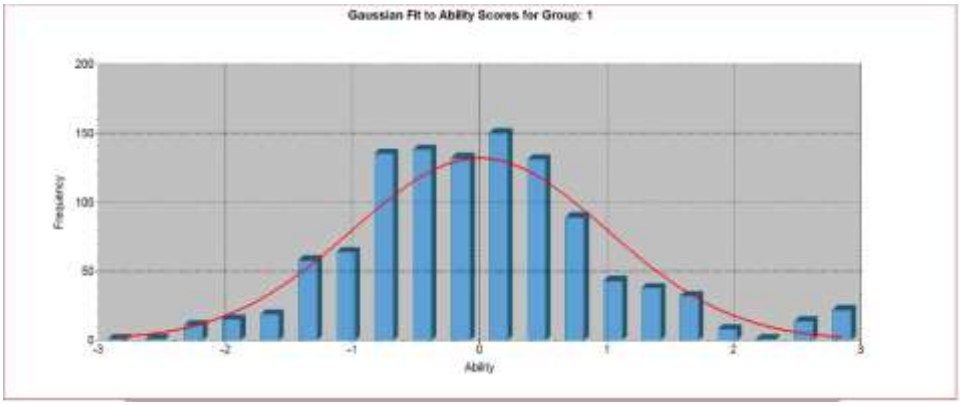

Figure 3 Frequency Distribution of Expected and Observed Data for Teachers' Perception on CPD

According to the Figure 3, the evidence is clear that substantial improvements in fit are obtained with the more general models, with the two-parameter model (2PL) fitting the data very well. The expected and observed data for the 2PL model are nearly identical. Therefore, 2PL model was employed by using BILOG-MG 3.

Item Parameter Estimation

Item parameter and ability parameters were estimated by BILOG-MG 3 Software Package (Zimowski, Muraki, Mislevy & Bock, 2003) which is capable of large-scale production applications with unlimited numbers of items of respondents. The Teachers' Perception on CPD Questionnaire was analyzed by 2PL model in this study, so the characteristics of the items can be described by item difficulty (*b*) and item discrimination (*a)* but no *c* or guessing parameter for these items. Actually, the acceptable range of an item is from 0 to 2 for discrimination (a) and from -2 to + 2 for difficulty (*b*) (Hambleton, swaminathan & Rogers, 1991). In Table 7, item parameters *a and b* of 31 items were estimated and obtained parameter estimates of each item respectively are presented.

Table 7. Item Parameter Estimates for the Teachers' Perception on CPD Questionnaire

Items	Discrimination (a)	Difficulty (b)
Item 1	0.52	1.18
Item 2	0.72	0.56
Item 3	0.42	0.99
Item 4	0.82	-0.85
Item 5	0.52	0.49
Item 6	0.52	-1.09
Item 7	0.42	0.86
Item 8	0.72	0.45
Item 9	0.52	-0.77
Item 10	0.32	-0.26
Item 11	0.42	-1.85
Item 12	0.52	0.89
Item 13	0.82	0.41
Item 14	0.72	-0.85
Item 15	0.52	1.65
Item 16	0.72	0.73
Item 17	0.62	-0.08
Item 18	0.72	-1.08
Item 19	0.62	0.50

Items	Discrimination (a)	Difficulty (b)
Item 20	0.42	-0.61
Item 21	0.32	-1.25
Item 22	0.62	-0.29
Item 23	0.62	-0.29
Item 24	0.52	0.88
Item 25	0.72	-0.31
Item 26	0.52	0.69
Item 27	0.82	0.59
Item 28	0.42	-0.39
Item 29	0.32	-1.39
Item 30	0.42	-1.18
Item 31	0.32	1.99

From the above result, it was found that the item discrimination parameter (a) estimates range from 0.32 to 0.82 and the mean of these estimates is 0.68. So, it is concluded by a consideration of their discrimination indices, the items are fairly good items to provide appropriate discrimination or information for the whole test. On the other hand, the items with the difficulty (b) values within -2 to +2 were expected to be selected (Nu Nu Khaing et.al., 2011). In this study, the variability of parameter (b) value was from -1.85 to + 1.99 and the mean of the estimates is 0.57 and thus it is concluded that the test is neither easy nor difficult. (see Table 8)

Table 8. Mean, Standard Deviation, Maximum and Minimum Values of Discrimination and Difficulty Parameters

	Parameters	
	Discrimination (*a*)	**Difficulty (*b*)**
Mean	0.68	0.57
Standard Deviation	0.05	0.16
Maximum	0.82	1.99
Minium	0.32	-1.85

Test Characteristic Function and Test Information Function

The test characteristic curve (TCC) for the 31 items test was graphed to learn the peculiarities of the test as a measuring instrument (see Figure 4). The TCC shows how test scores on the test are related to the ability ɵ of the examinee (Hambleton, Swamninathan & Roger, 1991). The TCC is a true score (r) of an examinee with ability ɵ in IRT.

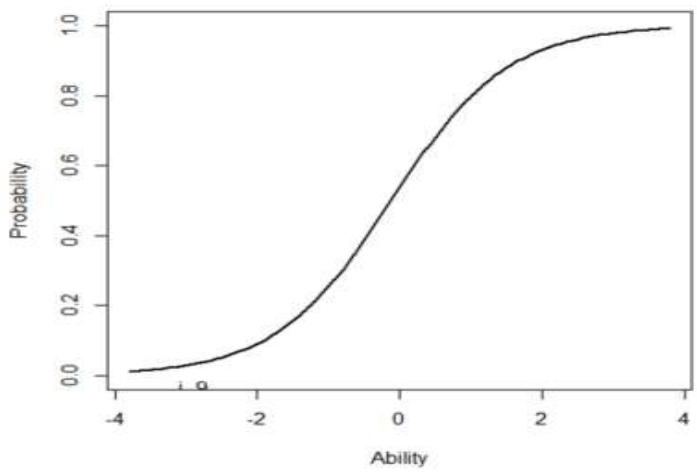

Figure 4. Test Characteristic Curve for the Test with 31 items

According to Figure 4, it was observed that the test is discriminating well among examinees with the range of ability level -3 to +1.5 appropriately. So, it can be fairly discriminating among examinees with extremely low or high ɵ. Therefore, it was observed that the above range of ability level -3 to +1.5 is neither too steep nor too smooth. To be precisely the maximum amount of information obtained from the test, test information function is used to know standard error of the test and its reliability. The standard error (SE) of the test is the inverse of the square root of information, thus, the greater information causes the smaller the standard error and the greater the reliability. Figure 5 illustrated the test information curve (TCI) of 31 items test and SE is the standard error of estimation.

Since the ability distribution of the examinees was assumed as a standard normal distribution, the test was desired to provide maximum discrimination or information in the ɵ range of ±2. By looking at Figure 4, it is visually clear that the test is discriminating well among examinees with the range of ability level from – 3 to +1.5 in the test. The maximum amount of information was I (ɵ) = 19.5 is at ɵ = -1. Ability estimates are more precise across the ability scale from -3 to + 1.5 than at the low and high ends of the scale. Therefore, it was concluded that this test composed of 31 items could be suitable for teacher educators whose ability level range is -1. However, smaller standard errors are associated with highly discriminating items for which the correct answers cannot be obtained by guessing (Hambleton et al., 1991, p.95, cited in Nu Nu Khaing et.al., 2011)

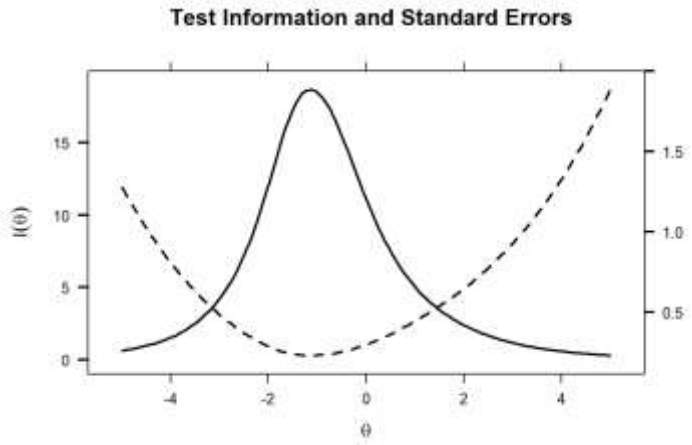

Figure 5. Test Information Curve for the Test with 47 Items

Table 9. Reliability Analysis of Teachers' Perception on CPD

Scale/ Subscales	Number of Items	Cronbach Alpha
Reflective Activities	7	0.72
Collaborative Activities	9	0.79
Updating Activities	8	0.77
Benefits of Attending CPD Activities	7	0.75
Total	31	0.81

According to Table 9, reliability coefficients of each subscale for Teachers' Perception on CPD ranged from 0.72 to 0.75. These values of reliability coefficients indicated that all 31 items were good to measure teachers' perception on CPD because according to Sekaran and Bougie (2013), reliability coefficients above 0.9 are generally considered as excellent, 0.80-0.89 were good and 0.7-0.79 were adequate. The reliability coefficient for Teachers' Perception on CPD were higher than 0.8. Thus, it was reliable to measure teachers' perception on CPD.

Discussion

This study was to verify the structural construct validity which is called factor analysis of Teachers' Perception on Continuing Professional Development Questionnaire (87 items). These items are analyzed and reduced by calculating exploratory factor analysis and confirmatory factor analysis. The two types of factor analysis _ exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used in this study. EFA provides to the researcher the necessary amount of factors to represent the data and to explore the dimension of a group of items. CFA can confirm how well the analyzed variables represent a smaller of number of constructs and the structural model of an instrument Ans so, 31 items were finally left in the questionnaire. Then, convergent validity and discriminant validity were accepted for this questionnaire. It had a good result by applying IRT model. The reliability coefficient of final questionnaire including only 31 items was greater than 0.8. So, factor analysis was very useful for the researcher to adapt the instruments to be more effective.

Conclusion

Teachers actually play very important roles in all aspects of education and students' lives. Although an appropriate teachers' perception on CPD and job crafting was developed for Myanmar school teachers in this study, region related differential item functioning on perception on CPD and job crafting should be investigated as items may function differently according to regions. The effect of teachers' perception on CPD and job crafting should be studied for private teachers and principals. It is suggested that research studies with the lager sample size from different regions would be more desirable so that the more generalized, reliable and valid results would be achieved.

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