Chapter IV

Data Analysis and Results

Introduction

This chapter presents the findings on factors influencing teachers' implementation of Competency Assessment and Modular Certification (CAMC) of vocational subjects in secondary school. It comprises three sections. Data collected in this study was processed using the Statistical Package for Social Sciences (SPSS) version 16.0 and Analysis of Moment Structures (AMOS) version 16. This study aimed to test if the *a priori* model of factors influencing the implementation of Competency Assessment and Modular Certification (CAMC) for vocational subjects**,** fit the empirical data collected from the teachers. In this chapter, findings related to the specific research questions are presented. These research questions are;

(1) To what extent does the *a priori* model fit the data collected?

(2) To what extent does teachers' conceptions, teachers' receptivity and quality assurance measures have significant direct and indirect influence on the degree of implementation of CAMC?

(3) To what extent does gender moderates the proposed model?

(4) To what extent does teachers' experience moderates the proposed model?

(5) To what extent does training moderates the proposed model?

(6) To what extent does field of specialization moderates the proposed model?

(7) What is the parsimonious model of factors influencing the degree of implementation of CAMC?

(8) What are the issues and barriers faced by the vocational teachers in implementing Competency Assessment and Modular Certification (CAMC) and suggestions from the teachers to improve the implementation of Competency Assessment and Modular Certification (CAMC)?

This chapter begins with results of the preliminary analyses which contained evaluation of SEM assumptions, respondents' demographic profile, exploratory factor analyses (EFA) and confirmatory factor analyses (CFA). The second section presents findings from the model tests of the measurement model and structural equation modeling to examine the model fit, and the direct and indirect effects of factors influencing implementation of CAMC. The third section presents findings from multiple group analysis of the proposed model and the parsimonious model. Finally the chapter concludes with the issues and barriers faced by the vocational teachers in implementing CAMC.

Preliminary Analyses

Before examining the specific research questions, some preliminary analyses were conducted. The first step in those preliminary analyses was to check the assumption in Structural Equation Modeling. The respondents' demographic profile was described and finally, both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed in order to determine the best factor structure to be used to represent the latent variables in this study.

Evaluation of Major Structural Equation Modeling (SEM) Assumptions

Some assumptions in SEM need to be met to assure that the findings of structural equation modeling are accurate and reliable. There are a series of assumptions for structural equation modeling, but for this study the two most important assumptions were evaluated. These are ‘sample size assumption’ and ‘normality assumption’.

Sample Size

SEM requires the sample size to be sufficiently large. However, there is no universal rule defining a “sufficiently large” sample size. Different researchers have made different sample size recommendations in SEM studies. For instance**,** Hoyle (1995) recommended at least a 100 cases**,** and preferably 200. Kline (2005) considered a sample size of under 100 to be untenable in SEM. The average sample size, based on a survey of 72 SEM studies, was 198 (Garson, 2007). According to Kline (2005), over 200 cases could be considered large. Large sample sizes were necessary for reasonable stability of the results. However, after the data cleaning process, this study used a data set of 493 observations. The minimum sample size for a particular SEM model depends on several factors, including the model complexity and the communalities. When the number of factors is larger than six, sample size requirements may exceed 500 (Hair et al, 1998). Hence, the sample size must be sufficient to allow the model to run, but more important, it must adequately represent the population of interest.

Multivariate Normality

Univariate and multivariate normality of the variable in the model is another important assumption in SEM. Simulation conducted by Kline (2005) indicated that SEM parameter estimates remained reasonably accurate when the assumption of normality was violated. However, the significance coefficients corresponding to such estimates were inflated. In particular, the Chi-square was inflated, which caused researchers to believe that the hypothesized model needed further modification when it actually fit the data quite well. Another problem linked to the violation of multivariate normality assumption was that the lack of multivariate normality tended to cause the deflation of standard errors, which in turn, made regression paths and factor/error covariances statistically significant**,** more often than they should be (Byrne, 2001).

While testing the univariate normality was relatively simple, directly examining the multivariate was challenging due to the complexity of the multi-dimentionality. In order to evaluate the multivariate normality in the present study, Mardia's coefficient, which is a commonly used approach for assessing multivariate normality, was obtained. The multivariate kurtosis value was much larger than the recommended value and this indicated that there was a significant kurtosis, or significant multivariate non-normality.

Handling Non-normality with Bootstrapping

One commonly used approach for handling multivariate non-normal data in SEM was to use a procedure known as 'bootstrapping' (Yung & Bentler, 1996; Zhu, 1997). 'Bootstrapping' was a procedure of re-sampling with replacements, to generate multiple sub-samples from the original sample. Such a procedure enabled the researcher to examine the parameter (e.g., regression weights or standard errors) distributions of these samples, which considered cumulative, served as a bootstrap sampling distribution -in much the same manner as sampling distribution was associated with parametric inferential statistics (Byrne, 2001). However, while the sampling distribution of the inferential approach was restricted by the normality assumption, bootstrapping was free of such an assumption (Zhu, 1997). Basically, bootstrapping provided an approach to addressing situations where the assumption of multivariate normality failed to hold (Yung & Bentler. 1996).

Bootstrapping has usually been used to achieve two objectives: 1) to assess the overall goodness of fit of the model (Bollen & Stine, 1993) and 2) to assess the level of stability of parameter estimates (Byrne, 2001). The 95% confidence interval (CI) was used to examine the significant levels of the estimates. If the 95% CI did not include zero, the effect was considered significant at the 0.5 level. In the present study, 1,000 bootstrap samples were created from the original data set, (n = 493), by random sampling. The models were run by utilizing this new sample to yield 1,000 estimations of each coefficient path. This bootstrap procedure was used to assess the model fit and the stability of parameter estimates.

Respondents' Demographic Profile

A total of 548 vocational subjects' teachers from 656 schools initially responded to the questionnaire. The data cleaning process was performed; incomplete and outlier cases were deleted. Otherwise their inclusion would cause the data to be invalid. Outliers in the dataset were identified by conducting Mahalanobis Distance analysis. After deleting the incomplete and outlier's cases, a total of 493 valid samples remained in the final analysis. Table 4.1 presents the demographic profile of the respondents. Male teachers made up a higher percentage of the respondents. Males and females accounted for 266 (54.0%) and 227 (46.0%) of the respondents, respectively. The largest number of respondents majored in their respective vocational subjects, (n = 359 or 72.8%). Those who majored in Living Skill comprised 71 (14.4%) respondents, and those who majored in other subjects comprised 63 (12.8%) respondents.

The largest number of respondents possessed a bachelor degree (n = 436 or 88.4%), while SPM/STPM, Diploma and Masters degree accounted for 20 (4.1%), 19 (3.9%) and 18 (3.7%) of the respondents, respectively. With respect to the professional qualification of the respondents, the largest group of respondents earned a KPLI (Post Graduate Teaching Course) qualification or the post-graduate teaching course qualification. They comprised 483 (70.6%) respondents. 90 (18.3%) of respondents earned a Diploma in Education, while 42 (8.5%) of respondents were qualified with a certificate of teaching. Only 13 (2.6%) of the respondents had other qualification.

As illustrated in Table 4.1, less experienced teachers made up a higher percentage of the respondents. 296 (60.0%) of the respondents had less than 5 years of teaching experience while 197 (40.0%) of the respondents had more. Teachers, who obtained partial training in CAMC, made up a higher percentage of the respondents than teachers who obtained full training in CAMC. Partially-trained and fully-trained teachers accounted for 271 (55.0%) and 222 (45.0%) of the respondents, respectively.

Twenty-two vocational subjects are offered in the implementation of CAMC. These vocational subjects are categorized into four field of specialization (see Table 4.2).

With respect to the field of specialization, the largest group of respondents was in the Home Science category. They comprised 167 (33.9%) respondents. The Engineering category consisted of 115 (23.3%) teachers. The Agriculture category, which accounted for 109 (22.1%) of the respondents, was close to that of the Information Technology category which had 102 (22.7%) respondents.

Table 4.1

Demographic Profile of Respondents

Characteristics	Frequency	Percent
Gender		
Male	266	54.0
Female	227	46.0
Major		
Vocational subject	359	72.8
Living Skills	71	14.4
Others	63	12.8
Academic Qualification		
SPM/STPM	20	4.1
Diploma	19	3.9
Bachelor Degree	436	88.4
Master Degree	18	3.7
Professional Qualification		
Certificate of Teaching	42	8.5
KPLI (Post Graduate Teaching Course)	348	70.6
Diploma in Education	90	18.3
Others	13	2.6
Teaching Experience		
Less than 5 years (Less experience)	296	60.0
More than 5 years (More experience)	197	40.0
Training in CAMC		
Attended partial training (Briefing on concept/design)	271	55.0
Attended full training (Concept/design, score moderation and item writing)	222	45.0
Field of Specialization		
Information Technology	102	20.7
Home Science	167	33.9
Agriculture	109	22.1
Engineering	115	23.3

Table 4.2

Frequency of Vocational Subjects Based on Field of Specialization

List of Vocational Subjects	Frequency	Percent
Information technology		
Signage Designing	53	10.8
Computer Graphics	28	5.7
Multimedia Production	21	4.3
Home Science		
Catering and Food Service	73	14.8
Fashion Designing and Tailoring	44	8.9
Food Processing	18	3.7
Basic Interior Decoration	10	2.0
Facial Care and Hair Styling	15	3.0
Basic Gerontology and Geriatric Care	1	.2
Basic Early Childhood Education	6	1.2
Agriculture		
Food Crops Cultivation	30	6.1
Landscape and Nursery	71	14.4
Aquaculture and Recreational Animal	8	1.6
Engineering		
Domestic Construction	16	3.2
Servicing of Domestic Electrical Appliances	21	4.3
Domestic Pipe Work	10	2.0
Domestic Wiring	19	3.9
Servicing of Refrigeration and Air-Conditioning Equipment	8	1.6
Automobile Servicing	8	1.6
Arc and Gas Welding	6	1.2
Motorcycle Servicing	11	2.2
Furniture Making	16	3.2
Total	**493**	**100.0**

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)

There are a total of four latent variables to be tested in the proposed model of this study. The four latent variables are Teachers' Conceptions of CAMC, Teachers' Receptivity to CAMC, Degree of Implementation of CAMC and Quality Assurance Measures of CAMC. Since the latent variables are unobserved hypothetical constructs, they were represented by sub-constructs and multiple indicators. There are a total of fourteen sub-constructs to measure the four latent variables in this study, and each sub-construct is represented by multiple indicators or observed variables. Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted. Exploratory factor analysis (EFA) was used as a technical preliminary step within the framework of confirmatory factor analysis (CFA). Results of the exploratory factor analysis (EFA) were used to provide information of which items are appropriate to serve as reference indicators in the CFA model. The evaluation of the goodness-of-fit criteria for the confirmatory factor analysis (CFA) was discussed in the previous chapter.

Once the overall model fit had been evaluated, the measurement model of each construct was then assessed for unidimensionality and reliability. Unidimensionality is an assumption underlying the calculation of reliability. According to Hair et al. (1998), the use of reliability measures such as Cronbach's alpha, did not ensure unidimensionality but assumed it existed. This encouraged researcher to compute the composite reliability (CR) and variance extracted (VE) separately for each multiple indicator construct in the model.

The composite reliability (CR) was a measure of the internal consistency of the construct indicators. More reliable measures such as composite reliability provided the researcher with greater confidence that the individual indicators were all consistent in their measurements. The commonly used threshold value for acceptable reliability is .70 (Hair et al., 1998). CR formula assumes that there are no correlations among errors associated with indicators, and renders better estimates of reliability compared to Cronbach's alpha as this formula works for congeneric measures.

Another measure of reliability was the variance extracted (VE) measure. This measure reflected the overall amount of variance in the indicators accounted for by the latent construct. Higher variance extracted values occurred when the indicators were truly representative of the latent construct. Guidelines suggested that the variance extracted value should exceed .50 for a construct (Hair et al., 1998). The variance extracted measure is a complementary measure to the composite reliability value.

The composite reliability (CR) of a construct is calculated as (Hair et al., 1998);

$$CR = \frac{(\text{Sum of standardized loadings})^2}{(\text{Sum of standardized loadings})^2 + \text{Sum of indicator measurement error}}$$

The standardized loadings were obtained directly from the program output, the measurement error is 1.0 minus the reliability of the indicator, which is the square of the indicator's standardized loading. The variance extracted (VE) of a construct is calculated as (Hair et al., 1998);

$$VE = \frac{\text{Sum of squared standardized loadings}}{\text{Sum of squared standardized loadings} + \text{Sum of indicator measurement error}}$$

This measure is quite similar to the reliability measure but differed in that the standardized loadings were squared before summing them. In this study, the composite reliability (CR) and the variance extracted (VE) were computed for the final measurement model of each construct.

Teachers' Conceptions of CAMC

Teachers' Conceptions of CAMC in this study referred to teachers' beliefs, meanings, concepts, rules and preferences of school-based assessment of CAMC. There are 11 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.3. The highest correlation value of an item with any other item in the construct is shown in bold.

In Table 4.3, the mean value for all the items are more than 3, indicating a high level of overall agreement in this construct. Based on the correlation coefficients, each item did correlate adequately with at least one other items in the construct ($0.3<r<0.9$).

Table 4.3

Descriptive Statistics for Items in Construct Teachers' Conceptions of CAMC

Item	Descriptive		Inter-item correlation											Factor Loading	
	M	*SD*	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	F1	F2
C01	4.02	.644	1.000											.688	
C02	4.18	.497	**.554**	1.000										.852	
C03	4.25	.480	.444	**.664**	1.000									.854	
C04	4.13	.483	.449	.489	.543	1.000								.688	
C05	4.07	.550	.410	.440	.505	.442	1.000							.750	
C06	3.93	.622	.440	.474	.428	.436	.519	1.000						.709	
C07	4.16	.504	.404	.514	**.617**	.494	.512	.560	1.000					.725	
C08	4.01	.526	.354	.469	.467	.404	**.525**	**.604**	.578	1.000				.663	
C09	4.16	.453	.393	.518	.528	**.558**	.496	.458	**.605**	**.532**	1.000			.634	
C10	4.05	.592	.322	.424	.403	.374	.307	.330	.435	.377	**.499**	1.000			.757
C11	3.53	.761	.269	.203	.226	.290	.265	.303	.334	.320	.331	**.515**	1.000		.962

M = Mean, SD= Standard Deviation

In the exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.907, which is considered to be very good. Two factors were extracted that explained 49.9% and 9.6% of the total variation in the 11 items. The factor loading values are in the last column of Table 4.3. The minimum factor loading value is 0.634. In the confirmatory factor analysis (CFA), a single factor model (Figure 4.1) was not acceptable [χ^2/df = 7.275, TLI=0.860, CFI=0.888, RMSEA= 0.113, AIC =364.1].

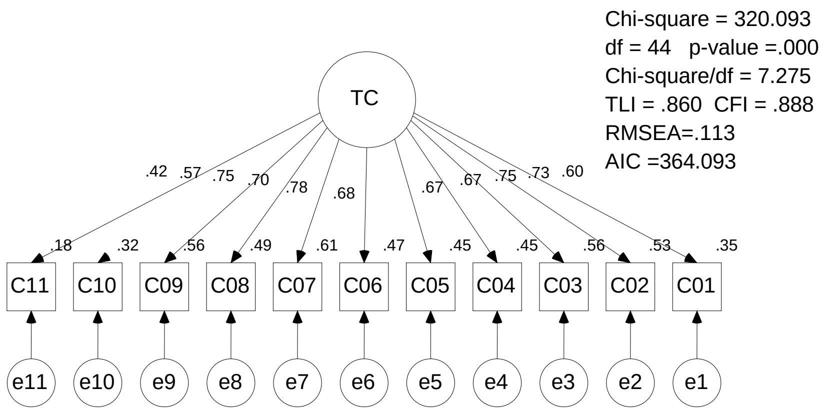

Figure 4.1. Single factor model for Teachers' Conceptions of CAMC

Based on the factor score weights (Table 4.4), there were two distinct constructs within Teachers' Conceptions of CAMC:

Teachers' Conception I: C09, C08, C07, C06, C05, C04 and C03

Teachers' Conception II: C01, C10 and C11.

Table 4.4

Factor Score Weights for Teachers' Conceptions of CAMC

	C11	**C10**	C09	C08	C07	C06	C05	C04	C03	C02	**C01**
TC	**.020**	**.042**	.109	.077	.115	.061	.065	.075	.105	.091	**.042**

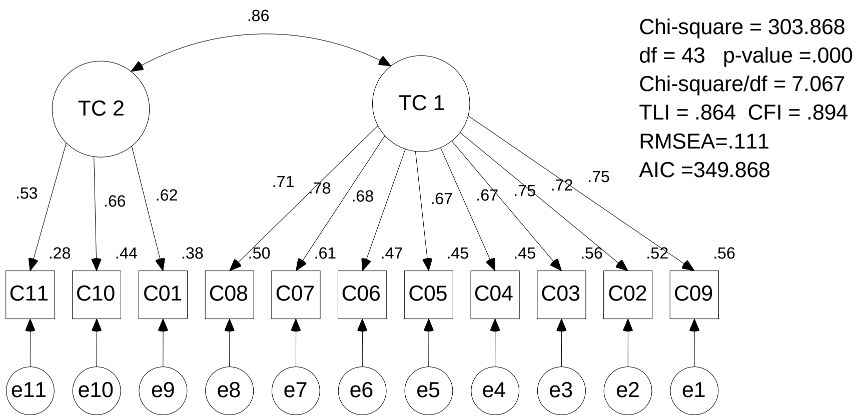

Figure 4.2. Two factor model for Teachers' Conceptions of CAMC

In the confirmatory factor analysis (CFA), the two factor model (Figure 4.2) was also not acceptable [χ^2/df = 7.067, TLI=0.864, CFI=0.894, RMSEA= 0.111, AIC =349.9]. The modification index showed a very high level of relationship between C01, C10 and C11, and C03. After dropping these four items, the final single factor model (Figure 4.3) was obtained [χ^2/df = 4.226, TLI=0.954, CFI=0.969, RMSEA= 0.081, AIC =87.1]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.5. The computed composite reliability (CR) is 0.881 and the variance extracted (VE) is 51.5%.

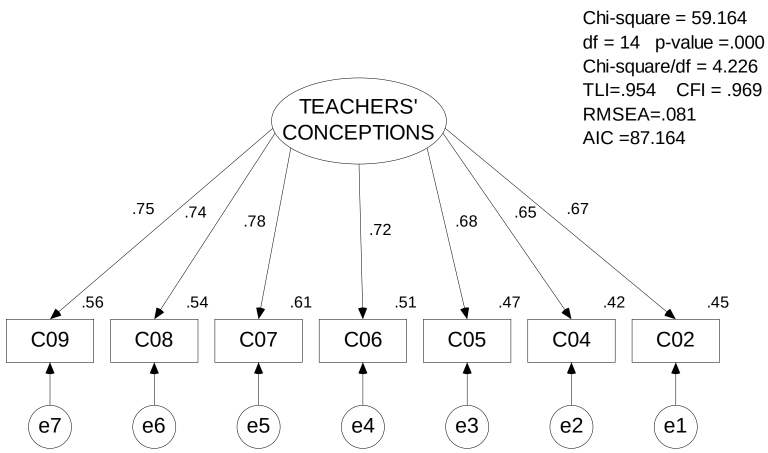

Figure 4.3. The final model for Teachers' Conceptions of CAMC

Table 4.5

Standardized Factor Loadings for Items In Teachers' Conceptions Of CAMC

Parameter			Estimate	95% CI*	
				Lower	Upper
C02	<---	TC	.663	.587	.733
C04	<---	TC	.646	.566	.714
C05	<---	TC	.675	.572	.755
C06	<---	TC	.747	.680	.808
C07	<---	TC	.770	.712	.818
C08	<---	TC	.735	.663	.789
C09	<---	TC	.774	.709	.831

*based on 1000 Bootstrap samples

Teachers' Receptivity to CAMC

There are six sub-constructs measuring teachers' receptivity to system-wide change that could influence the degree of implementation (DOI), in this study. These six teachers' perceptions offer pointers to educational administrators and policy makers on how best to encourage teachers to be more receptive to the changes in the implementation stage (Waugh & Godfrey, 1995). These sub-constructs were used and modified for the present study, as considered appropriate. The six sub-constructs are 'perceived cost benefit of CAMC (PCB)', 'practicality of CAMC in the classroom (Prac)', 'alleviation of fears and concerns (FC)', 'participation in decision making (PDM)', 'perceived improvements of CAMC compared with the previous system (PI)' and 'perceived support from senior teachers and principal (PS)'.

Perceived cost benefit of CAMC (PCB). In this study, 'perceived cost benefit' of CAMC to the teacher referred to a ratio of the amount of return against the amount of investment relating to the effects of the change for the teacher and the students, as perceived by the teacher. That is, the teacher will have a positive cost benefit if the work involved in implementing the change at the school level was perceived to provide benefits such as increased student learning and increased satisfaction with teaching, better matching of courses with student needs, interest and abilities and easier school administration.

There are 5 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.6. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.6

Descriptive Statistics for Items in Construct Perceived Cost Benefit of CAMC (PCB)

Item	Descriptive		Inter-item correlation					Factor Loading	
	M	*SD*	DA01	DA02	DA03	DA04	DA05	F1	F2
DA01	4.11	.511	1.000					.811	
DA02	3.86	.727	.405	1.000				.596	
DA03	4.15	.463	**.593**	**.424**	1.000			.890	
DA04	4.20	.473	.545	.344	**.726**	1.000		.854	
DA05	3.15	1.054	-.048	-.149	-.059	-.063	1.000		.972

M = Mean, SD= Standard Deviation

In Table 4.6, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item, except for DA05, did correlate adequately with at least one other items in the construct ($0.3<r<0.9$).

In the exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.748, which is considered to be very good. Two factors were extracted that explained 44.0% and 6.7% of the total variation in the 5 items.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.4) was not acceptable [χ^2/df = 3.162, TLI=0.852, CFI = 0.926, RMSEA= 0.066, AIC =35.8]. Guided by modification inAfter dropping DA05 (Figure 4.5), the model fitted better [χ^2/df = 1.493, TLI=0.979, CFI = 0.996, RMSEA= 0.032, AIC =19.5]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in

Table 4.7. The computed composite reliability (CR) is 0.812 and the variance extracted (VE) is 53.2%.

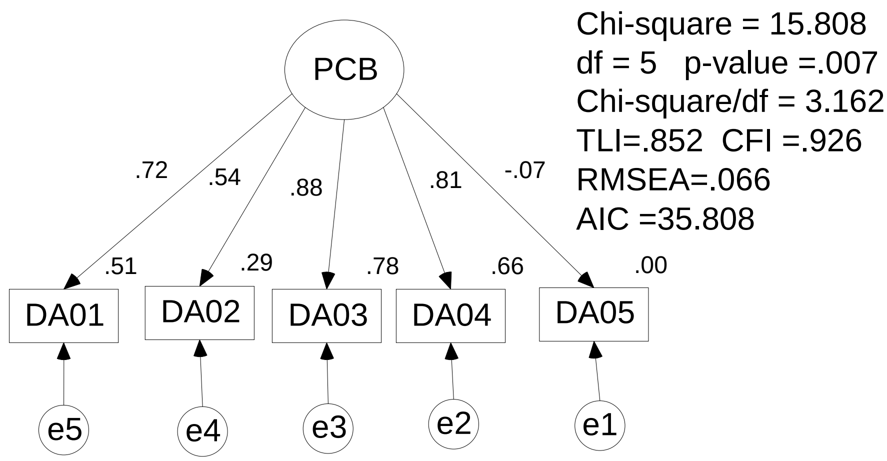

Figure 4.4. Single factor model for Perceived Cost Benefit of CAMC (PCB)

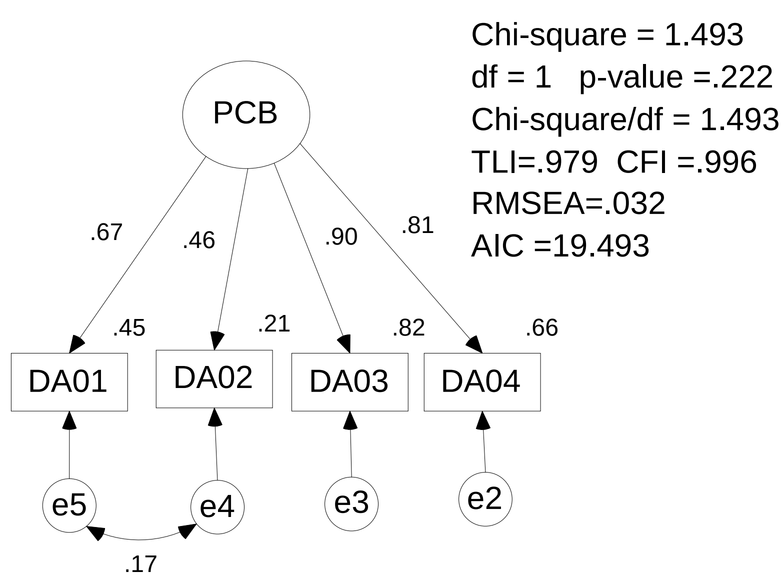

Figure 4.5. The final model for Perceived Cost Benefit of CAMC (PCB)

Table 4.7

Standardized Factor Loadings for Items in Perceived Cost Benefit of CAMC (PCB)

Parameter			Estimate	95% CI*	
				Lower	Upper
DA03	<---	PCB	.904	.859	.940
DA02	<---	PCB	.456	.376	.533
DA01	<---	PCB	.667	.606	.728
DA04	<---	PCB	.812	.748	.858

*based on 1000 Bootstrap samples

Practicality of CAMC in the classroom (Prac). In this study, ‘practicality of CAMC in the classroom’ was to measure the extent to which the teachers perceived the course outlines or syllabus, the assessment format and method to be practical in the classroom. There are 8 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.8. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.8

Descriptive Statistics for Items in Construct Practicality of CAMC in the Classroom (Prac)

Item	Descriptive		Inter-item correlation								Factor Loading
	M	*SD*	DB01	DB02	DB03	DB04	DB05	DB06	DB07	DB08	
DB01	3.99	.514	1.000								.625
DB02	3.96	.507	**.615**	1.000							.646
DB03	4.13	.427	.468	.474	1.000						.785
DB04	4.10	.447	.357	.447	.627	1.000					.706
DB05	4.15	.445	.440	**.476**	**.655**	**.641**	1.000				.809
DB06	4.12	.431	.454	.422	.641	.539	**.696**	1.000			.784
DB07	3.86	.688	.353	.322	.320	.322	.377	.403	1.000		.503
DB08	4.03	.599	.324	.339	.374	.308	.364	**.426**	**.410**	1.000	.513

M = Mean, SD= Standard Deviation

In Table 4.8, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item did correlate adequately with at least one other items in the construct ($0.3<r<0.9$).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.875, which is considered to be very good. A single factor was extracted that explained 46.3% of the total variation in the 8 items. The minimum factor loading value is 0.503.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.6) was not acceptable [χ^2/df = 9.072, TLI=0.866, CFI=0.924, RMSEA= 0.128, AIC =213.437].

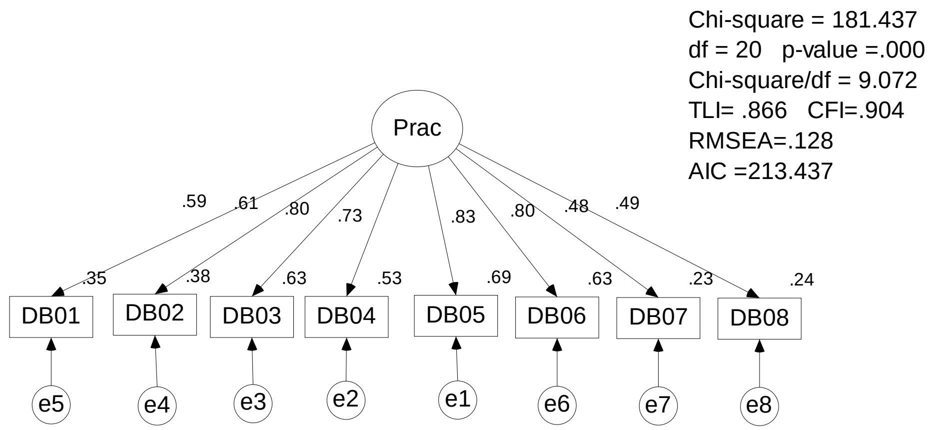

Figure 4.6. Single factor model for Practicality of CAMC in the Classroom (Prac)

Based on the factor score weights, Table 4.9, there were two distinct constructs within Practicality of CAMC in the Classroom (Prac):

Prac I: DB01, DB02, DB07 and DB08

Prac II: DB03, DB04, DB05 and DB06

Table 4.9

Factor Score Weights for Practicality of CAMC in the Classroom (Prac)

	DB08	DB07	**DB06**	DB01	DB02	**DB03**	**DB04**	**DB05**
Prac	.034	.028	**.156**	.055	.060	**.158**	**.106**	**.184**

The two factor model (Figure 4.7) was also not acceptable [χ^2/df = 5.013, TLI = 0.933, CFI = 0.955, RMSEA= 0.09, AIC =129.256].

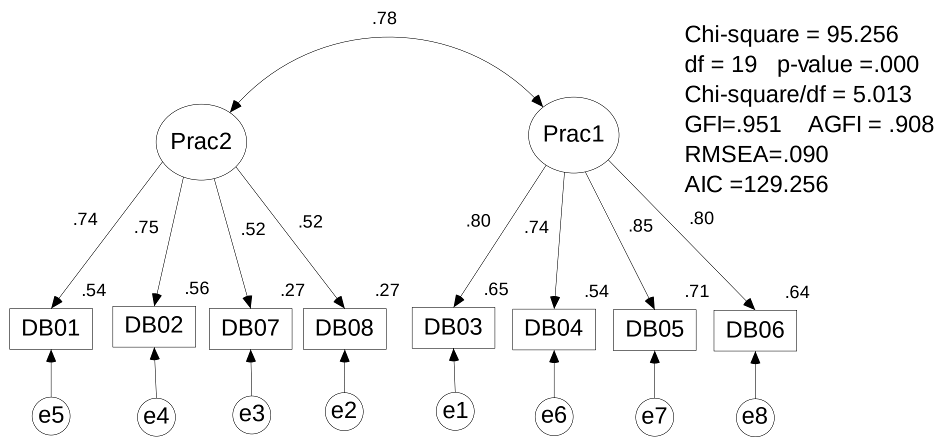

Figure 4.7. Two factor model for Practicality of CAMC in the classroom (Prac)

Guided by the modification indices, after dropping items DB01, DB06, DB08, the model (Figure 4.8) was found to be acceptable. [χ^2/df = 1.138, TLI=0.987, CFI=0.994, RMSEA= 0.017, AIC =25.69]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.10. The computed composite reliability (CR) is 0.827 and the variance extracted (VE) is 50.0%.

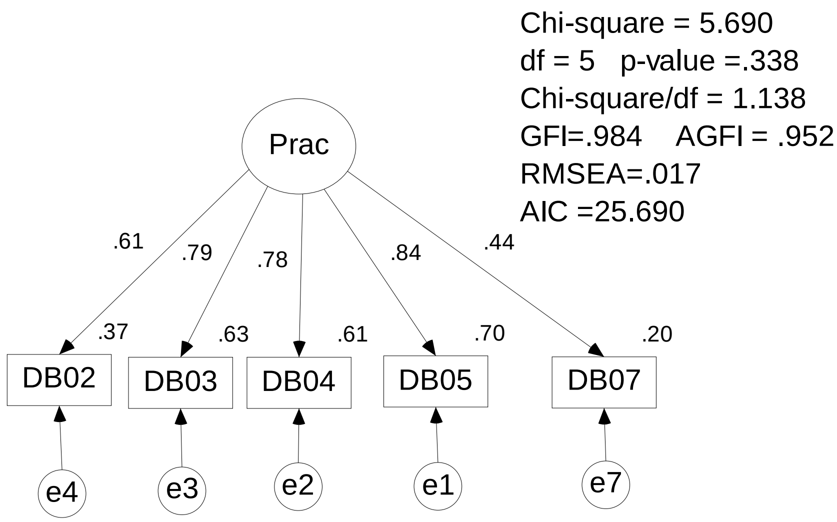

Figure 4.8. The final model for Practicality of CAMC in the classroom (Prac)

Table 4.10

Standardized Factor Loadings for Items in Practicality of CAMC in the Classroom (Prac)

Parameter			Estimate	95% CI*	
				Lower	Upper
DB02	<---	Prac	.608	.543	.671
DB07	<---	Prac	.444	.342	.513
DB05	<---	Prac	.837	.781	.877
DB04	<---	Prac	.778	.715	.824
DB03	<---	Prac	.793	.723	.842

*based on 1000 Bootstrap samples

Alleviation of Fears and Concerns (FC). 'Alleviation of fears and concerns' in this study referred to teachers raising their concerns about the plan and to have those concerns answered in order to ensure a faithful implementation of the School-based Assessment of Competency Assessment and Modular Certification (CAMC). There are 8 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.11. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.11

Descriptive Statistics for Items in Construct Alleviation of Fear and Concern (FC)

Item	Descriptive		Inter-item correlation						Factor Loading	
	M	*SD*	DC01	DC02	DC03	DC04	DC05	DC06	F1	F2
DC01	3.65	.869	1.000							.568
DC02	3.81	.748	.409	1.000					.614	
DC03	3.74	.670	.302	.336	1.000				.890	
DC04	3.63	.705	.293	.323	.749	1.000			.877	
DC05	3.57	.976	.232	.017	.106	.129	1.000			.884
DC06	3.61	.775	.468	.468	.426	.425	.146	1.000	.636	

M = Mean, SD= Standard Deviation

In Table 4.11, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item, except DC05, did correlate adequately with at least one other items in the construct ($0.3<r<0.9$).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.722, which is considered to be very good. Two factors were extracted that explained 45.6% and 17.2% of the total variation in the 6 items.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.9) was not acceptable [χ^2/df = 18.569, GFI=0.886, AGFI=0.734, RMSEA= 0.189, AIC =191.125].

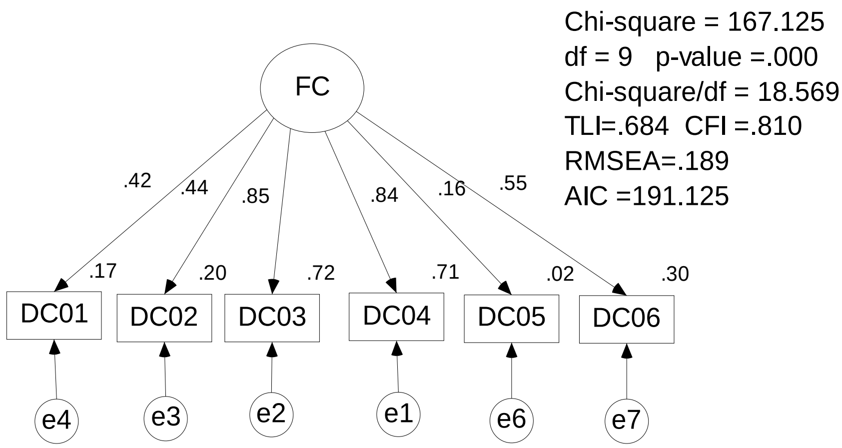

Figure 4.9. Single factor model for Alleviation of Fear and Concern (FC)

Based on the factor score weights, there were two distinct constructs within Alleviation of Fear and Concern (FC):

FC I: DC03, DC04

FC II: DC1, DC02, DC05 and DC06

Table 4.12

Factor Score Weights for Alleviation of Fear and Concern (FC)

	DC06	DC05	DC01	DC02	**DC03**	**DC04**
FC	.053	.009	.030	.038	**.237**	**.216**

The two factor model (Figure 4.10) was also not acceptable [χ^2/df = 3.925, TLI = 0.963, CFI = 0.9805, RMSEA= 0.065, AIC =50.388].

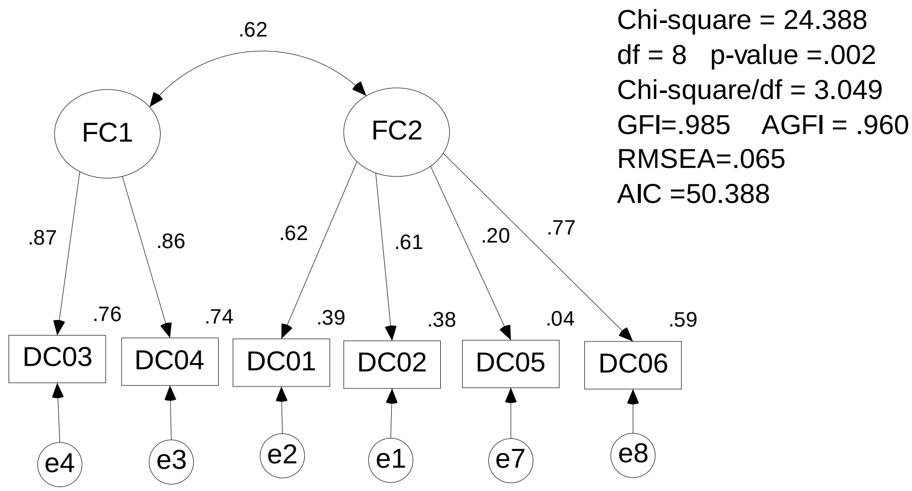

Figure 4.10. Two factor model for Alleviation of Fear and Concern (FC)

Guided by the modification indices, after dropping items DC01 and DC06, the model (Figure 4.11) was found to be acceptable. [χ^2/df = 1.296, TLI=0.987, CFI=0.998, RMSEA<0.001, AIC =17.296]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.13. The computed composite reliability (CR) is 0.683 and the variance extracted (VE) is 41.5%.

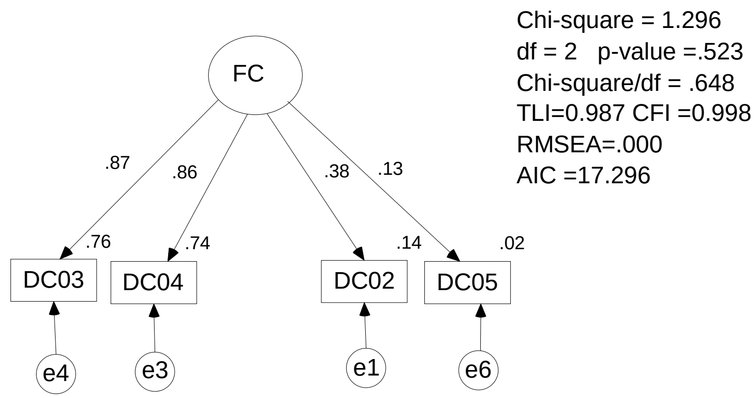

Figure 4.11. The final model for Alleviation of Fear and Concern (FC)

Table 4.13

Standardized Factor Loadings for Items in Alleviation of Fear and Concern (FC)

Parameter			Estimate	95% CI*	
				Lower	Upper
DC02	<---	FC	.380	.297	.466
DC03	<---	FC	.873	.789	.940
DC04	<---	FC	.858	.789	.925
DC05	<---	FC	.132	.040	.219

*based on 1000 Bootstrap samples

Participation in decision making (PDM). This dimension referred to teachers taking part in decisions about the change which affected their school and, in particular, the vocational subject that they taught. Teachers had a say in how they carried out the school-based assessment of CAMC in their classrooms. There are 7 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.14.

The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.14

Descriptive Statistics For Items In Construct Participation In Decision Making (PDM)

Item	Descriptive		Inter-item correlation							Factor Loading	
	M	*SD*	DD01	DD02	DD03	DD04	DD05	DD06	DD07	F1	F2
DD01	4.17	.503	1.000							.780	-.067
DD02	4.18	.428	**.612**	1.000						.907	.016
DD03	4.15	.414	.536	**.763**	1.000					.859	.048
DD04	3.47	1.064	.082	.202	.165	1.000				.083	.444
DD05	4.19	.439	.435	.676	**.638**	.276	1.000			.804	.037
DD06	3.77	.840	.240	.316	.332	.211	.275	1.000		.019	.911
DD07	3.72	.906	.184	.266	.286	**.302**	.225	**.819**	1.000	-.061	.962

M = Mean, SD= Standard Deviation

In Table 4.14, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, except item DD05, all the other item did correlate adequately with at least one other items in the construct (0.3<r<0.9).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.747, which is considered to be very good. Two factors were extracted that explained 47.8% and 20.8% of the total variation in the 7 items.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.12) was not acceptable [χ^2/df = 39.599, TLI=0.516, CFI = 0.677, RMSEA= 0.280, AIC =582.391].

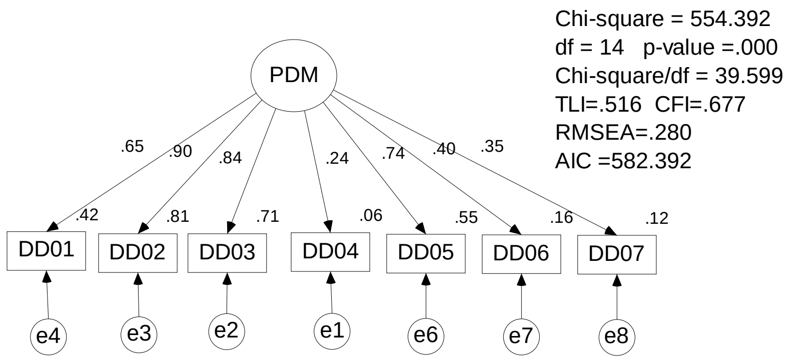

Figure 4.12 . The final model for Participation in Decision Making (PDM)

Based on the factor score weights (Table 4.15), there were two distinct constructs within Participation in decision making (PDM):

PDM I: DC04, DD06 and DD07

PDM II: DD01, DD02, DD03 and DC05

Table 4.15

Factor Score Weights for Participation in Decision Making (PDM)

	DD07	DD06	**DD05**	**DD01**	**DD02**	**DD03**	DD04
PDM	.014	.018	**.118**	**.068**	**.353**	**.220**	.008

The two factor model (Figure 4.13) was also not acceptable [χ^2/df = 4.290, TLI=0.959, CFI=0.974, RMSEA = 0.082, AIC =85.774].

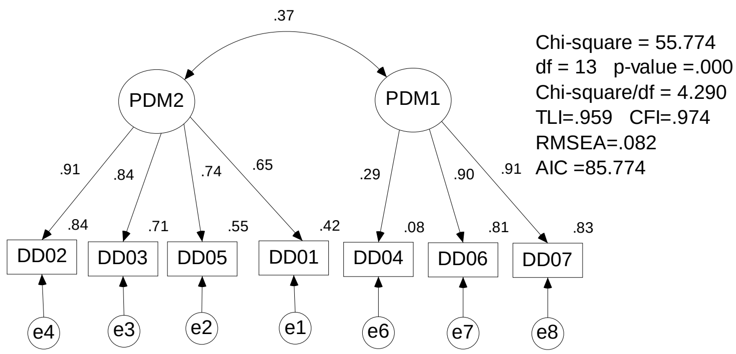

Figure 4.13. Two factor model for Participation in Decision Making (PDM)

Guided by the modification indices, after dropping items DD04, DD06 and DD07, the model (Figure 4.14) was found to be acceptable. [χ^2/df = 1.880, TLI=0.9995, CFI=0.999, RMSEA=0.042, AIC =19.880]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 12. The computed composite reliability (CR) is 0.871 and the variance extracted (VE) is 63.2%.

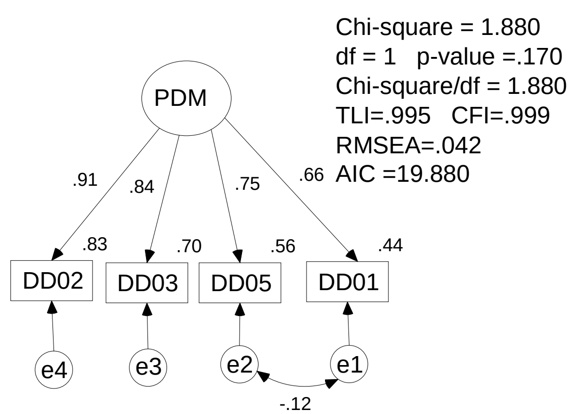

Figure 4.14. The final model for Participation in Decision Making (PDM)

Table 4.16

Standardized Factor Loadings For Items In Participation In Decision Making (PDM)

Parameter			Estimate	95% CI*	
				Lower	Upper
DD01	<---	PDM	.661	.558	.734
DD02	<---	PDM	.913	.876	.946
DD03	<---	PDM	.836	.777	.879
DD05	<---	PDM	.747	.669	.805

*based on 1000 Bootstrap samples

Perceived improvements of CAMC compared with the previous system. 'Perceived Improvements of CAMC compared with the previous system', in this study, referred to teachers' attitudes to the new system which focused on demonstrated improvements, and teachers' perceptions towards the school-based assessment of CAMC as compared to the previous assessment system. There are 6 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.17. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.17

Descriptive Statistics For Items In Construct Perceived Improvement Of CAMC (PI)

Item	Descriptive		Inter-item correlation						Factor Loading
	M	*SD*	DE01	DE02	DE03	DE04	DE05	DE06	
DE01	4.06	.515	1.000						0.825
DE02	4.07	.474	**.808**	1.000					0.848
DE03	3.92	.582	.524	.566	1.000				0.672
DE04	4.01	.506	.583	.582	.582	1.000			0.757
DE05	4.06	.452	.694	**.693**	**.589**	**.700**	1.000		0.875
DE06	4.13	.468	.552	.591	.427	.528	**.657**	1.000	0.695

M = Mean, SD= Standard Deviation

In Table 4.17, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item, did correlate adequately with at least one other items in the construct (0.3<r<0.9).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.873, which is considered to be very good. A single factor was extracted that explained 61.2% of the total variation in the 6 items. The minimum factor loading value is 0.672.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.15) was not acceptable [χ^2/df = 14.438, TLI=0.890, CFI=0.934, RMSEA= 0.165, AIC =153.941].

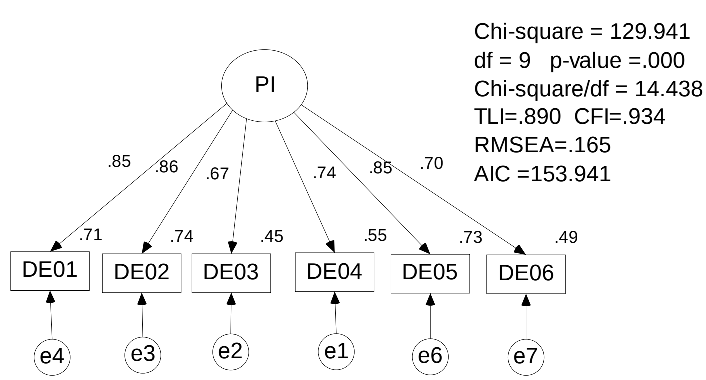

Figure 4.15. Single factor model for Perceived Improvement of CAMC (PI)

Guided by the modification indices, after dropping items DE01 and DE03, the model (Figure 4.16) was found to be acceptable. [χ^2/df = 2.462, TLI=0.991, CFI=0.997, RMSEA = 0.055, AIC =20.924]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.18. The computed composite reliability (CR) is 0.872 and the variance extracted (VE) is 63.2%.

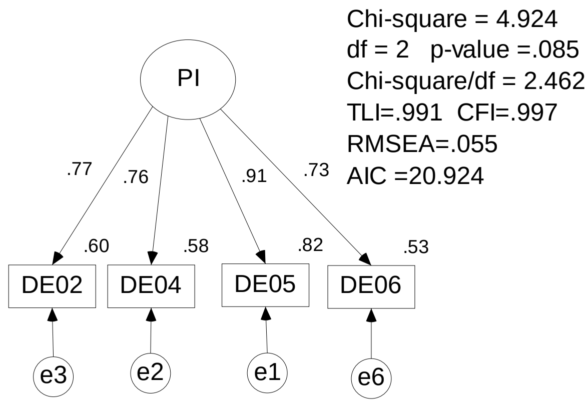

Figure 4.16. Final model for Perceived Improvement of CAMC (PI)

Table 4.18

Standardized Factor Loadings for Items in Perceived Improvement of CAMC (PI)

Parameter			Estimate	95% CI*	
				Lower	Upper
DE02	<---	PI	.772	.709	.822
DE04	<---	PI	.761	.684	.823
DE05	<---	PI	.908	.871	.940
DE06	<---	PI	.727	.662	.788

*based on 1000 Bootstrap samples

Perceived support from senior teachers and principal. 'Perceived support from senior teachers and principal', in this study, referred to teachers' perceptions of their principal and senior staff support for the school-based assessment of CAMC in their communications and actions at the school. There are 5 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.19. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.19

Descriptive Statistics for Items in Construct Perceived Support from Senior Teachers and Principal (PS)

Item	Descriptive		Inter-item correlation					Factor Loading
	M	*SD*	DF01	DF02	DF03	DF04	DF05	
DF01	3.65	.820	1.000					.652
DF02	3.48	.894	**.482**	1.000				.827
DF03	3.69	.757	.378	**.645**	1.000			.821
DF04	3.84	.674	.295	.490	**.508**	1.000		.740
DF05	4.11	.554	.231	.233	.311	**.330**	1.000	.525

M = Mean, SD= Standard Deviation

In Table 4.19, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item, did correlate adequately with at least one other items in the construct (0.3<r<0.9).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.766, which is considered to be very good. A single factor was extracted that explained 52.1% of the total variation in the 5 items. The minimum factor loading value is 0.525.

In CFA, a single factor model (Figure 4.17) was not acceptable [χ^2/df = 6.032, TLI=0.992, CFI=0.961, RMSEA= 0.101, AIC =50.159].

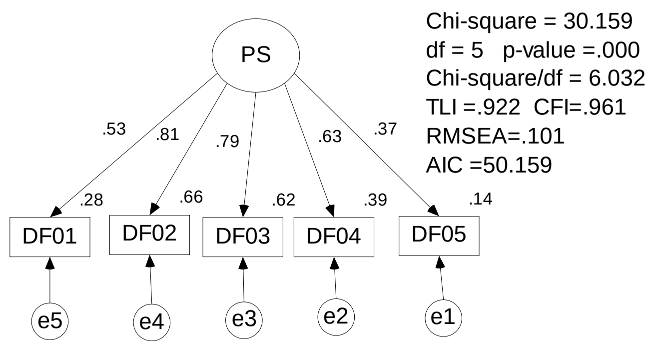

Figure 4.17. Single factor model for Perceived Support from senior teachers and principal (PS)

Guided by the modification indices, after dropping item DF05, the model (Figure 4.18) was found to be acceptable. [χ^2/df = 0.053, TLI=0.998, CFI=0.999, RMSEA <0.001, AIC =18.053]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.20. The computed composite reliability (CR) is 0.775 and the variance extracted (VE) is 43.3%.

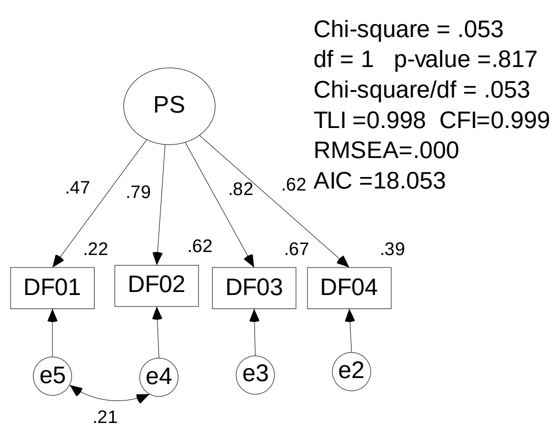

Figure 4.18. Final model for Perceived Support from senior teachers and principal (PS)

Table 4.20

Standardized Factor Loadings for Items in Perceived Support from Senior Teachers and Principal (PS)

Parameter			Estimate	95% CI*	
				Lower	Upper
DF01	<---	PS	.465	.369	.550
DF02	<---	PS	.789	.720	.850
DF03	<---	PS	.817	.748	.874
DF04	<---	PS	.622	.531	.691

*based on 1000 Bootstrap samples

Degree of Implementation

The 'Degree of Implementation' referred to the degree to which teachers implemented the school-based assessment of Competency Assessment and Modular Certification (CAMC) of vocational subjects in secondary schools, as intended by the Ministry of Education (MOE). A total of five dimensions were found to be necessary and sufficient for conceptualization of the construct to measure the degree of implementation (Cheung et al., 1996). They are 'logistics arrangement', 'use of assessment activities', 'quality relationship between assessment, teaching and learning', 'knowledge of the characteristics of the assessment scheme' and 'attitude towards school-based assessment'.

Logistics arrangement (LA). This construct focused on the organizational structure in the local setting as well as teachers' access to information and technical support to implement the school-based assessment of CAMC. There are 11 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.21. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.21

Descriptive Statistics for Items in Construct Logistics Arrangement (LA)

Item	Descriptive		Inter-item correlation											Factor Loading		
	M	*SD*	EA01	EA02	EA03	EA04	EA05	EA06	EA07	EA08	EA09	EA10	EA11	F1	F2	F3
EA01	3.31	1.074	1.000											-.008	.086	**.818**
EA02	3.49	.987	**.585**	1.000										.027	.029	**.699**
EA03	3.72	.860	.105	.038	1.000									-.087	.159	.080
EA04	3.22	1.057	.084	-.059	.246	1.000								-.084	.221	.011
EA05	4.23	.438	.113	.073	.074	.111	1.000							.396	**.598**	-.027
EA06	4.22	.474	.089	.109	.013	.076	**.822**	1.000						.372	**.619**	-.027
EA07	4.24	.464	.143	.107	.048	.102	.746	**.779**	1.000					**.493**	.462	.029
EA08	4.17	.516	.118	.117	.048	.109	.663	.656	.664	1.000				**.501**	.342	.038
EA09	4.22	.504	.060	.061	.029	.050	.656	.636	**.666**	**.634**	1.000			**.889**	-.024	-.013
EA10	4.16	.465	.066	.054	-.018	.008	.595	.579	.633	.574	.780	1.000		**1.047**	-.247	.007
EA11	4.17	.482	.056	.042	.016	.037	.606	.579	.640	.606	**.830**	**.887**	1.000	**1.111**	-.285	-.004

M = Mean, SD= Standard Deviation

In Table 4.21, the mean values for all the items are more than 3, indicating high level of overall agreement. Based on the correlation coefficients, each item, except EA02, EA03, and EA04, did correlate adequately with at least one other items in the construct (0.3<r<0.9). The correlation between EA10 and EA11 is high.

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.861, which is considered to be very good. Three factors were extracted that explained 44.5%, 10.8% and 5.7% of the total variation in the 11 items.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.19) was not acceptable [χ^2/df = 20.060, TLI=0.694, CFI=0.755, RMSEA= 0.197, AIC =926.636].

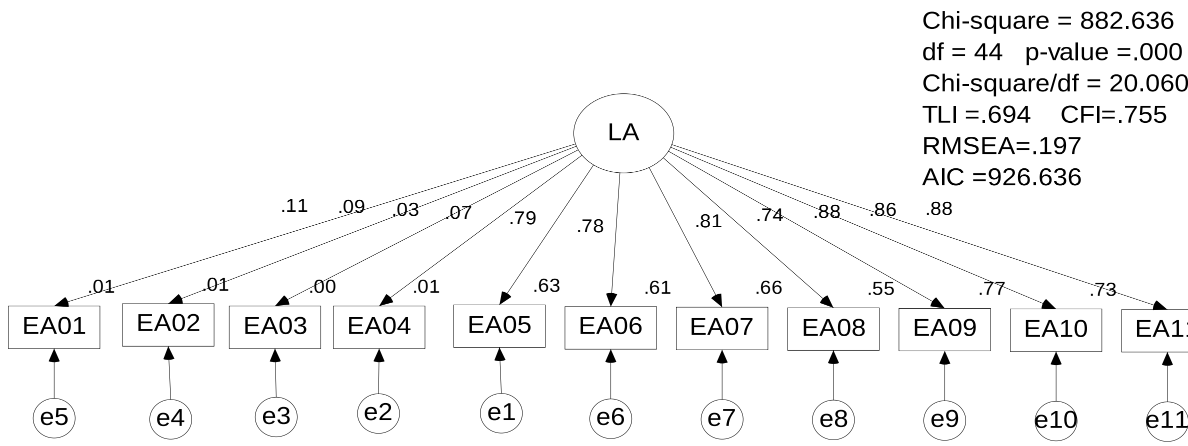

Figure 4.19. Single factor model for Logistics arrangement (LA)

Based on the factor score weights (Table 4.22), there were two distinct constructs within Logistics arrangement (LA):

LA I: EA01, EA02, EA03 and EA04

LA II: EA05, EA06, EA07, EA08, EA09, EA10 and EA11

Table 4.22

Factor Score Weights for Logistics Arrangement (LA)

	EA11	EA10	EA09	EA08	EA07	EA06	**EA01**	**EA02**	**EA03**	**EA04**	EA05
LA	.053	.046	.050	.022	.034	.029	**.001**	**.001**	**.000**	**.000**	.033

The two factor model (Figure 4.20) was also not acceptable [χ^2/df = 15.653, TLI=0.765, CFI=0.816, RMSEA = 0.173, AIC =719.059].

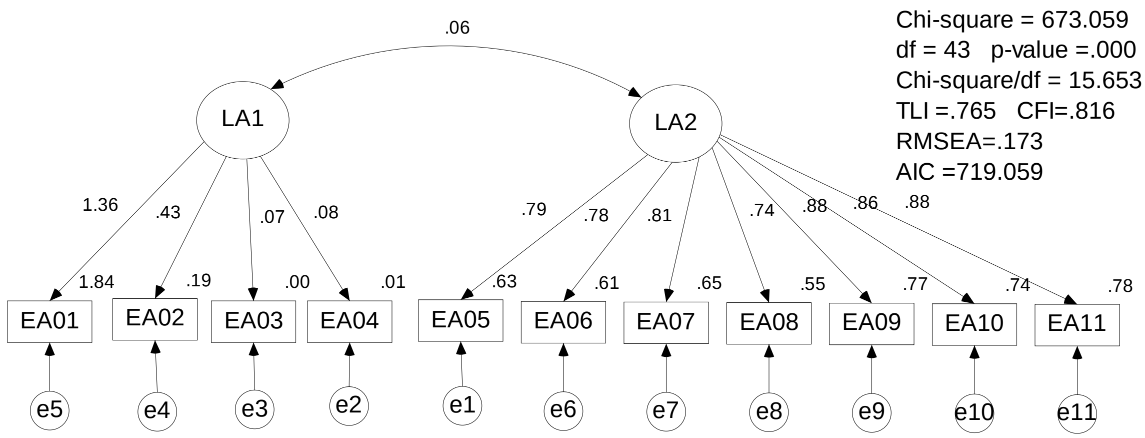

Figure 4.20. Two factor model for Logistics arrangement (LA)

Guided by the modification indices, after dropping all items except for EA09, EA10 and EA11, the model (Figure 4.21) was found to be acceptable. [χ^2/df = 0.190, TLI=0.999, CFI=0.999, RMSEA< 0.001, AIC =10.19]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.23. The computed composite reliability (CR) is 0.938 and the variance extracted (VE) is 83.5%.

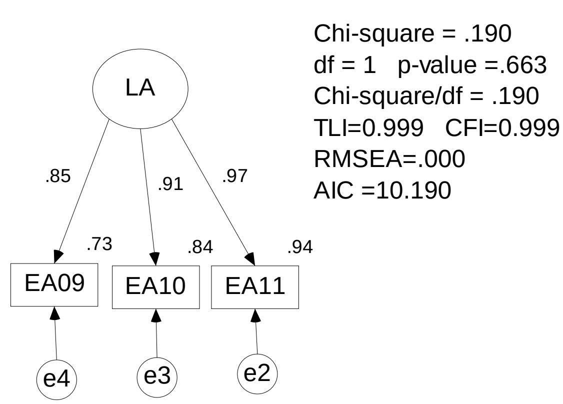

Figure 4.21. The final model for Logistics arrangement (LA)

Table 4.23

Standardized Factor Loadings for Items in Logistics Arrangement (LA)

Parameter			Estimate	95% CI*	
				Lower	Upper
EA09	<---	LA	.852	.802	.891
EA10	<---	LA	.914	.881	.941
EA11	<---	LA	.972	.944	.991

*based on 1000 Bootstrap samples

Use of assessment activities (UAA). ‘Use of assessment activities’ referred to the degree to which the teacher used assessment methods and grading strategies, as well as students’ participation in the school-based assessment of CAMC. There are 5 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.24. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.24

Descriptive Statistics for Items in Construct Use of Assessment Activities (UAA)

Item	Descriptive		Inter-item correlation					Factor Loading
	M	*SD*	EB01	EB02	EB03	EB04	EB05	
EB01	4.28	.457	1.000					.916
EB02	4.26	.446	**.917**	1.000				.955
EB03	4.25	.444	.887	**.918**	1.000			.950
EB04	4.13	.599	.578	.627	.640	1.000		.689
EB05	4.23	.441	.769	.795	**.804**	**.700**	1.000	.866

M = Mean, SD= Standard Deviation

In Table 4.24, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, items EB01, EB02 and EB03, showed a very high level of association (r>0.9).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.876, which is considered to be very good. A single factor was extracted that explained 77.5% of the total variation in the 5 items. The minimum factor loading value is 0.689.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.22) was not acceptable [χ^2/df = 5.475, TLI=0.880, CFI=0.940, RMSEA= 0.095 AIC =47.373].

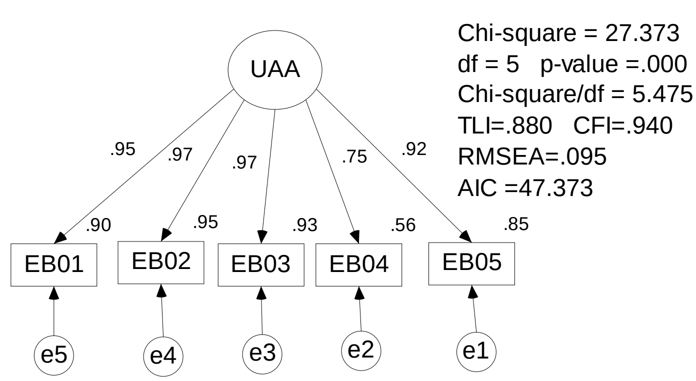

Figure 4.22. Single factor model for Use of assessment activities (UAA)

Guided by the modification indices, after dropping items EB04 the model (Figure 4.23) was found to be acceptable. [χ^2/df = 0.865, TLI=0.999, CFI =0.999, RMSEA < 0.001, AIC =17.729]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.25. The computed composite reliability (CR) is 0.960 and the variance extracted (VE) is 85.7%.

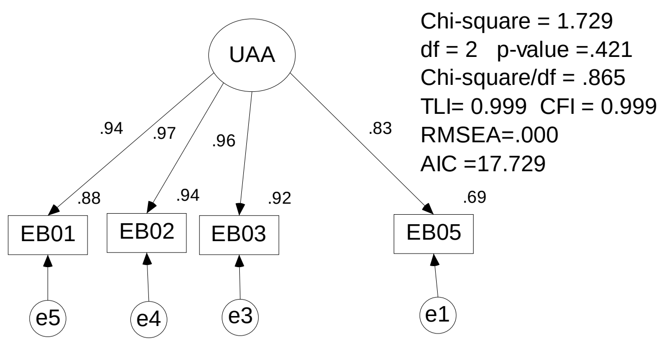

Figure 4.23. The final model for Use of assessment activities (UAA)

Table 4.25

Standardized Factor Loadings for items in Use of assessment activities (UAA)

Parameter			Estimate	95% CI*	
				Lower	Upper
EB01	<---	UAA	.938	.905	.959
EB02	<---	UAA	.970	.947	.982
EB03	<---	UAA	.958	.929	.976
EB05	<---	UAA	.830	.777	.878

*based on 1000 Bootstrap samples

Quality relationship of assessment, teaching and learning (QrATL). 'Quality relationship of assessment, teaching and learning' in this study referred to how teachers implemented school-based assessment during the normal teaching and learning process, according to curriculum developers' conceptions and ideologies. There are 7 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.26. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.26

Descriptive Statistics for Items in Construct Quality Relationship of Assessment, Teaching and Learning (QrATL)

Item	Descriptive		Inter-item correlation							Factor Loading
	M	*SD*	EC01	EC02	EC03	EC04	EC05	EC06	EC07	
EC01	4.24	.442	1.000							.840
EC02	4.13	.572	.595	1.000						.663
EC03	4.23	.486	**.711**	**.596**	1.000					.818
EC04	3.14	1.018	.113	.107	.122	1.000				.143
EC05	4.15	.394	.635	.489	.627	.140	1.000			.790
EC06	4.19	.421	.696	.524	**.691**	.097	**.758**	1.000		.869
EC07	4.24	.470	.655	.502	.596	.104	.602	**.702**	1.000	.769

M = Mean, SD= Standard Deviation

In Table 4.26, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item, except EC04, did correlate adequately with at least one other items in the construct (0.3<r<0.9).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.898, which is considered to be very good. A single factor was extracted that explained 59.5% of the total variation in the 7 items. The minimum factor loading is 0.143.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.24) was not acceptable [χ^2/df = 5.307, TLI=0.952, CFI=0.968, RMSEA= 0.094, AIC =102.293]. The factor loading for EC04 was very low.

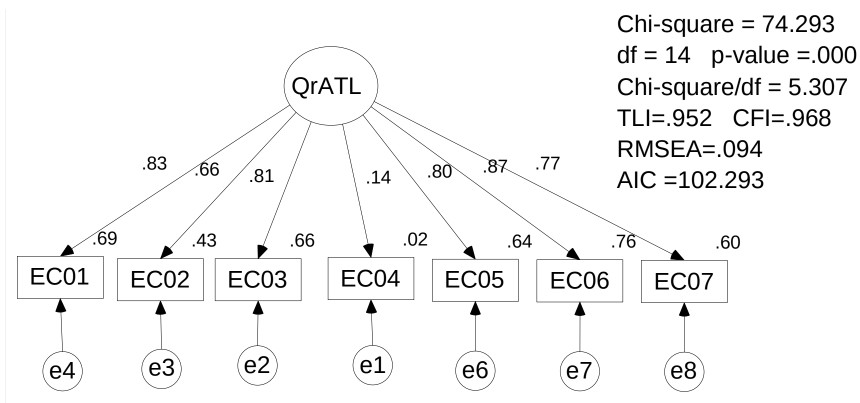

Figure 4.24. Single factor model for Quality relationship of assessment, teaching and learning (QrATL)

After dropping EC04 and correcting for the error terms, a single factor model (Figure 4.25) was found to be acceptable [χ^2/df = 2.257, TLI=0.990, CFI=0.995, RMSEA= 0.051, AIC =43.7983]. The factor loading for EC04 was very low. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.27. The computed composite reliability (CR) is 0.905 and the variance extracted (VE) is 61.6%.

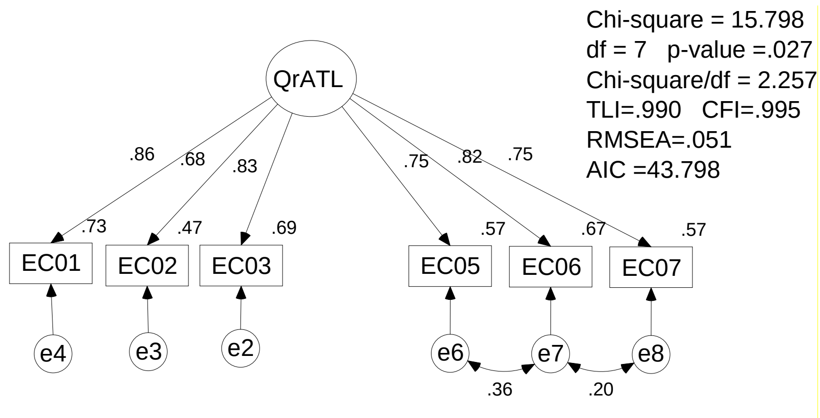

Figure 4.25. Final model for Quality relationship of assessment, teaching and learning (QrATL)

Table 4.27

Standardized Factor Loadings for Items in Quality Relationship of Assessment, Teaching and Learning (QrATL)

Parameter	Estimate	95% CI*	
		Lower	Upper
EC01 <--- QrATL	.857	.790	.904
EC02 <--- QrATL	.683	.575	.762
EC03 <--- QrATL	.833	.782	.878
EC05 <--- QrATL	.752	.693	.805
EC06 <--- QrATL	.819	.767	.862
EC07 <--- QrATL	.752	.696	.802

*based on 1000 Bootstrap samples

Knowledge of the characteristics of the assessment scheme (KCA). This study referred to 'Knowledge of the characteristics of the assessment scheme' of CAMC among the vocational subjects teachers as to whether teachers understood the requirements and philosophy of a given school-based assessment scheme. This included the question of whether they had adequate skills to carry out the new educational reform, felt positive about a program, valued what it contributed to the educational setting and were committed to its goals. There are 8 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.28. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.28

Descriptive Statistics for Items in Construct Knowledge of the Characteristics of the Assessment Scheme (KCA)

Item	Descriptive		Inter-item correlation								Factor Loading
	M	*SD*	ED01	ED02	ED03	ED04	ED05	ED06	ED07	ED08	
ED01	4.18	.404	1.000								.906
ED02	4.16	.412	**.885**	1.000							.904
ED03	4.05	.540	.654	.671	1.000						.737
ED04	4.15	.431	.765	.784	.644	1.000					.860
ED05	4.14	.420	.802	**.761**	**.657**	**.804**	1.000				.879
ED06	4.16	.435	.721	.741	.639	.707	**.773**	1.000			.855
ED07	4.06	.524	.561	.535	.476	.533	.506	**.599**	1.000		.625
ED08	4.34	.504	.580	.572	.417	.509	.527	.592	**.404**	1.000	.625

M = Mean, SD= Standard Deviation

In Table 4.28, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item did correlate adequately with at least one other items in the construct (0.3<r<0.9).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.908, which is considered to be very good. A single factor was extracted that explained 65.7% of the total variation in the 8 items. The minimum factor loading value is 0.625.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.26) was not acceptable [χ^2/df = 5.524, TLI=0.956, CFI=0.969, RMSEA= 0.096, AIC =142.48].

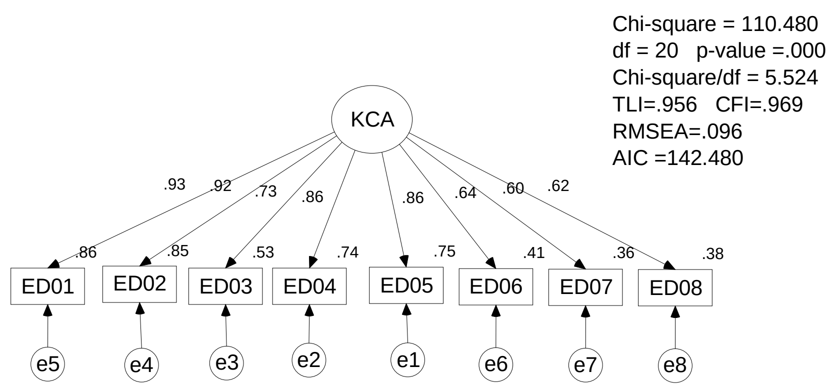

Figure 4.26. Single factor model for Knowledge of the characteristics of the assessment scheme (KCA)

Guided by the modification indices, after dropping items ED01 and Ed02, the model (Figure 4.27) was found to be acceptable. [χ^2/df = 1.716, TLI=0.992, CFI =0.995, RMSEA =0.038, AIC =39.448]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.29. The computed composite reliability (CR) is 0.873 and the variance extracted (VE) is 54.2%.

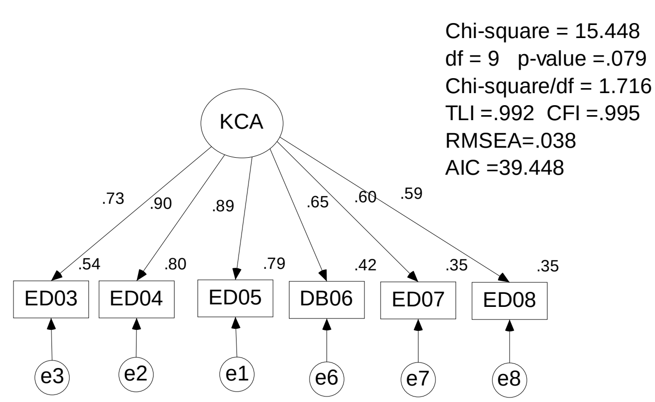

Figure 4.27. The final model for Knowledge of the characteristics of the assessment scheme (KCA)

Table 4.29

Standardized Factor Loadings for Items in Knowledge of the Characteristics of the Assessment Scheme (KCA)

Parameter	Estimate	95% CI*	
		Lower	Upper
ED03 <--- KCA	.733	.669	.775
ED04 <--- KCA	.897	.856	.926
ED05 <--- KCA	.890	.848	.921
ED06 <--- KCA	.647	.582	.711
ED07 <--- KCA	.595	.527	.672
ED08 <--- KCA	.588	.525	.643

*based on 1000 Bootstrap samples

Attitude towards school-based assessment (ATSBA). The ‘attitude towards school-based assessment’ concerned teachers’ opinions about the school-based assessment of CAMC they were carrying out in schools. There are 8 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.30. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.30

Descriptive Statistics for Items in Construct Attitude towards School-Based Assessment (ATSBA)

Item	Descriptive		Inter-item correlation					Factor Loading
	M	*SD*	EF01	EF02	EF03	EF04	EF05	
EE01	3.93	.538	1.000					.636
EE02	4.17	.443	**.510**	1.000				.912
EE03	4.17	.435	.494	**.815**	1.000			.915
EE04	4.21	.452	.413	.787	**.799**	1.000		.902
EE05	4.14	.480	.463	.742	.754	**.789**	1.000	.887

M = Mean, SD= Standard Deviation

In Table 4.30, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item did correlate adequately with at least one other items in the construct ($0.3<r<0.9$).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.874, which is considered to be very good. A single factor was extracted that explained 73.5% of the total variation in the 5 items. The minimum factor loading value is 0.636.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.28) was not acceptable [χ^2/df = 3.913, TLI=0.853, CFI=0.926, RMSEA= 0.077, AIC =39.563]. The factor loading for EF01 was relatively low.

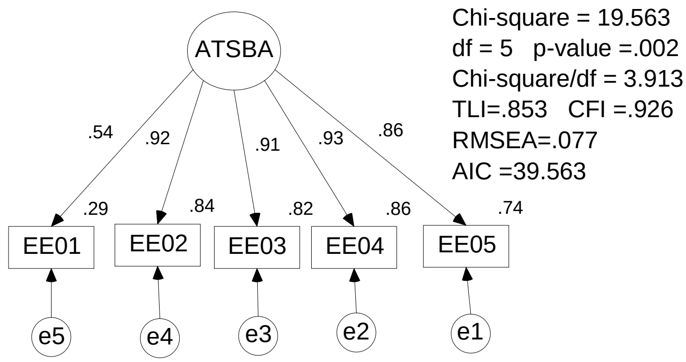

Figure 4.28. Single factor model for Attitude towards School-Based Assessment (ATSBA)

After dropping EF01, a better fit (Figure 4.29) was [χ^2/df = 1.744, TLI=0.975, CFI=0.992, RMSEA= 0.039, AIC =19.487]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.31. The computed composite reliability (CR) is 0.937 and the variance extracted (VE) is 78.7%.

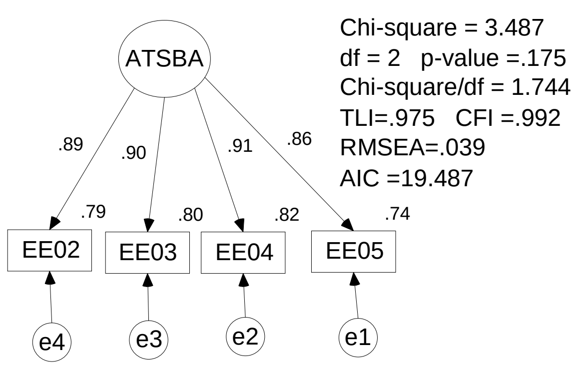

Figure 4.29. The final model for Attitude towards School-Based Assessment (ATSBA)

Table 4.31

Standardized Factor Loadings for Items in Attitude towards School-Based Assessment (ATSBA)

Parameter	Estimate	95% CI*	
		Lower	Upper
EE02 <--- ATSBA	.886	.841	.922
EE03 <--- ATSBA	.895	.834	.931
EE04 <--- ATSBA	.907	.868	.935
EE05 <--- ATSBA	.860	.811	.903

*based on 1000 Bootstrap samples

Quality Assurance Measures

The quality assurance measures in this study refers to the 'monitoring' and the 'moderation' measures in the conceptual framework of Competency Assessment and Modular Certification (CAMC), developed by the Malaysian Examination Syndicate (MES), Ministry of Education.

Monitoring. Monitoring' refers to the monitoring measures taken by the Ministry of Education as part of the quality assurance strategies in the implementation of school-based assessment of CAMC. There are 6 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.32. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.32

Descriptive Statistics for Items in Construct Monitoring

Item	Descriptive		Inter-item correlation						Factor Loading
	M	*SD*	FA01	FA02	FA03	FA04	FA05	FA06	
FA01	4.24	.802	1.000						.258
FA02	3.40	1.222	.277	1.000					.732
FA03	3.47	1.127	.205	**.670**	1.000				.741
FA04	3.05	1.259	.077	.485	**.542**	1.000			.728
FA05	2.85	1.363	.190	.508	.479	**.563**	1.000		.740
FA06	3.38	1.177	.163	.340	.362	.509	**.540**	1.000	.597

M = Mean, SD= Standard Deviation

In Table 4.32, the mean values for all items, except FA05, are more than 3, indicating generally a high level of agreement. Based on the correlation coefficients, each item, except for FA01, did correlate adequately with at least one other items in the construct (0.3<r<0.9).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.801, which is considered to be very good. A single factor was extracted that explained 43.1% of the total variation in the 6 items. The minimum factor loading value is 0.258.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.30) was not acceptable [χ^2/df = 13.557, TLI=0.808, CFI=0.885, RMSEA= 0.160, AIC =146.012].

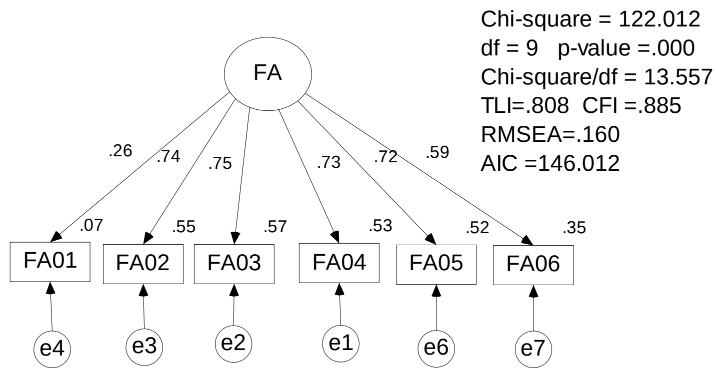

Figure 4.30. Single factor model for Monitoring

Guided by the modification indices, after dropping items FA01, FA02 and FA03, the model (Figure 4.31) was found to be acceptable. [χ^2/df = 1.828, TLI=0.994, CFI =0.998, RMSEA =0.041, AIC =11.828]. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.33. The computed composite reliability (CR) is 0.778 the variance extracted (VE) is 53.9%

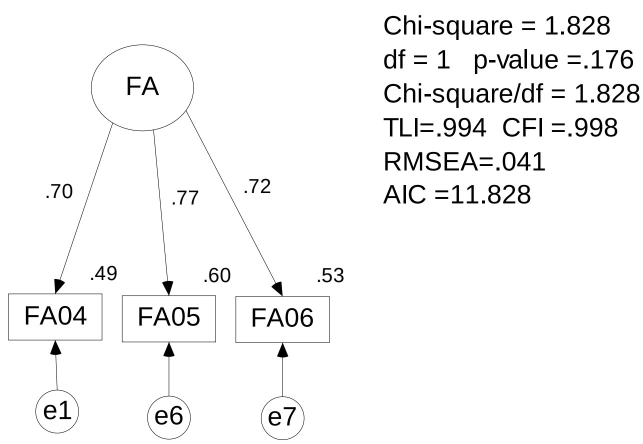

Figure 4.31. The final model for Monitoring

Table 4.33

Standardized Factor Loadings For Items In Monitoring

Parameter	Estimate	95% CI*	
		Lower	Upper
FA04 <--- FA	.729	.653	.795
FA05 <--- FA	.773	.697	.838
FA06 <--- FA	.699	.640	.755

*based on 1000 Bootstrap samples

Moderation. In this study, moderation refers to the internal and external moderation done by personnel appointed by the Malaysia Examination Syndicate, as part of the quality assurance strategies in the implementation of school-based assessment of CAMC. There are 5 items in this construct (refer to questionnaire). The descriptive statistics, inter-item correlations and the factor loadings based on exploratory factor analysis (EFA) are shown in Table 4.34. The highest correlation value of an item with any other item in the construct is shown in bold.

Table 4.34

Descriptive Statistics for Items in Construct Moderation

Item	Descriptive		Inter-item correlation					Factor Loading
	M	*SD*	FB01	FB02	FB03	FB04	FB05	
FB01	4.16	.924	1.000					.276
FB02	3.36	1.303	.178	1.000				.759
FB03	3.66	1.032	.234	.535	1.000			.695
FB04	3.38	1.298	.198	.536	**.538**	1.000		.743
FB05	3.34	1.288	.212	**.618**	.493	**.585**	1.000	.773

M = Mean, SD= Standard Deviation

In Table 4.34, the mean values for all the items are more than 3, indicating a high level of overall agreement. Based on the correlation coefficients, each item, except for FB01, did correlate adequately with at least one other items in the construct ($0.3<r<0.9$).

In exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin (KMO) value was 0.809, which is considered to be very good. A single factor was extracted that explained 45.7% of the total variation in the 5 items. The minimum factor loading value is 0.276.

In confirmatory factor analysis (CFA), a single factor model (Figure 4.32) was found to be acceptable [χ^2/df = 2.896, TLI=0.975, CFI=0.987, RMSEA=0.062, AIC =34.479. However, the factor loading for FB01 was very low.

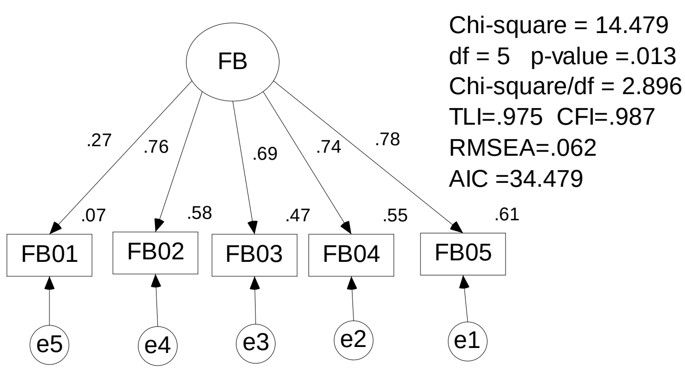

Figure 4.32. Single factor model for Moderation

After dropping FB01 and correcting for the error terms, the model (Figure 4.33) fitted even better [χ^2/df = 0.639, TLI=0.998, CFI=0.999, RMSEA< 0.001, AIC =18.639. The standardized factor loadings and 95% confidence interval based on 1000 bootstrap samples are given in Table 4.35. The computed composite reliability (CR) is 0.778 and the variance extracted (VE) is 53.9%.

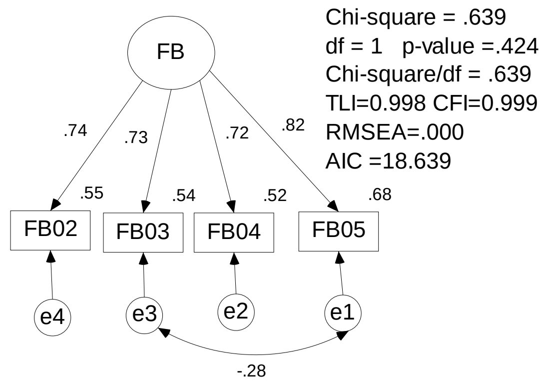

Figure 4.33. The final model for Moderation

Table 4.35

Standardized Factor Loadings for Items in Moderation

Parameter			Estimate	95% CI*	
				Lower	Upper
FB02	<---	FB	.743	.673	.803
FB03	<---	FB	.732	.650	.804
FB04	<---	FB	.720	.659	.783
FB05	<---	FB	.822	.755	.885

*based on 1000 Bootstrap samples

The Measurement Model

The measurement model for all latent variables was estimated using the maximum likelihood method, before the full structural model was estimated. This was done because (a) the structural portion of a full structural equation model involved relations only among latent variables, and (b) the primary concern in working with a full model was to assess the extent to which these relations were valid. It was critical that the measurement of each latent variable was psychometrically sound (Byrne, 2001). Thus an important preliminary step in the analysis of a full latent variable model was to first test for the validity of the measurement model before attempting to evaluate the structural model. Accordingly, the confirmatory factor analysis (CFA) procedures were used in testing the validity of the latent variables. Once it was known that the measurement model fit adequately, confidence increased in the findings related to the assessment of the hypothesized structural model.

There are a total of four latent variables to be tested in the proposed model of this study. They are: 'Teachers' Conceptions of CAMC (TC)', 'Teachers' Receptivity to CAMC (TR)', 'Degree of Implementation of CAMC (DOI)' and 'Quality Assurance Measures of CAMC (QA)'. These are represented by fourteen sub-constructs whose testing by both the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA) have been described in the previous section. This section describes the testing of the measurement models for the four latent variables and finally, the evaluation of the entire measurement model.

Teachers' Conceptions of CAMC (TC)

'Teachers' Conceptions of CAMC' is a measure of teachers' beliefs, meanings, concepts, rules and preferences to school-based assessment of CAMC. It is measured through seven indicators or observed variables i.e. C02, C04, C05. C06, C07, C08 and C09. Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were previously conducted and a single factor model was found to be reasonable [χ^2/df = 4.226, TLI=0.954, CFI=0.969, RMSEA= 0.081, AIC =87.164].

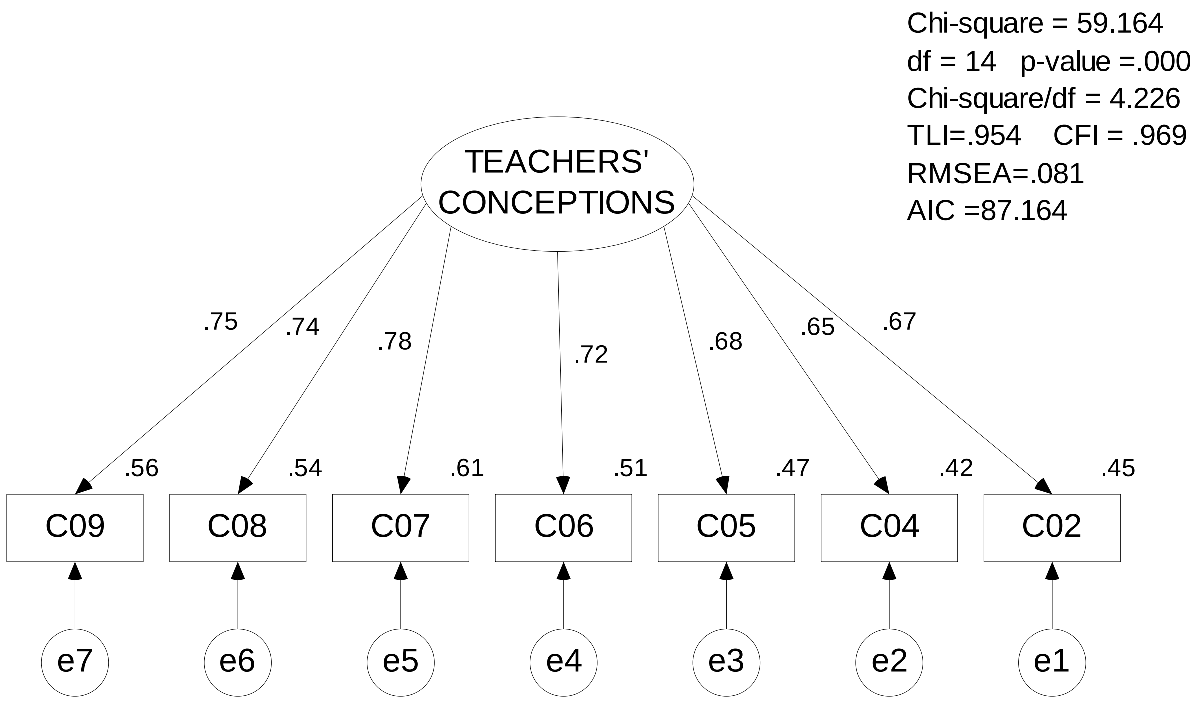

Figure 4.34. The measurement model for Teachers' Conceptions CAMC

Teachers' Receptivity to CAMC (TR)

'Teachers, Receptivity to CAMC' is the measure of teachers' receptiveness to the changes, in the implementation stage of CAMC. It is measured through six sub-constructs namely, 'perceived cost benefit of CAMC (PCB)', 'practicality of CAMC in the classroom (Prac)', 'alleviation of fears and concerns (FC)', 'participation in decision making (PDM)', 'perceived improvements of CAMC compared with the previous system (PI)' and 'perceived support from senior teachers and principal (PS)'.

The previous section detailed both the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA) conducted on the sub-constructs, and the final single factor model obtained for each sub-construct. The second order measurement model of Teachers, Receptivity to CAMC (Figure 4.35) was found to be acceptable [χ^2/df = 1.965, TLI=0.955, CFI=0.960, RMSEA= 0.044, AIC =591.4].

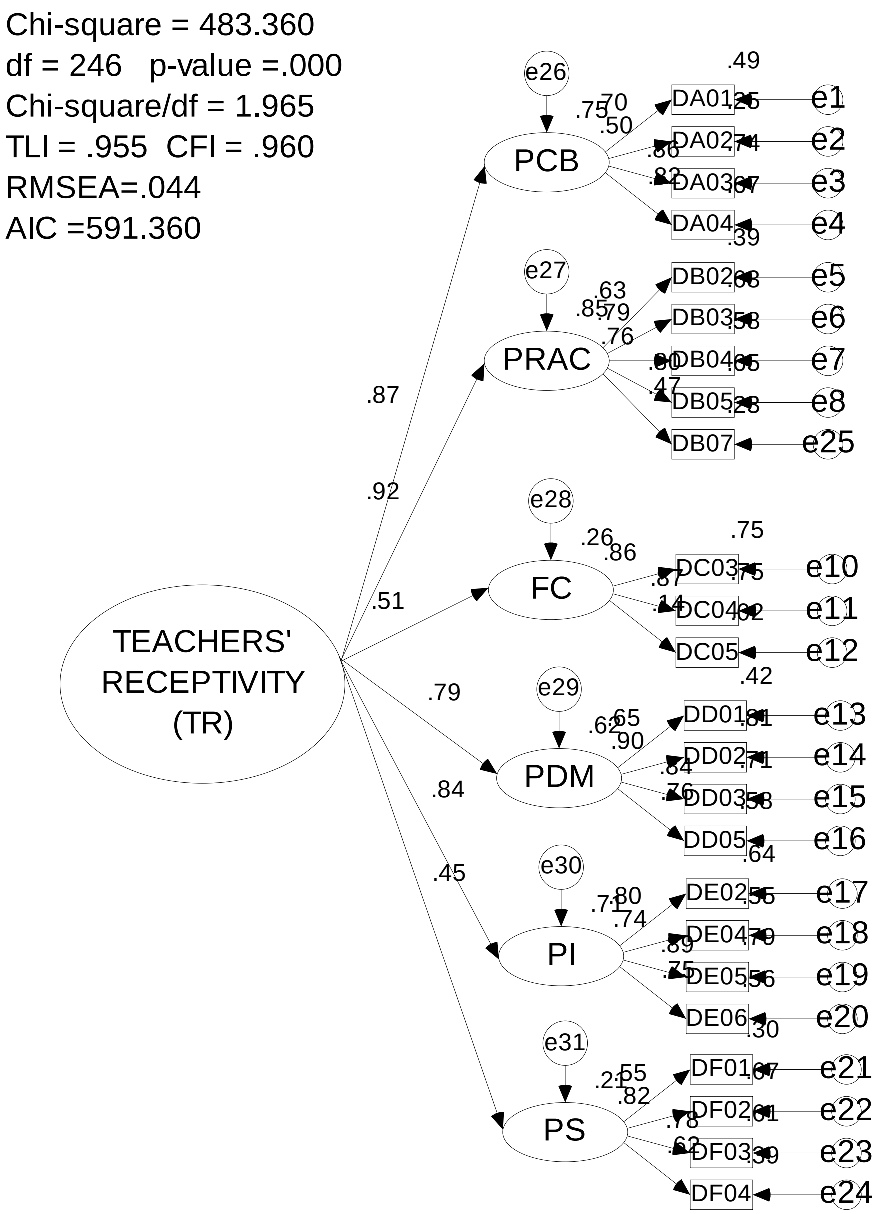

Figure 4.35. The measurement model for Teachers' Receptivity to CAMC

Degree of Implementation of CAMC (DOI)

'Degree of Implementation (DOI)' is the measure of the degree to which teachers implemented the school-based assessment of Competency Assessment and Modular Certification (CAMC) of vocational subjects in secondary schools, as intended by the

Ministry of Education (MOE). It is measured through five sub-constructs namely, 'logistics arrangement (LA)', 'use of assessment activities (UAA)', 'quality relationship between assessment, teaching and learning (QrATL)', 'knowledge of the characteristics of the assessment scheme (KCA)' and 'attitude towards school-based assessment (ATSBA)'.

Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted, as explained in the previous section, and the final single factor model was obtained for each sub-construct. The hypothesized second order confirmatory factor analysis (CFA) was tested. Several goodness-of-fit indices were used to see if this model fitted the data. In the confirmatory factor analysis (CFA), the second order factor model was found to be reasonable [χ^2/df = 3.383, TLI=0.948, CFI=0.954, RMSEA= 0.070, AIC =863.2].

Guided by the modification indices, the covariance between error terms for items EC05 and EC06 were added to the initial measurement model. These variables were retained because they were important to measure the dimensions of quality relationship between assessment, teaching and learning. Another error term that was correlated was between EB05 and UAA as guided by the modification indices. The model was re-estimated with the error covariance between FA06 and FB05, and EB05 and UAA. The final second order measurement model of Degree of Implementation (DOI) (Figure 4.36) was found to fit even better [χ^2/df = 2.911, TLI=0.958, CFI=0.963, RMSEA= 0.062, AIC =755.1].

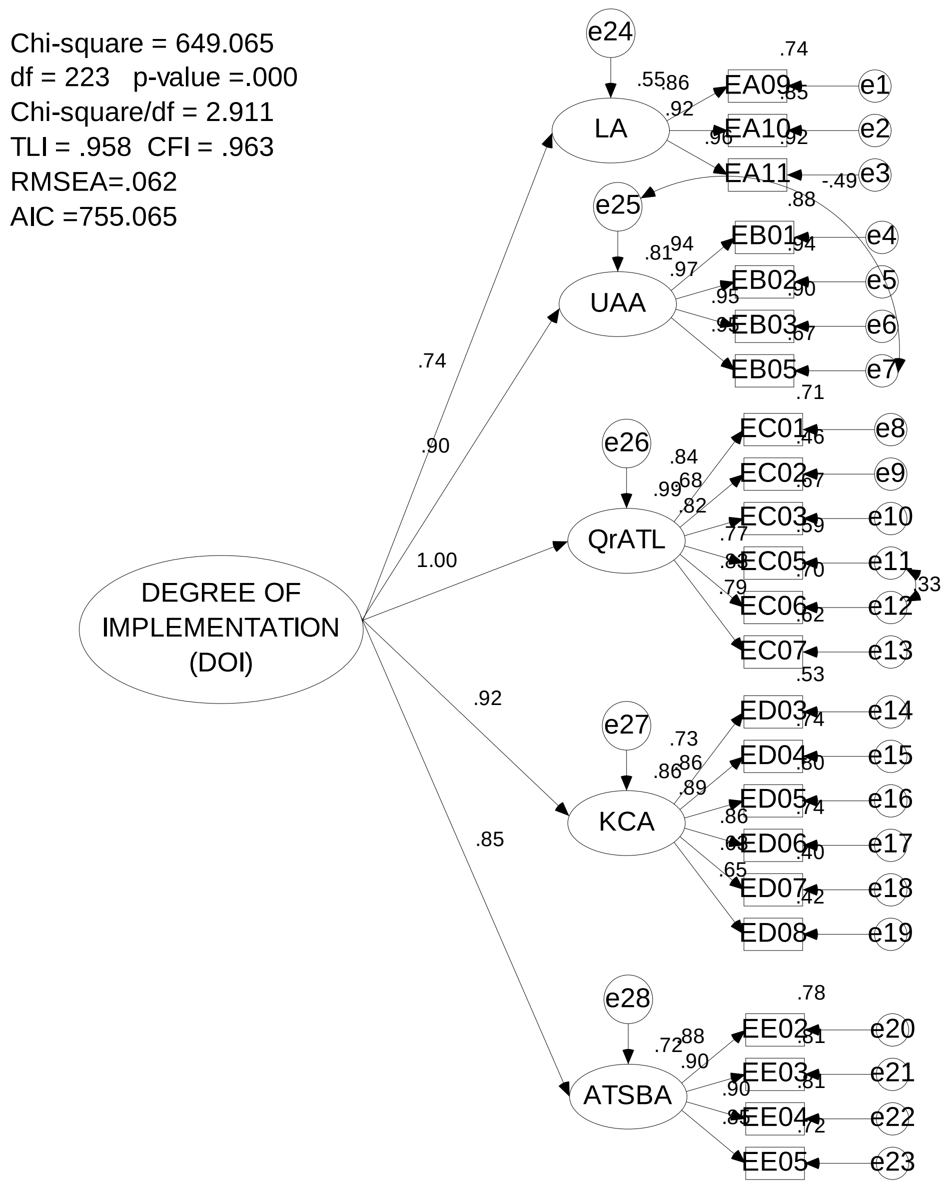

Figure 4.36 The measurement model for Degree of Implementation of CAMC

Quality Assurance Measures of CAMC (QA)

Quality Assurance Measures of CAMC (QA) is the measure of the quality control method of Competency Assessment and Modular Certification (CAMC), used by the Malaysian Examination Syndicate (MES), Ministry of Education.

It is measured through two sub-constructs namely, 'monitoring' and 'moderation of CAMC'. As described in the previous section, both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted and the final single factor model was obtained for each sub-construct. The hypothesized second order confirmatory factor analysis (CFA) was tested. Several goodness-of-fit indices were used to see if this model fitted the data. In the confirmatory factor analysis (CFA), the second order factor model was found to be reasonable [χ^2/df = 3.395, TLI=0.961, CFI=0.976, RMSEA= 0.070, AIC =74.129].

Guided by the modification indices, the covariance between error terms for items FA06 and FB05 were added to the initial measurement model. These variables were retained because they were important to measure both dimensions of 'monitoring' and 'moderation'. The model was re-estimated with the error covariance between FA06 and FB05. The final second order measurement model of Quality Assurance Measures of CAMC (QA) (Figure 4.37) was found to have an even better fit [χ^2/df = 1.918, TLI=0.985, CFI=0.991, RMSEA= 0.043, AIC =55.0].

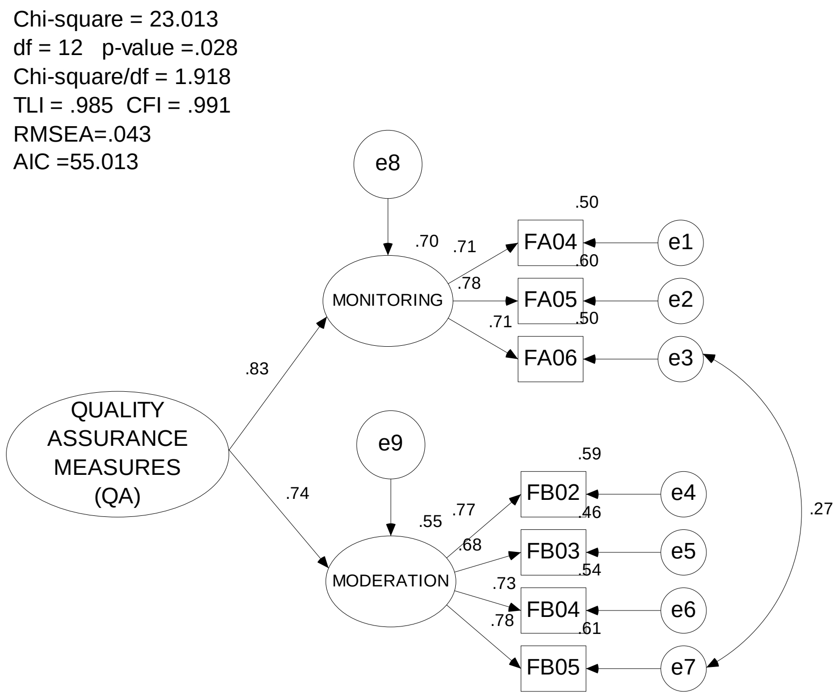

Figure 4.37 The measurement model for the Quality Assurance Measures of CAMC

The Evaluation of the Entire Measurement Model

There are four main latent constructs in the proposed measurement model namely ‘Degree of Implementation (DOI)’, ‘Quality Assurance Measures in CAMC (QA)’, ‘Teachers’ Receptivity to CAMC (TR)’ and ‘Teachers’ Conceptions of CAMC (TC)’ (refer to the previous section).

The measurement model path output is shown in Figure 4.38. In the measurement model, the fit was found to be acceptable [χ^2/df = 1.953, TLI=0.917, CFI=0.920, RMSEA=0.044, AIC =3820.9]. The correlations between the latent constructs and the 95% CI based on 1000 bootstrap samples are provided in Table 4.36.

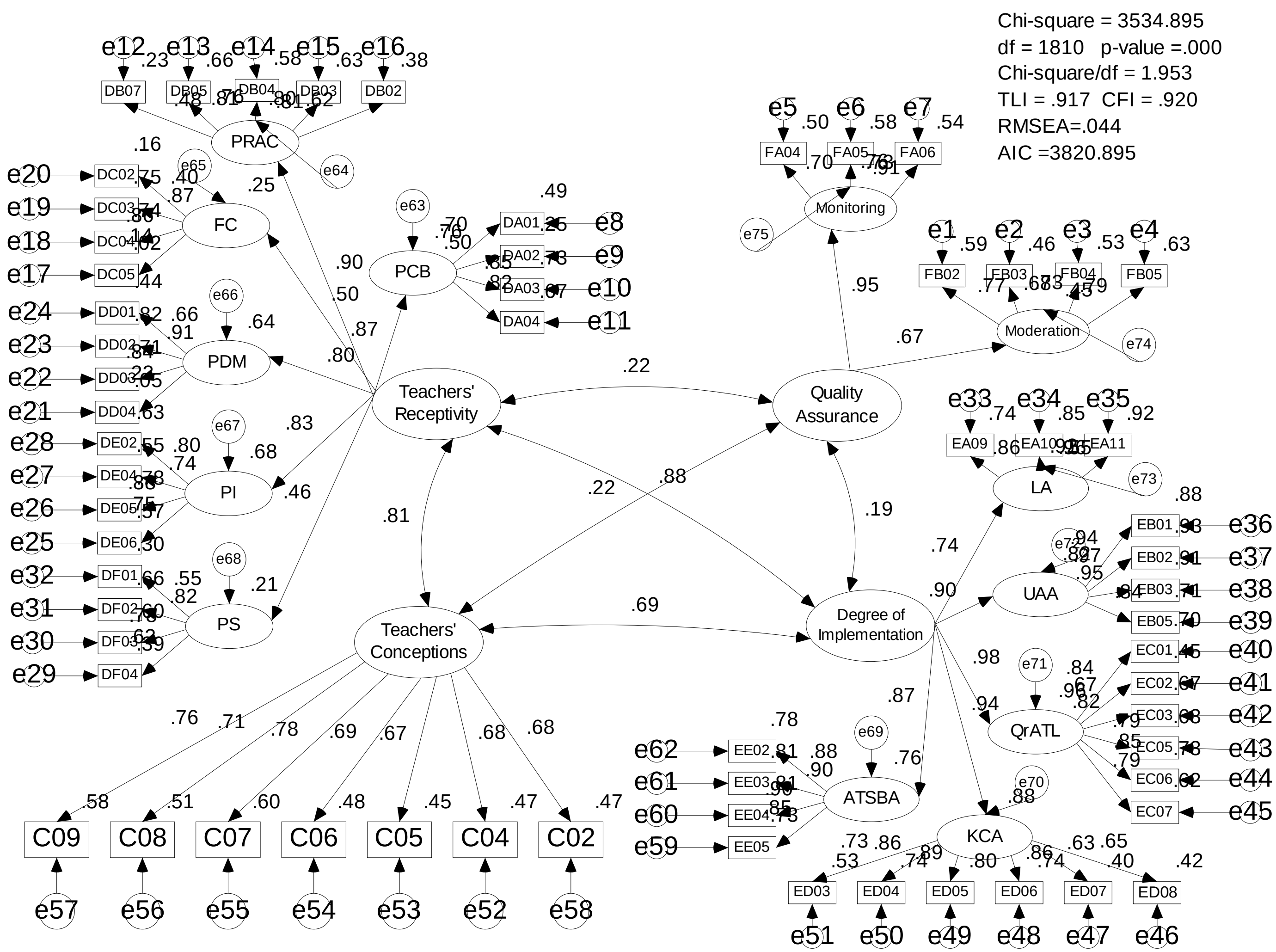

Figure 4.38 The measurement model

Table 4.36

Correlation between The Latent Constructs

Parameter			Estimate	95% CI*	
				Lower	Upper
Teachers'_Receptivity	<-->	Quality_Assurance	.219	.085	.336
Teachers'_Conceptions	<-->	Degree of_Implementation	.692	.598	.773
Teachers'_Conceptions	<-->	Teachers'_Receptivity	.812	.739	.875
Quality_Assurance	<-->	Degree of_Implementation	.194	.065	.316
Teachers'_Conceptions	<-->	Quality_Assurance	.216	.094	.317
Teachers'_Receptivity	<-->	Degree of_Implementation	.880	.838	.921

*based on 1000 Bootstrap samples

Based on Table 4.36, there is a high level of correlation between Teachers' Receptivity (TR) and Teachers' Conceptions (TC), Degree of Implementation (DOI) and Teachers' Conceptions (TC), Teachers' Receptivity (TR) and Degree of Implementation (DOI). The correlations between other pairs are rather weak. Based on the model indices, the overall model fit is acceptable [χ^2/df = 1.953, TLI=0.917, CFI=0.920, RMSEA=0.044, AIC =3820.9]. Thus, across this particular set of model fit indices, the measurement model represented a substantively adequate fit to the data. This measurement model was accepted as the final measurement model for testing the structural model.

The Structural Model

Since the measurement model fit was satisfactory, the structural model was tested to examine the relationships among the latent variables (factors), using the maximum likelihood method. The structural model path output is shown in Figure 4.39. Several goodness-of fit indices were used to see if the structural model fitted the data. Based on the model indices, the overall fit was acceptable [χ^2/df = 1.953, TLI=0.917, CFI=0.920, RMSEA=0.044, AIC =3820.9]. Based on the path output, Quality Assurance Measures explained 4.8% of variance in Teachers' Receptivity. In addition, Quality Assurance Measures and Teachers' Receptivity explained 66.1% of variance in Teachers' Conceptions. Furthermore, Quality Assurance Measures, Teachers' Receptivity and Teachers' Conceptions explained 77.6% of variance in Degree of Implementation.

The standardized regression coefficients between the constructs are provided in Table 4.37. The 95% confidence intervals are obtained based on 1000 bootstrap resampling technique. Where the interval does not contain the value of zero, there is a relationship between the two constructs. Based on Table 4.37, there is a significant, positive relationship between Teachers' Receptivity (TR) and Degree of Implementation (DOI), Quality Assurance Measures (QA) and Teachers' Receptivity (TR), and Teachers' Receptivity (TR) and Teachers' Conceptions (TC). The relationships between other pairs was not significant.

Table 4.37

Standardized Regression Coefficients

Parameter			Estimate	95% CI*	
				Lower	Upper
Teachers'_Receptivity	<---	Quality_Assurance	.219	.085	.336
Teachers'_Conceptions	<---	Quality_Assurance	.040	-.048	.114
Teachers'_Conceptions	<---	Teachers'_Receptivity	.803	.724	.879
Degree of_Implementation	<---	Quality_Assurance	.004	-.075	.089
Degree of_Implementation	<---	Teachers'_Receptivity	.934	.773	1.128
Degree of_Implementation	<---	Teachers'_Conceptions	-.068	-.276	.113

*based on 1000 Bootstrap samples

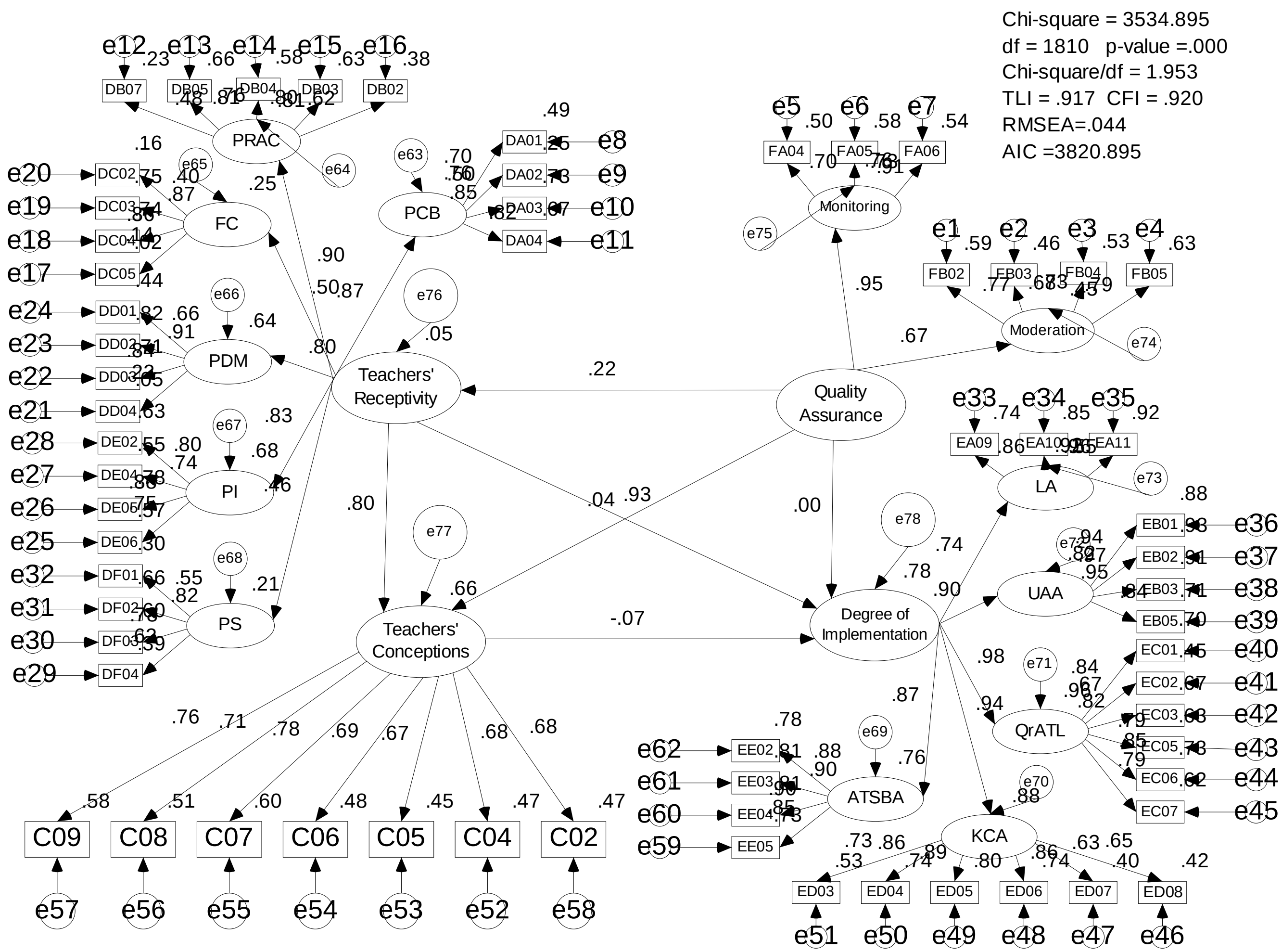

Figure 4.39. The structural model

The Direct and Indirect Effects of Latent Variables

The Direct Effects

Based on Table 4.37, among the three latent variables, only Teachers' Receptivity (TR) showed significant direct effect on the Degree of Implementation (DOI). TR → DOI = 0.934 and the 95% CI = [0.773, 1.129] (refer to Table 4.37). Since the value of 0 does not fall within the 95% CI, the Teachers' Receptivity (TR) to Degree of Implementation (DOI) direct relationship is significant. The direct effect of Quality Assurance Measures (QA) to Degree of Implementation (DOI) and Teachers' Conceptions (TC) to Degree of Implementation (DOI) relationships are not significant. Based on Table 4.37, QA → DOI = 0.004 and the 95% CI = [-0.075, 0.089]. Since the value of 0 falls within the 95% CI, the Quality Assurance Measures (QA) to Degree of Implementation (DOI) direct relationship is not significant. While TC → DOI = -0.068 and the 95% CI = [-0.276, 0.113]. Since the value of 0 falls within the 95% CI, the Teachers' Conceptions (TC) to Degree of Implementation (DOI) direct relationship is also not significant. Therefore, the only significant direct relationship is between Teachers' Receptivity (TR) and Degree of Implementation (DOI).

Based on Table 4.37, another two pairs of latent variables showed significant direct effects. The Quality Assurance Measures (QA) on Teachers' Receptivity (TR) and the Teachers' Receptivity (TR) on Teachers' Conceptions (TC). QA → TR = 0.219 and the 95% CI = [0.083, 0.336], and the direct effect of TR → TC = 0.803 and the 95% CI = [0.724, 0.879]. Since the value of 0 for both relationships does not fall within the 95% CI, their direct relationships are significant.

The Indirect Effects

Based on Table 4.37, Quality Assurance Measures (QA) showed significant indirect effect on Degree of Implementation (DOI) through Teachers' Receptivity (TR). Indirect effects that are small (less than 0.08), are generally not of interest because they are likely trivial relative to direct effects (Hair et al, 1998). QA → TR → DOI = 0.219 × 0.934 = 0.205, which is more than 0.08. Therefore, Teachers' Receptivity (TR) mediates the relationship between Quality Assurance Measures (QA) and Degree of Implementation (DOI). Since the indirect effect is sizeable and the direct effect is not significant, Teachers' Receptivity (TR) is a total mediator.

On the other hand, another indirect effect of Quality Assurance Measures (QA) on Degree of Implementation (DOI) through Teachers' Conceptions (TC) was not significant. QA → TC → DOI = 0.040 × -0.068 = -0.003, which is less than 0.085 in magnitude. Therefore, Teachers' Conceptions (TC) does not mediate the relationship between Quality Assurance Measures (QA) and Degree of Implementation (DOI). Since the indirect effect is not sizeable, Teachers' Conceptions (TC) is not a mediator.

Based on Table 4.37, the indirect effect of Teachers' Receptivity (TR) on Degree of Implementation (DOI) through Teachers' Conceptions (TC) was also not significant. TR → TC → DOI = 0.803 × -0.068 = -0.055, which is less than 0.085 in magnitude. Therefore, Teachers' Conceptions (TC) does not mediate the relationship between Teachers' Receptivity (TR) and Degree of Implementation (DOI).

Multiple Group Analysis

Multiple group analysis on the structural model was performed to test the equality in the structural model across groups. The multiple group analysis was used to test the moderating effects of several demographic variables, such as teachers' gender, experience, training and field of specialization. The multiple group analysis was tested using the maximum likelihood method. Testing for moderators effects of grouping variables (e.g. gender) requires testing for factorial invariance (i.e. both measurement and structural invariance) of the model across the groups of interest. Before testing for measurement invariance across groups, first the measurement and structural were tested to see if models have acceptable fit for each of the multiple groups. Then it was followed by testing for measurement invariance between the unconstrained models, and the constrained models. It was found that the chi-square difference statistic does not reveal a significant difference between the unconstrained and the constrained models, then the researcher concludes that the model has measurement invariance across groups Several goodness-of fit indices were used to see if the measurement and structural model for all the groups fitted the data. The standardized regression coefficients between the constructs are also provided. The 95% confidence intervals are obtained based 1000 bootstrap resampling technique. If the confidence intervals between the groups did not overlap, it shows that there is a statistically significant difference between the groups. If the confidence intervals between the groups overlapped, there is no significant difference between the groups.

Then, a chi-square difference test was performed between the constrained and the unconstrained models. The chi-square, degree of freedom (df), change in chi-square, change in degree of freedom (df) and p-value for the constrained and unconstrained model comparison for the groups are provided. The p-value was calculated and if the p-value was less that 0.05, the demographic variable was the moderator but if the p-value was more that 0.05, then the demographic variable was not a moderator.

Gender as a Moderating Variable

The measurement and structural model for male teachers were found to be acceptable [χ^2/df = 1.651, TLI=0.903, CFI=0.908, RMSEA=0.050, AIC =3274.1]. The structural model for the male teachers is given in Figure 4.40. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.38.

The measurement and structural model for female teachers were found to be reasonable [χ^2/df = 1.721, TLI=0.859, CFI=0.865, RMSEA=0.056, AIC =3401.1]. The structural model for the female teachers is given in Figure 4.41. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are also provided in Table 4.38

Table 4.38

Standardized Regression Coefficients for Males and Females

Parameter			Male (n=266)			Female (n=227)		
				95% CI*			95% CI*	
			Estimate	Lower	Upper	Estimate	Lower	Upper
TR	<---	QA	.177	.018	.349	.242	.106	.444
TC	<---	TR	.775	.655	.869	.836	.706	.956
TC	<---	QA	.073	-.040	.191	-.015	-.171	.093
DOI	<---	QA	.053	-.053	.149	-.023	-.236	.078
DOI	<---	TR	.890	.688	1.124	.959	.685	1.590
DOI	<---	TC	-.018	-.272	.206	-.123	-.722	.155

In Table 4.38, the confidence intervals for the male and female teachers overlapped, for all relationships. Thus, statistically, there was no significant difference between male and female teachers.

The chi-square difference test was performed between the constrained and the unconstrained models. The unconstrained multiple group analysis path output is given in Figure 4.42. The chi-square value is 6103.4 with a degree of freedom (df) of 3626. These values are summarized in Table 4.39. The constrained multiple group analysis path output is given in Figure 4.43.The chi-square value is 6109.4 with a degree of freedom (df) of 3626. These values are also summarized in Table 4.39.

Table 4.39

Comparison Between Constrained And Unconstrained Model For Gender

Model	Chi-square	df	Change in Chi-square	Change in df	p-value
Constrained	6109.4	3626	6	6	0.423
Unconstrained	6103.4	3620			

In Table 4.39, the chi-square, df, change in chi-square, change in df and p-value for the comparison between the constrained and unconstrained model for gender are provided. Since the p-value is 0.423 which is more that 0.05, gender was not a moderator.

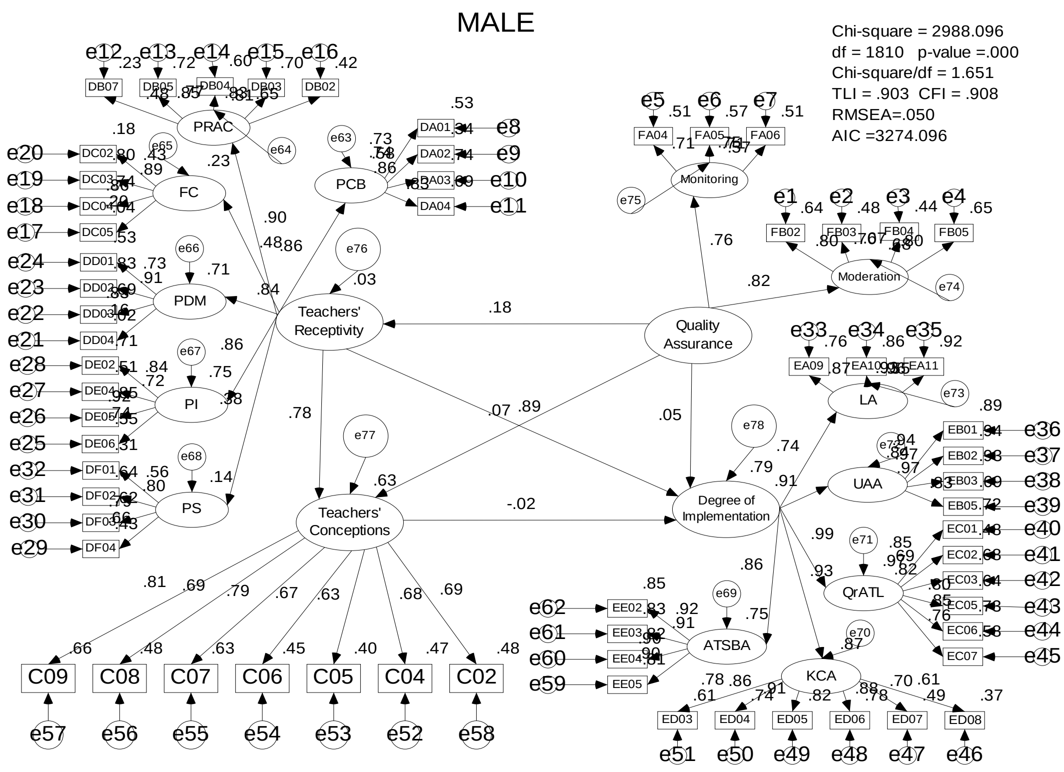

Figure 4.40. The stuctural model for the male teachers

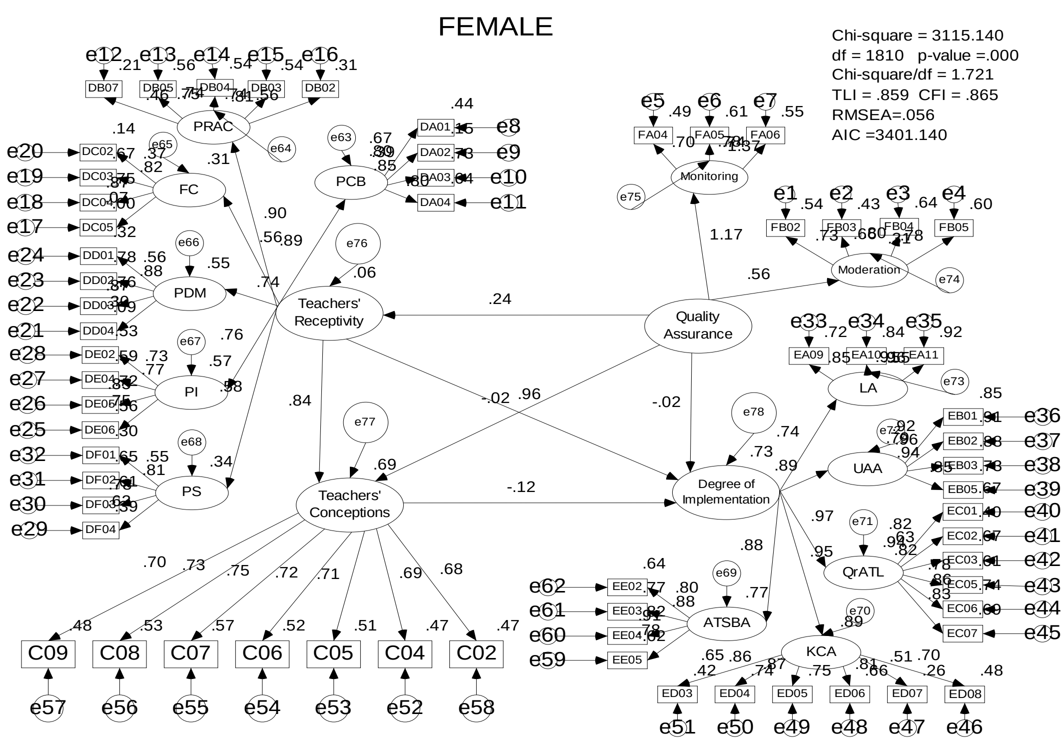

Figure 4.4. The stuctural model for the female teachers

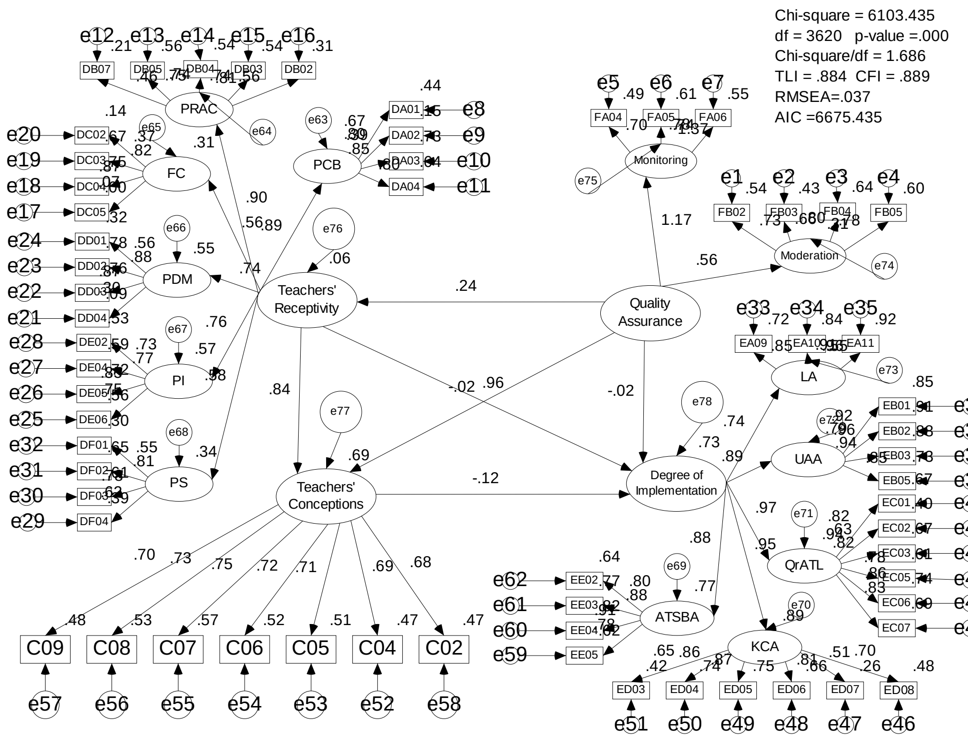

Figure 4.42. Unconstrained multiple group comparison between male and female teachers

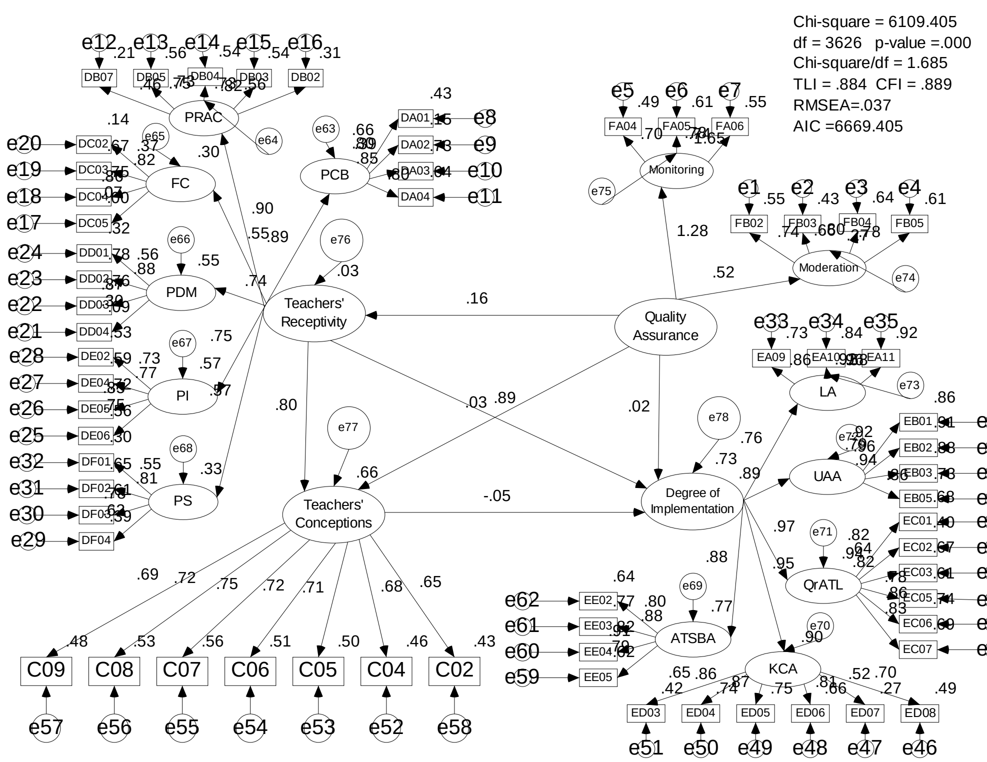

Figure 4.43. Constrained multiple group comparison between male and female teachers

Teachers' experience as a Moderating Variable

The measurement and structural model for less experienced teachers were found to be acceptable [χ^2/df = 1.730, TLI=0.894, CFI=0.898, RMSEA=0.050, AIC =3417.8]. The structural model for the less experienced teachers is given in Figure 4.44. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.40.

The measurement and structural model for more experienced teachers were found to be reasonable [χ^2/df = 1.700, TLI=0.863, CFI=0.869, RMSEA=0.060, AIC =3363.5]. The structural model for the more experienced teachers is given in Figure 4.45. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.40.

Table 4.40

Standardized Regression Coefficients For Less Experience And More Experience

Parameter			Less Exp (n=296)			More Exp (n=197)		
				95% CI*			95% CI*	
			Estimate	Lower	Upper	Estimate	Lower	Upper
TR	<---	QA	.250	.086	.406	.112	.006	.332
TC	<---	TR	.866	.776	.940	.716	.571	.831
TC	<---	QA	.025	-.080	.133	.074	-.094	.199
DOI	<---	QA	.052	-.065	.161	-.042	-.207	.057
DOI	<---	TR	.975	.719	1.340	.870	.649	1.100
DOI	<---	TC	-.132	-.498	.144	.017	-.239	.274

In table 4.40, the confidence intervals for the less experienced and more experienced overlapped for all relationships. Thus, statistically, there was no significant difference between the less experienced and the more experienced

LESS EXPERIENCE

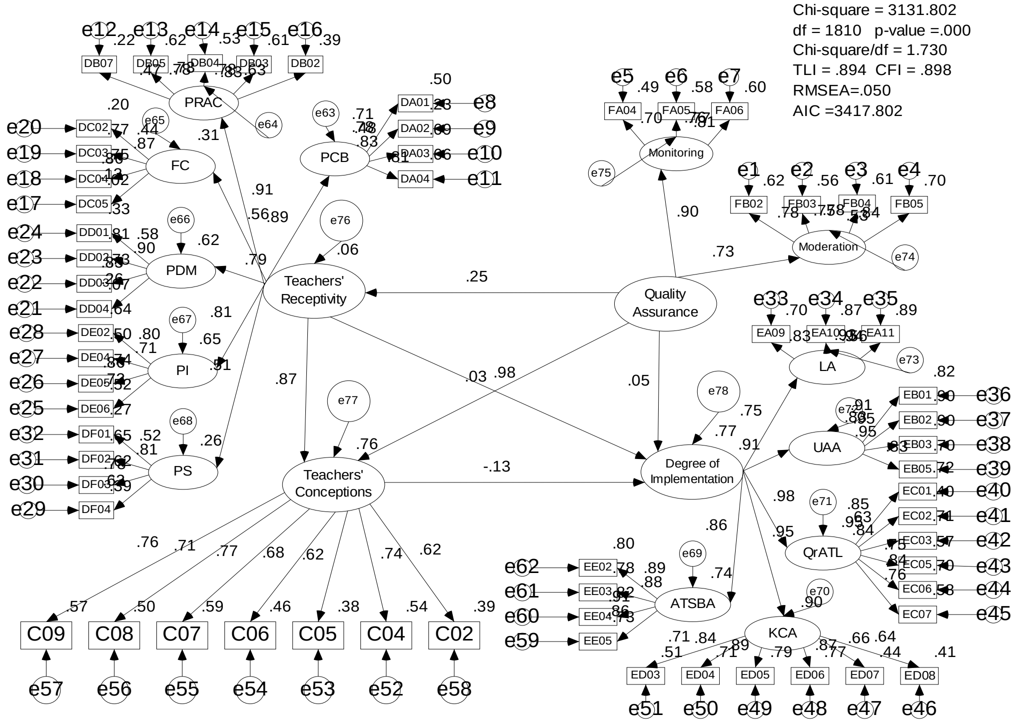

Figure 4.44. The stuctural model for the less experienced teachers

MORE EXPERIENCE

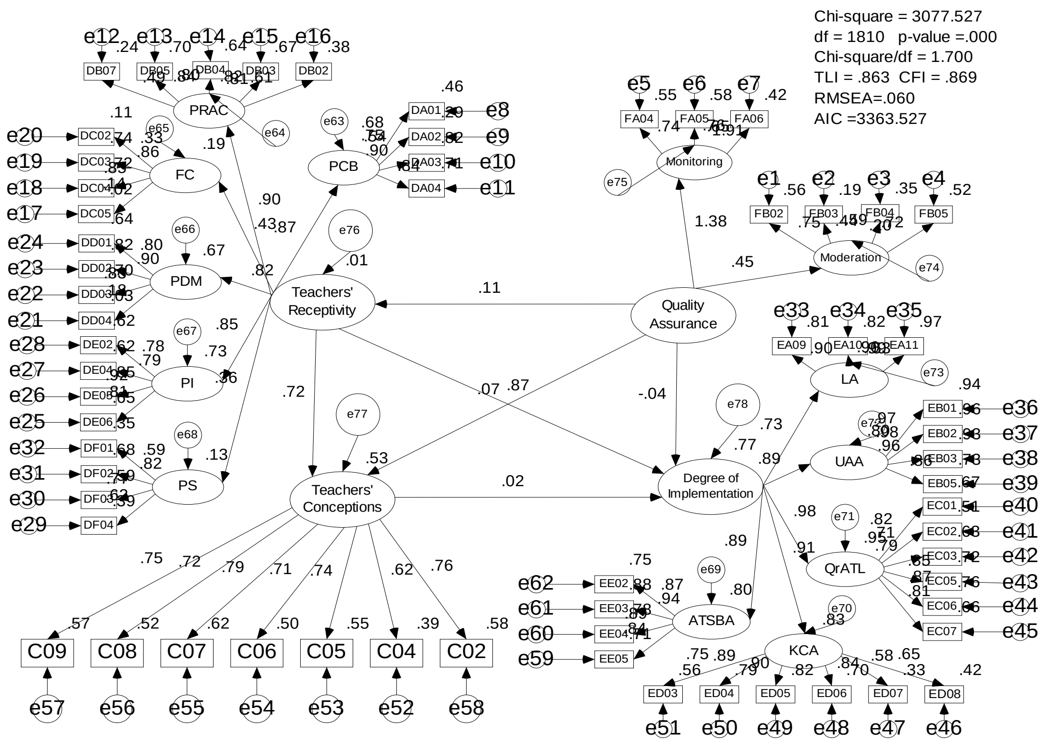

Figure 4.45. The stuctural model for the more experienced teachers

The chi-square difference test was performed between the constrained and the unconstrained models. The unconstrained multiple group analysis path output is given in Figure 4.46. The chi-square value is 6210.4 with a degree of freedom (df) of 3620. These values are also summarized in Table 4.41. The constrained multiple group analysis path output is given in Figure 4.47. The chi-square value is 6217.7 with a a degree of freedom (df) of 3626. These values are also summarized in Table 4.41.

Table 4.41

Comparison between Constrained and Unconstrained Model for Teachers' Experience

Model	Chi-square	df	Change in Chi-square	Change in df	p-value
Constrained	6217.7	3626	7.3	6	0.294
Unconstrained	6210.4	3620			

In Table 4.41, the chi-square, degree of freedom (df), change in chi-square, change in df and p-value for the comparison between the constrained and unconstrained model for teachers' experience are provided. Since the p-value is 0.294, which is more that 0.05, teachers' experience was not a moderator.

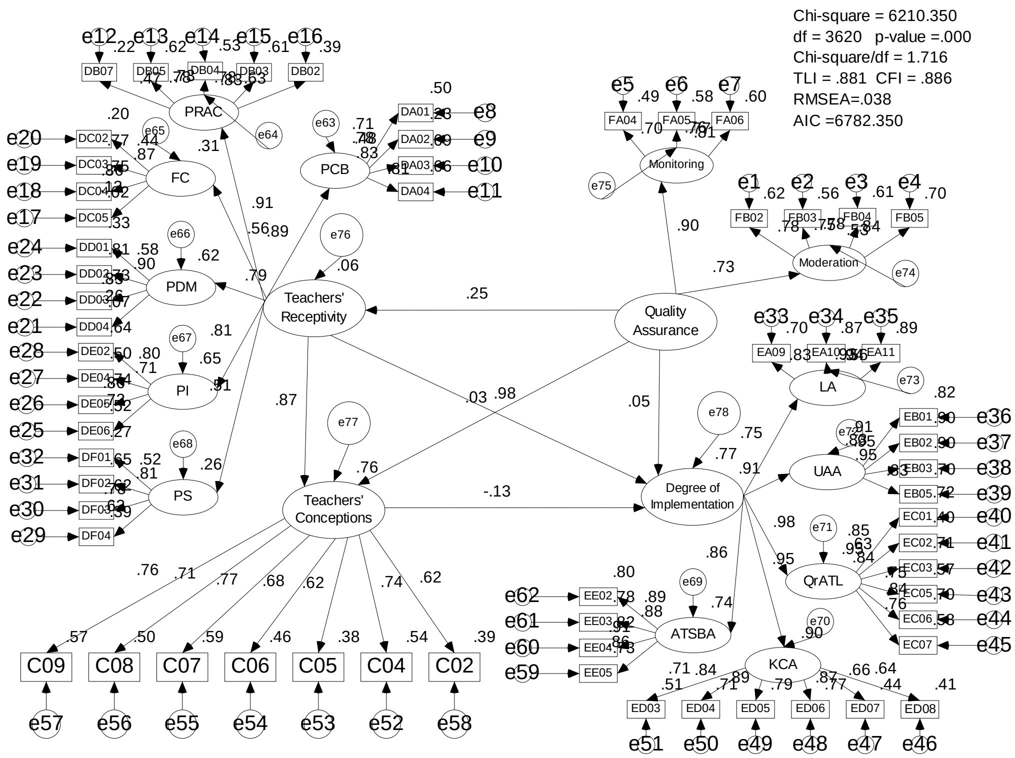

Figure 4.46. Unconstrained multiple group comparison between less experience and more experience teachers

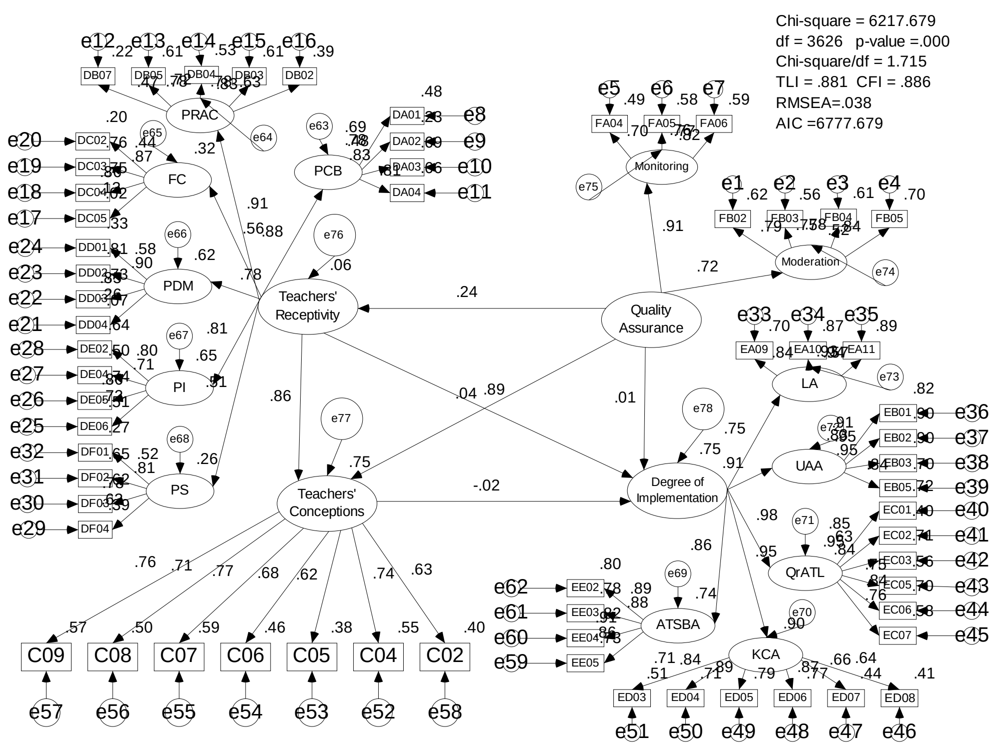

Figure 4.47. Constrained multiple group comparison between less experience and more experience teachers

Teachers' training as a Moderating Variable

The measurement and structural model for fully-trained teachers were found to be reasonable [χ^2/df = 1.722, TLI=0.877, CFI=0.882, RMSEA=0.057, AIC =3402.4]. The structural model for fully-trained teachers is given in Figure 4.48. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.42.

The measurement and structural model for partially-trained teachers were found to be reasonable [χ^2/df = 1.701, TLI=0.883, CFI=0.888, RMSEA=0.051, AIC =3364.3]. The structural model for partially-trained teachers is given in Figure 4.49. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.42.

Table 4.42

Standardized Regression Coefficients for Training

Parameter			Partial training (n=271)			Full Training (n=222)		
				95% CI*			95% CI*	
			Estimate	Lower	Upper	Estimate	Lower	Upper
TR	<---	QA	.265	.117	.436	.136	-.066	.307
TC	<---	TR	.891	.801	.975	.734	.593	.839
TC	<---	QA	-.002	-.122	.105	.049	-.059	.189
DOI	<---	QA	-.040	-.161	.073	.010	-.108	.135
DOI	<---	TR	.982	.616	1.766	.904	.720	1.118
DOI	<---	TC	-.099	-.884	.310	-.049	-.276	.161

In table 4.42, the confidence intervals for the two groups overlapped for all relationships. Hence, statistically, there was no significant difference between the fully-trained and partially-trained teachers.

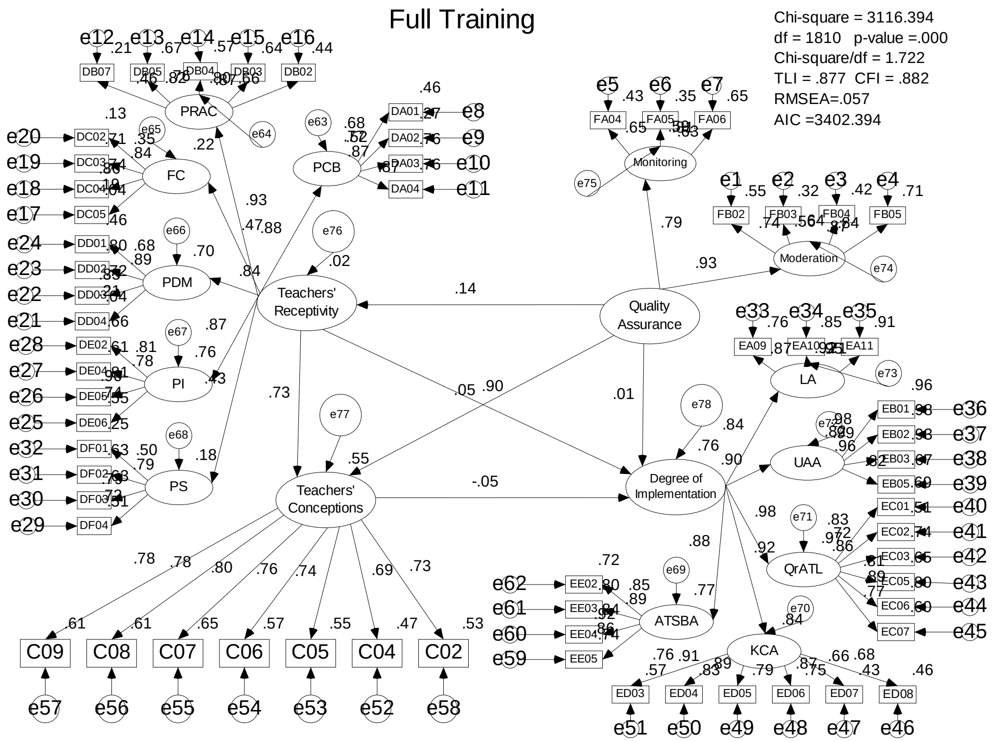

Figure 4.48. The structural model for the fully trained teachers

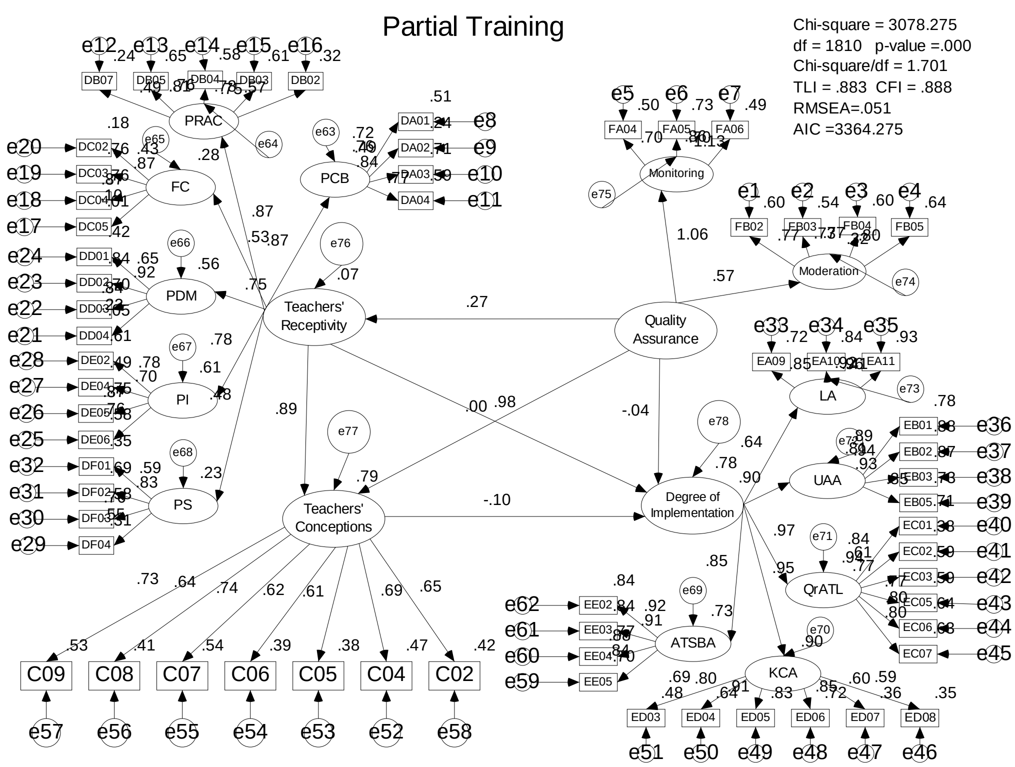

Figure 4.49. The structural model for partially trained teachers

The chi-square difference test was performed between the constrained and the unconstrained models. The unconstrained multiple group analysis path output is given in Figure 4.50. The chi-square value is 6194.9with a degree of freedom (df) of 3620. These values are also summarized in Table 4.43. The constrained multiple group analysis path output is given in Figure 4.51. The chi-square value is 6201.0with a degree of freedom (df) of 3626. These values are also summarized in Table 4.43.

Table 4.43

Comparison between Constrained and Unconstrained Model for Teachers' Training

Model	Chi-square	df	Change in Chi-square	Change in df	p-value
Constrained	6201.0	3626	6.1	6	0.412
Unconstrained	6194.9	3620			

In Table 4.43, the chi-square, degree of freedom (df), change in chi-square, change in df and p-value for the comparison between the constrained and unconstrained model for teachers' experience are provided. Since the p-value is 0.412 which is more that 0.05, training was not a moderator.

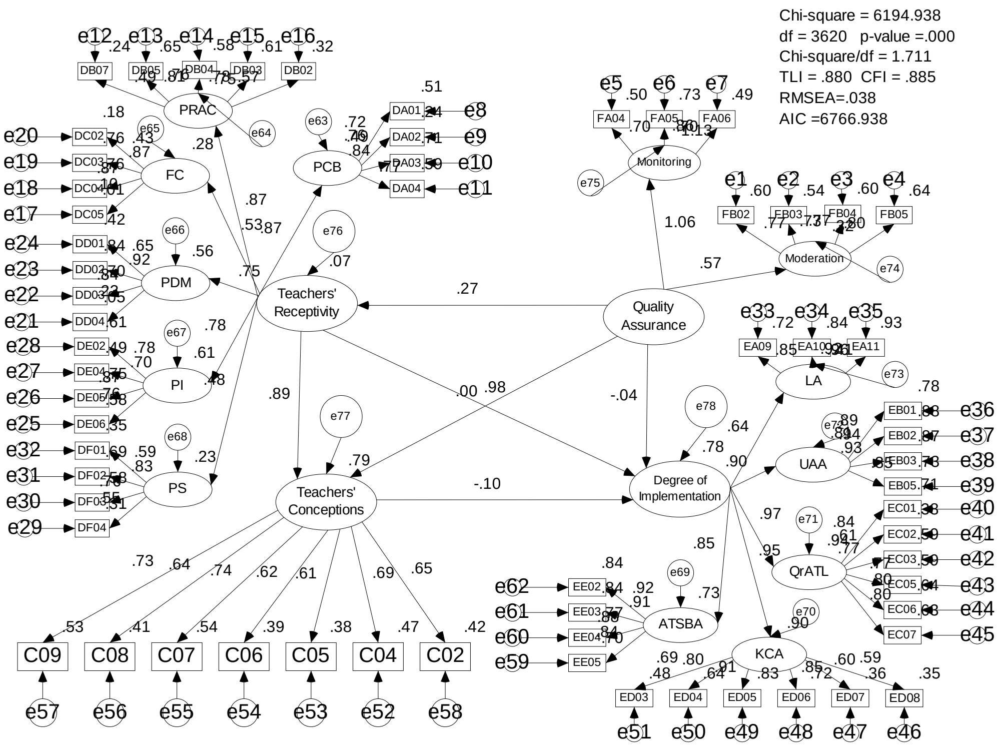

Figure 4.50. The unconstrained multiple group comparison between fully trained and partially trained teachers

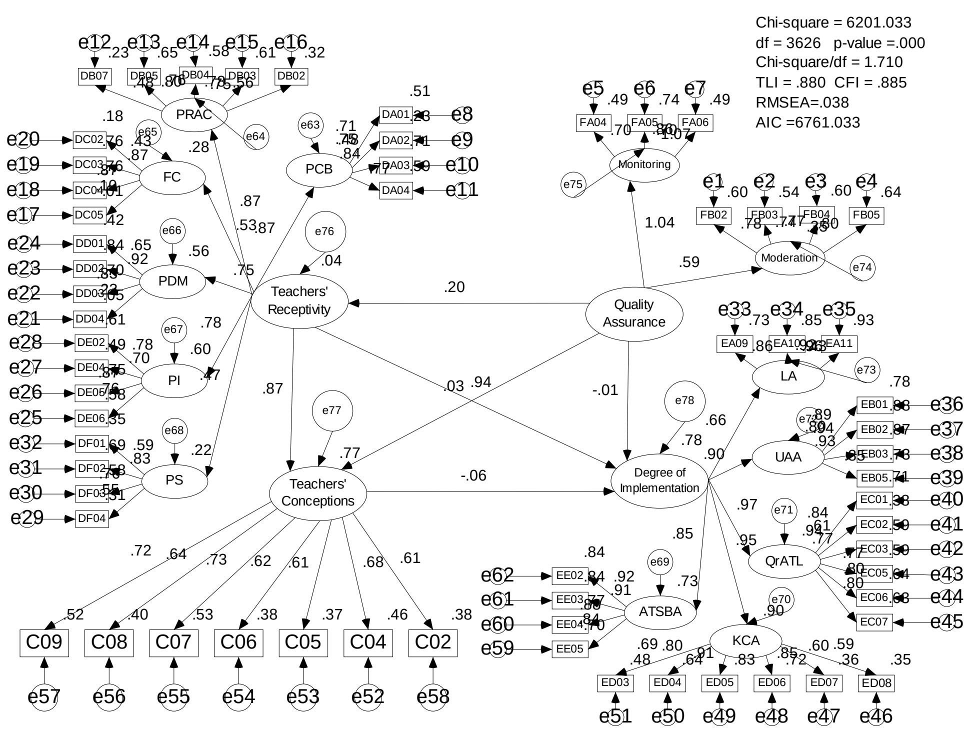

Figure 4.51. The constrained multiple group comparison between fully trained and partially trained teachers

Field of Specialization as a Moderating Variable

The measurement and structural model for Information Technology teachers were found to be reasonable [χ^2/df = 1.756, TLI=0.742, CFI=0.753, RMSEA=0.086, AIC =3463.7]. The structural model for the Information Technology teachers is given in Figure 4.52. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.44.

The measurement and structural model for Home Science teachers were found to be reasonable [χ^2/df = 1.762, TLI=0.828, CFI=0.835, RMSEA=0.068, AIC =3475.6]. The structural model for the Home Science teachers is given in Figure 4.53. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.44.

The measurement and structural model for Engineering teachers were found to be reasonable [χ^2/df = 1.697, TLI=0.791, CFI=0.800, RMSEA=0.078, AIC =3357.6]. The structural model for the Engineering teachers is given in Figure 4.54. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.45.

The measurement and structural model for Agriculture teachers were found to be reasonable [χ^2/df = 1.831, TLI=0.734, CFI=0.746, RMSEA=0.088, AIC =3486.9]. The structural model for the Agriculture teachers is given in Figure 4.55. The standardized regression coefficients and their 95% CI based on 1000 bootstrap samples are provided in Table 4.45.

Table 4.44

Standardized Regression Coefficients for Field of Specialization (Information Technology and Home Science)

Parameter			Information Technology (n=102)			Home science (n=167)		
				95% CI*			95% CI*	
			Estimate	Lower	Upper	Estimate	Lower	Upper
TR	<---	QA	.179	.026	.544	.218	.005	.441
TC	<---	TR	.950	.825	1.037	.793	.638	.929
TC	<---	QA	-.055	-.180	.189	-.042	-.224	.111
DOI	<---	QA	-.022	-.481	.188	-.084	-.315	.073
DOI	<---	TR	1.417	.628	4.744	1.046	.800	1.518
DOI	<---	TC	-.501	-3.834	.273	-.188	-.664	.056

Table 4.45

Standardized Regression Coefficients for Field of Specialization (Engineering and Agriculture)

Parameter			Engineering (n=115)			Agriculture (n=109)		
				95% CI*			95% CI*	
			Estimate	Lower	Upper	Estimate	Lower	Upper
TR	<---	QA	.297	.095	.496	.107	-.146	.385
TC	<---	TR	.766	.565	.931	.776	.609	.909
TC	<---	QA	.093	-.084	.285	.101	-.071	.283
DOI	<---	QA	.069	-.076	.251	.014	-.163	.223
DOI	<---	TR	.886	.417	1.308	.791	.374	1.394
DOI	<---	TC	-.062	-.531	.439	.086	-.584	.483

In table 4.44 and 4.45, the confidence intervals for the four groups overlapped for all relationships. Hence, statistically, there was no significant difference between the Information Technology, Home Science, Engineering and Agriculture teachers.

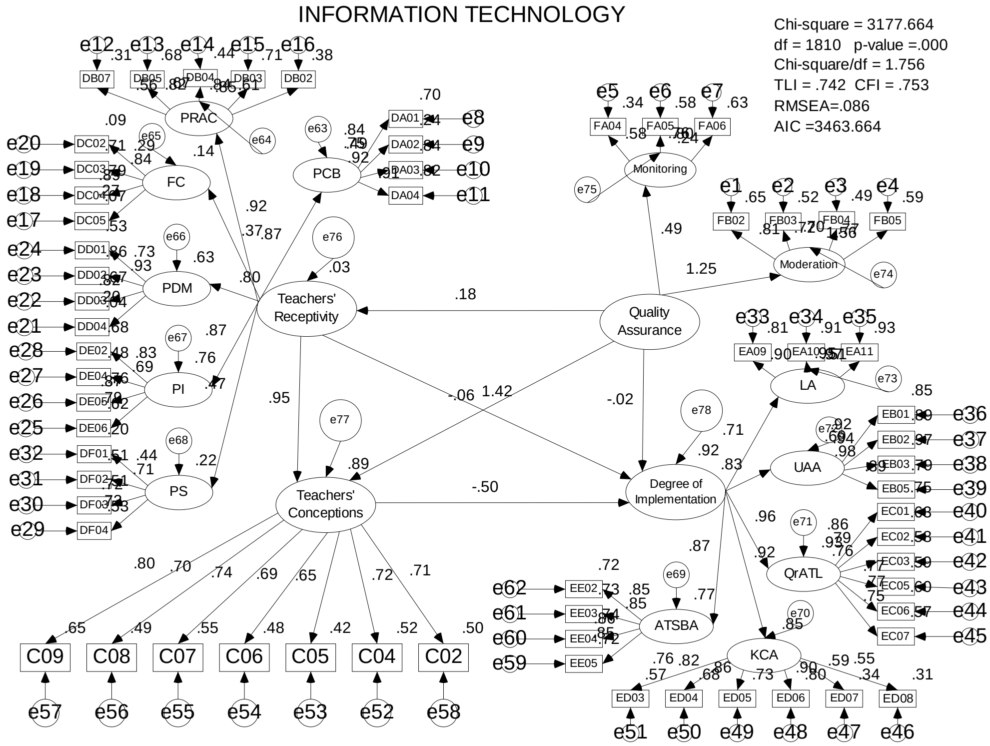

Figure 4.52. The structural model for the Information Technology teachers

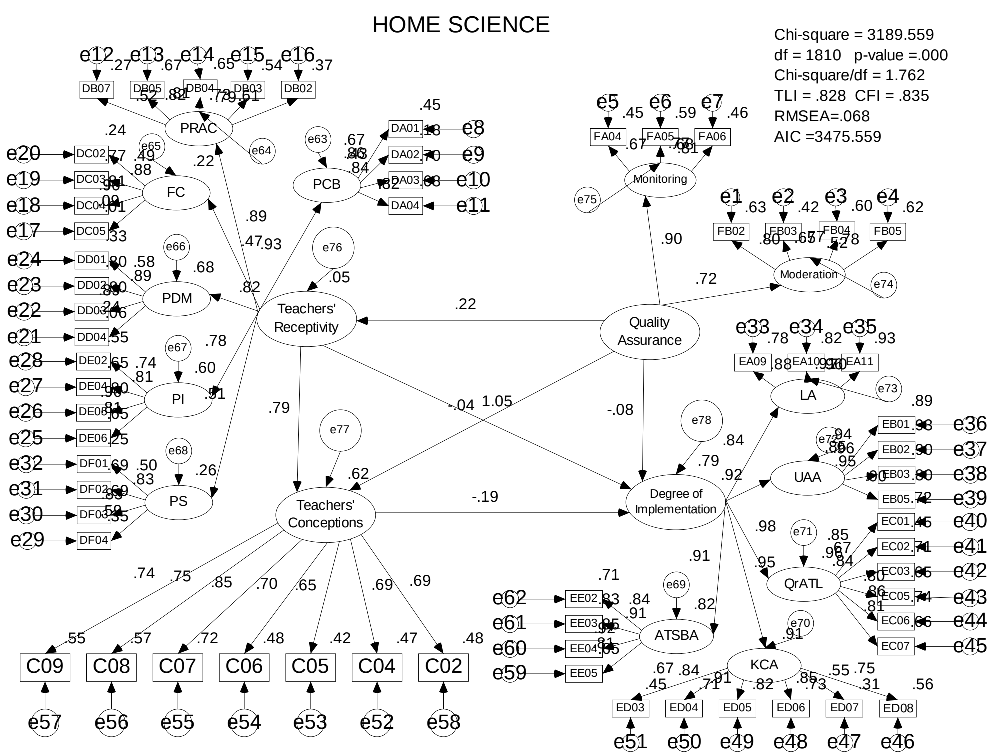

Figure 4.53. The structural model for the Home Science teachers

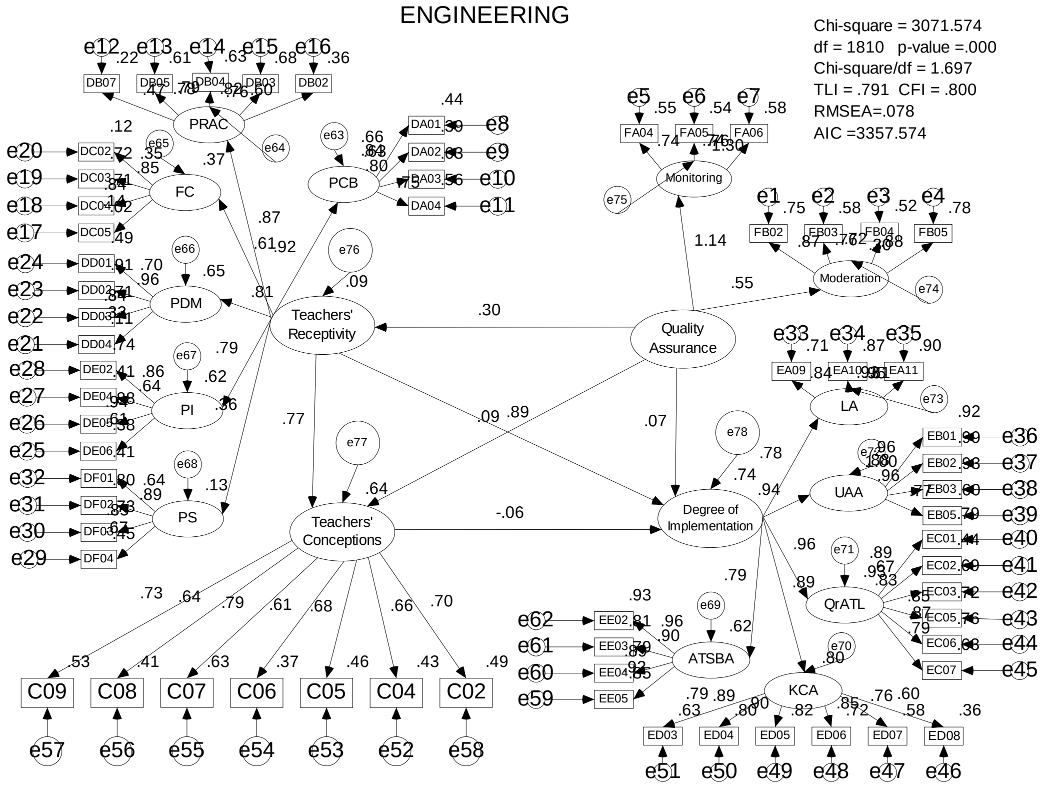

Figure 4.54. The structural model for the Engineering teachers

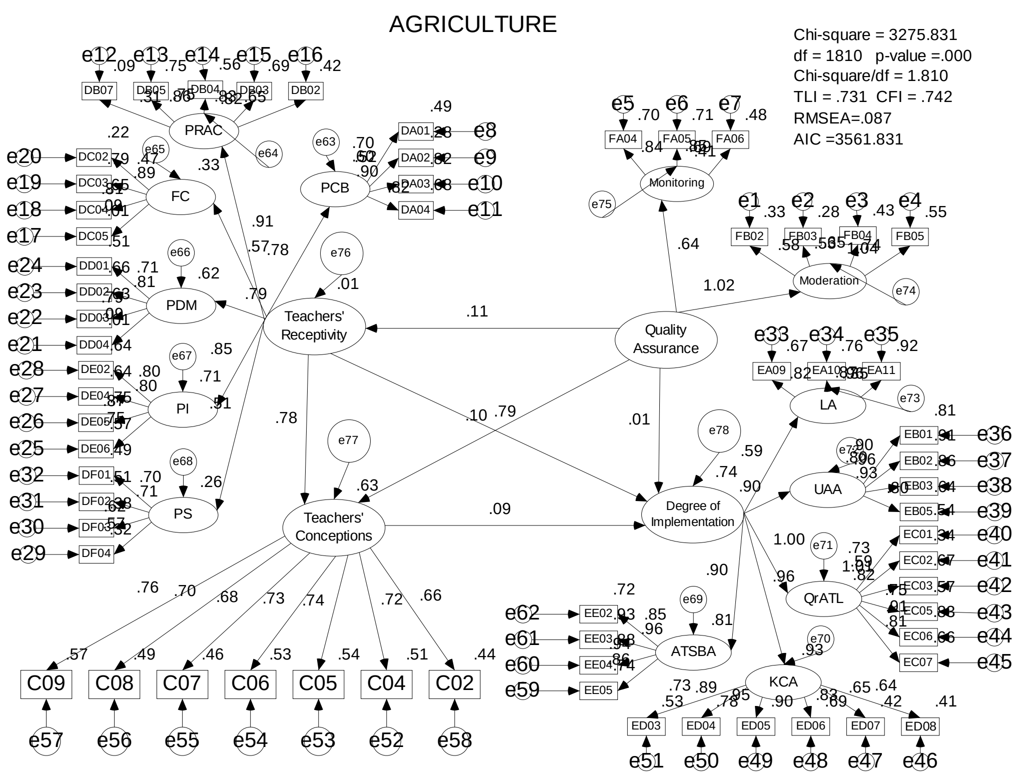

Figure 4.55. The structural model for the Agriculture teachers

The chi-square difference test was performed between the constrained and the unconstrained models. The unconstrained multiple group analysis path output is given in Figure 4.56. The chi-square value is 12727.7with a degree of freedom (df) of 7242. These values are summarized in Table 4.46. The constrained multiple group analysis path output is given in Figure 4.57. The chi-square value is 12744.5 with a degree of freedom (df) of 7263. These values are also summarized in Table 4.46.

Table 4.46

Comparison between Constrained and Unconstrained Model for Field of Specialization

Model	Chi-square	df	Change in Chi-square	Change in df	p-value
Constrained	12738.66	7262	18.99	19	0.457478
Unconstrained	12719.67	7244			

In Table 4.46, the chi-square, degree of freedom (df), change in chi-square, change in df and p-value for the comparison between the constrained and unconstrained model for field of specialization are provided. Since the p-value = 0.457, which is more that 0.05, the field of specialization was not a moderator.

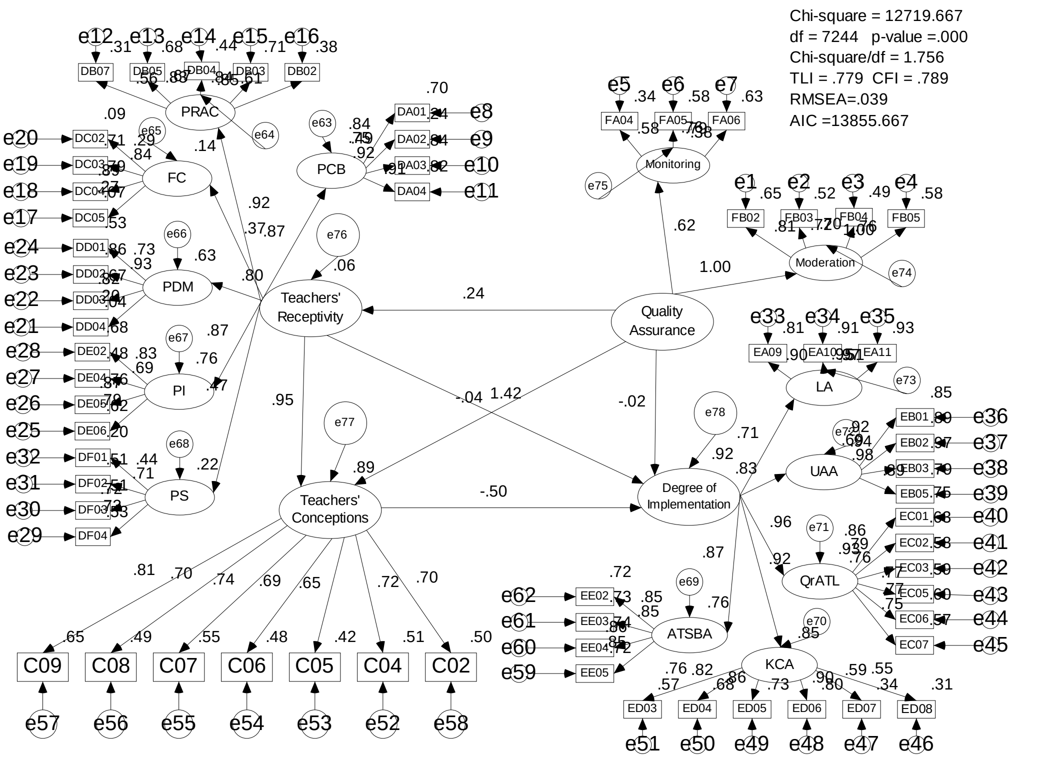

Figure 4.56. The unconstrained multiple group comparison field of specialization

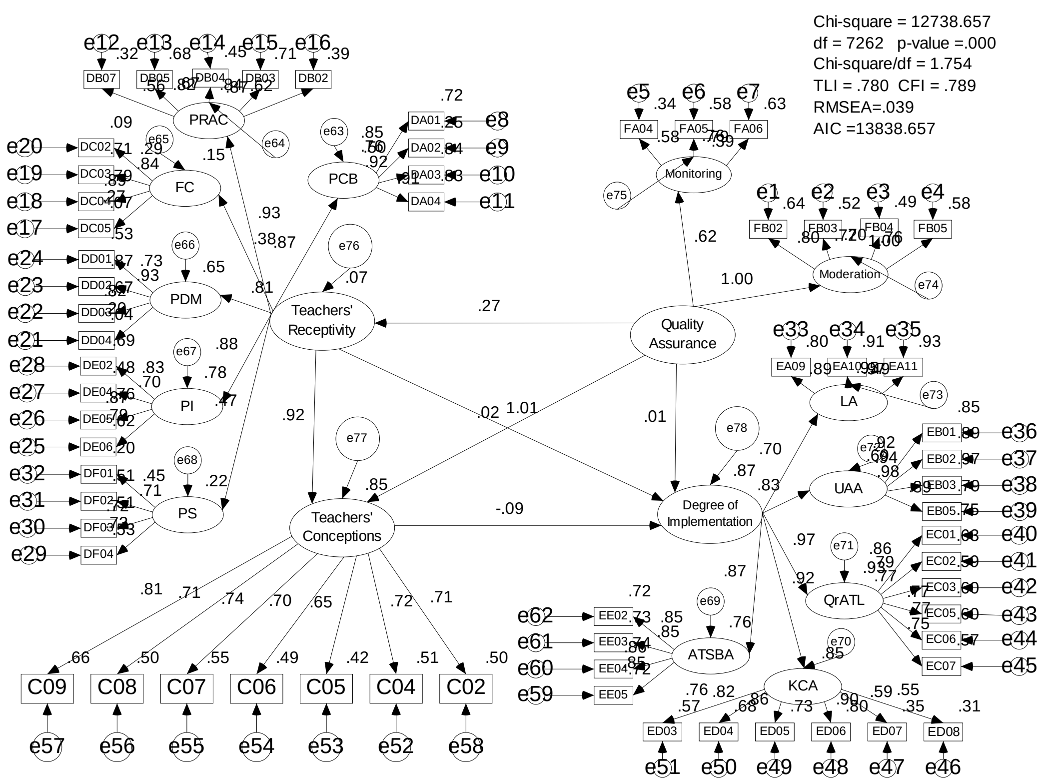

Figure 4.57. The constrained multiple group comparison field of specialization

The multiple group analysis for all the four demographic variables, that is, gender, experience, training and teachers' field of specialization, indicated that there was no significant difference in the structural model across groups. First of all, all the models showed a reasonable fit to the data. A large overlap in the confidence intervals for all the relationship in the structure indicated that there could be no significant difference between groups. In addition, the model fit did not become significantly worse when the constrained model was compared to the unconstrained model. Furthermore, the p-value for all the groups was more that 0.05, so all the four demographic variables i.e. gender, experience, training and teachers' field of specialization were not moderating variables.

The Parsimonious Model

The parsimonious model path output is shown in Figure 4.58. Several goodness-of-fit indices were used to see if the structural model fit the data. Based on the model indices, the overall fit was acceptable [χ^2/df = 1.951, TLI=0.917, CFI=0.920, PCFI=0.882, RMSEA=0.044, AIC =3817.0]. The testing of the structural model was discussed in the previous section and based on the model fit indices, the overall fit was also acceptable [χ^2/df = 1.953, TLI=0.917, CFI=0.920, PCFI=0.881, RMSEA=0.044, AIC =3820.9]. The fit indices for both models were compared to determine whether the parsimonious model was a better model to predict the effects of factors influencing the degree of implementation of CAMC.

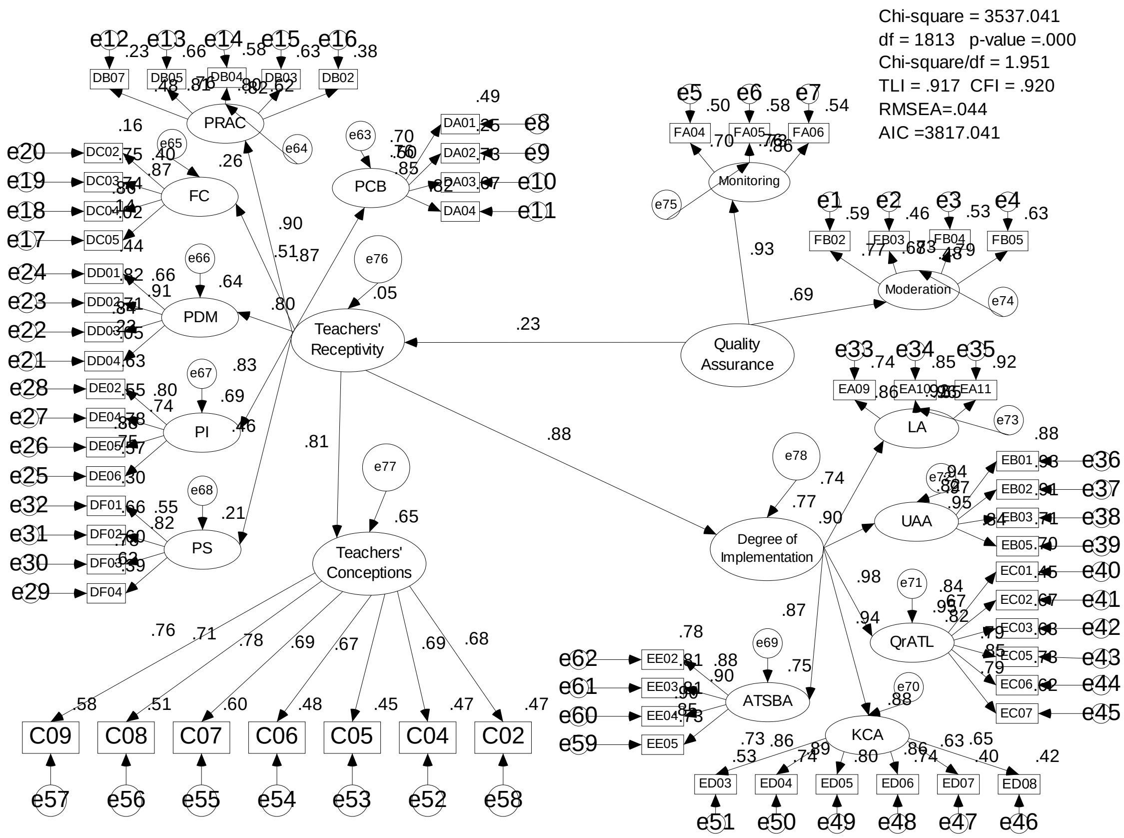

Figure 4.58. The parsimonious model

Table 4.47

Comparison of Goodness-of-Fit Indices between the Structural and Parsimonious Model

Model	χ^2	df	χ^2/df	RMSEA	TLI	CFI	PCFI	AIC
Structural	3534.9	1810	1.953	0.044	.917	.920	0.881	3820.9
Parsimonious	3537.0	1813	1.951	0.044	.917	.920	0.882	3817.0

In Table 4.47, the comparison of goodness-of-fit between the structural model and parsimonious model showed that there was a slight increase in PCFI [0.881 to 0.882] and a slight difference in AIC indices [3820.9 to 3817.0]. Therefore the parsimonious model was a better model to predict the effects of factors influencing the degree of implementation of CAMC.

Issues and Barriers Faced by the Vocational Teachers in Implementing Competency Assessment and Modular Certification (CAMC).

Responses from the open-ended item on issues and barriers faced by the teachers were categorized and are shown in Table 4.48. Responses on suggestions on how to improve the implementation of CAMC are discussed in the next chapter. There were six main issues and barriers found to be faced by the vocational teachers in implementing CAMC. They are issues related to infrastructure, funding, curriculum documents, assessment, teachers and students. These issues are discussed as follows;

Issues related to infrastructure

Infrastructure was the major issue. Three hundred and thruty-nine teachers responded that there was a lack of infrastructural facilities for teaching, learning and assessment for the vocational subjects. This infrastructural issue was re-categorized to five other issues. 59%, or 203 teachers responded that their workshops lacked equipment. There were 65 (19.2%) teachers who said that the tools supplied to their schools were of low quality and did not follow the specification outlined by MOE. Another 37, (10.9%), of teachers responded that there was a lack of workshops and workshop facilities in their schools. There were 28 (8.3%) teachers who responded that their workshop was too small and cramped, and that there was little space to move around when a practical class was being carried out. This, they said could also easily cause accidents. Finally, six (1.8%) teachers mentioned that the power supply to their workshop was insufficient. There was equipment that needed higher voltage to run, which could not be used because of the insufficient power supply.

Issues related to funding

Funding was the second major issue. There were 315 teachers who responded that there was a lack of funding to implement the vocational subjects. This funding issue was then re-categorized to three issues. Two hundred and ninety-one (92.4%) teachers responded that the per capita grant (PCG) allocated for a vocational subject was insufficient. They highlighted that most of the raw materials had increased in price. Some of the materials were too expensive and the school could not afford to purchase it. This has hindered them in carrying out the teaching and assessing of certain modules. A further 20 (6.3%) teachers responded that there no funds were allocated for the maintenance of the machines and equipments. These machines needed to be serviced from time to time to ensure that they remained in good condition and to avoid any accidents in the workshop. Four (1.3%) teachers said that there were no funds allocated to replace faulty machines and other equipment. Some of the supplied equipment was of low quality and spoilt easily. The school then needed to purchase new machines and equipment to be able to continue to carry out the teaching and assessing of those vocational subjects.

Table 4.48

The Frequency of Responses on Issues and Barriers Faced by The Vocational Teachers in Implementing CAMC

No	Categories	No. of responses	Total
1	Issues related to infrastructure		
	- Shortage of equipment	203 (59.9%)	339
	- Low quality of tools supplied	65 (19.2%)	(100%)
	- Lack of workshop and workshop facilities	37 (10.9%)	
	- Workshop too small	28 (8.3%)	
	- Power supply to workshop insufficient	6 (1.8%)	
2	Issues related to funding		
	- low level of funding	291 (92.4%)	315
	- No fund for maintenance of machines/equipment	20 (6.3%)	(100%)
	- No fund to replace spoilt machines/equipments	4 (1.3%)	
3	Issues related to curriculum documents		
	- a few subjects need to be revised	135 (47.4%)	285
	- Not accordance to industrial needs and standards	123 (43.2%)	(100%)
	- Outdated	17 (6.0%)	
	- Old terminology used	10 (3.5%)	
4	Issues related to assessment (CAMC)		
	- too much paper work	189 (68.7%)	275
	- incur extra cost for re-assess cases	67 (24.4%)	(100%)
	- not monitored by MOE	11 (4.0%)	
	- score not moderated by MOE	5 (1.8%)	
	- no action taken after feedback given to MOE	3 (1.2%)	
5	Issues related to teachers		
	- heavy workload	174 (64.7%)	269
	- No critical allowances	53 (19.7%)	(100%)
	- no lab/workshop assistant	22 (8.2%)	
	- no training/briefing given	11 (4.1%)	
	- Given other duties besides vocational subjects	9 (3.3%)	
6	Issues related to students		
	- absenteeism of students	126 (49.8%)	253
	- discipline problem students	89 (35.2%)	(100%)
	- no interest in the subject	30 (11.9%)	
	- not motivated	8 (3.2%)	

Issues related to curriculum document

The curriculum document was the third major issue. Two hundred and eighty-five teachers responded with problems regarding the curriculum document. This curriculum document issue was re-categorized to four issues. There are 135 (47.4%) teachers who responded that the curriculum document, for some subjects, needed to be revised. One hundred and twenty-three of them (43.2%) answered that the curriculum document for certain subjects was not in accordance with industrial needs and standards. There were 17 (6.0%) teachers who responded that some of the recommended modules in the curriculum document, for certain subjects, were outdated. Ten (3.5%) teachers added that some of the terminology used in the modules for certain subjects, were old and outdated.

Issues related to assessment (CAMC)

Assessment was the fourth major issue. There were 275 teachers who responded that there was a lack in the assessment system, that is the CAMC, for the vocational subjects. This assessment issue was re-categorized to five issues. There were 189 (68.7%) teachers responded that there was too much paper work in this system. There were too many forms to be filled in to record the scores. Sixty-seven (24.4%) teachers responded that cases of re-assessment incurred extra cost. Further, due to the low funding, some of them could not allow the students to be re-assessed unless the students were willing to buy their own materials. There were 11 (4.0%) teachers who responded that the MOE did not monitor the implementation of CAMC in their schools ; and five (1.8%) teachers responded that their scores for the CAMC were not moderated by the MOE, nor by any personnel appointed by the MOE. There were 3 (1.2%) teachers who said that they had voiced out their problems and provided feedback to the personnel who monitored their school, but no action was taken by the MOE.

Issues related to teachers

The vocational subject teachers was the fifth issue. There were 269 teachers who responded that there were issues related to the teachers of vocational subjects. This teachers' issue was re-categorized to five issues. There were 174 (64.7%) teachers who responded that they were overloaded with work in teaching, and assessing the CAMC. 53 (19.7%) teachers felt that they should be given critical allowances as their workload was heavier compared to teachers who taught mathematics and science in English. There were 22 (8.2.0%) teachers who responded that the MOE had not sent laboratory or workshop assistants to their school. There were 11 (4.1%) teachers who responded that they had not attended any of the briefings or trainings conducted by the Malaysia Examination Syndicate (MES), and nine (3.3%) teachers said they had been given other duties in addition to teaching vocational subjects. This had added even more to their already heavy workload, and their ineffectiveness in carrying out their duties in school.

Issues related to students

The student was the final issue. There were 253 teachers who responded that there were issues related to the students of the vocational subjects. This issue was re-categorized to four issues. One hundred and twenty-six (49.8%) teachers who responded said the absenteeism rate was very high among these students. There were 89 (35.2%) teachers who responded that they were given students with discipline problems. These students, who were not academically inclined, were sent to take the vocational subjects as their elective subject. Thirty (11.9.0%) teachers answered to say that their students were not interested in the subjects offered to them. There were 8 (3.2%) teachers who responded that their students were not motivated to study the vocational subject offered to them.

Summary

The section dealing with preliminary analyses detailed the descriptive statistics, exploratory factor analyses (EFA) and confirmation factor analyses (CFA) which were performed, in order to determine the best factor structure to represent the latent variables in this study. The second section presented findings related to the specific research questions, from the testing of the measurement and the structural models, to examining the model fit, and the direct and indirect effects of factors influencing implementation of CAMC.

The measurement and structural model fitted adequately to the data. The Quality Assurance Measures explained 4.8% of variance in Teachers' Receptivity. In addition, Quality Assurance Measures and Teachers' Receptivity explained 66.1% of variance in Teachers' Conceptions. Furthermore, Quality Assurance Measures, Teachers' Receptivity and Teachers' Conceptions explained 77.6% of variance in Degree of Implementation. Teachers' Receptivity (TR) showed significant direct effect on the Degree of Implementation (DOI). There were two other pairs of latent variables that showed significant direct effects – The Quality Assurance Measures (QA) on Teachers' Receptivity (TR) and the Teachers' Receptivity (TR) on Teachers' Conceptions (TC).

On the other hand, only the Quality Assurance Measures (QA) showed significant indirect effect on Degree of Implementation (DOI) through Teachers’ Receptivity (TR). Teachers’ Receptivity (TR) mediated the relationship between Quality Assurance Measures (QA) and Degree of Implementation (DOI). Therefore Teachers’ Receptivity (TR) is a mediator.

The third section presented findings on multiple group analysis of the model and the parsimonious model. The multiple group analysis for all the four demographic variables, that is, gender, experience, training and teachers’ field of specialization, indicated that there was no significant difference in the structural model across groups. All the models showed a reasonable fit to the data and the p-value for all the groups was more than 0.05, so all the four demographic variables, that is, gender, experience, training and teachers’ field of specialization were not moderating variables.

The final section presented the findings from the open-ended items on issues and barriers faced by the vocational teachers in implementing CAMC. The responses were categorized into six main issues They were issues related to infrastructure, funding, curriculum documents, assessment, the teachers and students. In the concluding chapter, the statistical results from this chapter are interpreted and discussed in greater detail.