EXPLORATORY FACTOR ANALYSIS (EFA) AND CONFIRMATORY FACTOR ANALYSIS (CFA) TO MEASURE THE VALIDITY AND RELIABILITY CONSTRUCTS OF HISTORICAL THINKING SKILLS, TPACK AND APPLICATION OF HISTORICAL THINKING SKILLS

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Abstract:

In teaching and learning sessions, the effectiveness of applying Historical Thinking Skill (TKPS) elements to students depends on the level of teacher mastery in Historical Thinking Skill (KPS) and the skills of adapting Technological, Pedagogical and Content Knowledge (TPACK) components in teaching and learning sessions and approach study uses quantitative studies based on the Structural Equation Model (SEM). This study aims to develop and verify the validity and reliability of the instrument using the Exploration Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) to measure the construction of KPS, TPACK and TKPS. This study has adapted the instruments developed by some earlier researchers, and also modified some statements in accordance with current studies. Therefore, it is necessary to re-run the Analysis of Factor Analysis of the Exploration (EFA) and Confirmatory Factor Analysis (CFA), as the current study area may differ from previous studies, or the current study population is far different from previous studies in terms of socio-economic status, ethnicity and culture (Awang, 2010). The samples of this research were 100 upper secondary school Islamic Education teachers from various districts in Kelantan, Malaysia. After implementing the EFA, the constructs of historical thinking skills (KPS) and application of historical thinking skills (TKPS) were scaled down from five sub-constructs each to only one main construct for each set of skills with 18 and 13 items respectively. As for the TPACK construct, after the implementation of EFA,

some items were moved to other constructs. Then, in the second stage of this study, CFA was implemented and after its implementation, 12 items and one construct (Technological construct) were deleted. Finally, only three main constructs (KPS, TKPS and TPACK) and 2 sub-constructs (Pedagogical and Content Knowledge) were proved to be statistically significant with the 35 remaining items and proceeded to be used for further study.

Keywords:

Exploratory Factor Analysis (EFA); Confirmatory Factor Analysis (CFA), Historical Thinking Skill (KPS), Technological, Pedagogical And Content Knowledge (TPACK) And Application Of Historical Thinking Skill (TKPS)

Introduction

History was made a core subject in the Curriculum Standard for Secondary Schools (KSSM) starting from 2017 aimed at producing students to master the historical knowledge of Malaysia and the world (Ministry of Education Malaysia, 2013; Center for Curriculum Development (PPK), 2016). Accordingly, teachers should be have an expertise to aply the process of Historical Thinking Skills (KPS) during its teaching and learning to allow students to develop critical thinking skills by placing themselves in a position of an experienced historian while studying history (Atkin, 2016; Bickford II & Bickford, 2015). How do they position themselves in a position of an experienced historian are depending on expertise of teacher apply the sub concept of KPS during teaching and learning process. The five sub concept of KPS are Cronology, Rasionalism, Imagination, Interpretation and Validity Evidence. An expertise of teacher deliver the combination of sub concept will be effected students' appreciation of historical elements during the learning process.

In the context of history education in Malaysia, the goals of teaching and learning History enshrined in the syllabus are to guide students to understand the state of our society and country and their relationship with the world history. Studies on the implementation of historical thinking skills (KPS) in history-related education need to be explored further. Zarina Yassin (2013) in her study suggests that KPS has the ability to instill the skills of critical thinking, making connections between one event and another, exploring evidence and building imagination among students. This supports the opinion of Ahmad Raffi Ayudin (2011) who stresses that it is important for students to understand the concepts of history first before discussing the characteristics as well as the causes and consequences of history. All these put historical thinking skills (KPS) are the important components of the process of developing the thinking skills on appreciation of historical elements and should be applied to students in particular and teachers in general during teaching process, especially in the subject of History. Marzona, et al. (1998) explain that historical thinking involves a set of mental operations known as processes. These processes include concept formation, principle formation, understanding, problem solving, decision making, investigating and merging thinking skills. The thought process in the early stages concentrates more on the acquisition of knowledge, while in the final stages it focuses more on the production and application of knowledge. The ability of teachers in applying KPS to students depends entirely on their level of competence and mastery of the KPS concept.

The effectiveness of the KPS application to students is influenced by an intermediary component known as TPACK (Technological, Pedagogical and Content Knowledge). TPACK components involve the level of mastery of technology among teachers where integration of technology in the classroom is practiced and measured by its pedagogical impact on teaching and learning as well as the ensuing student achievement. Technological knowledge of content pedagogy includes pedagogical reasoning about content with an understanding of how technology can be used to support teaching and learning objectives (Niess & Gillow, 2013). In teaching and learning sessions, the effectiveness of applying KPS elements to students depends on the level of teacher mastery in KPS and the skills of adapting TPACK components in teaching and learning sessions.

KPS has five specific skills, namely, understanding chronology, exploring evidence, making interpretations, building imagination, and making rationalizations. These five skills, literally, involve thought processes and procedural skills between teachers and students. Teachers should wisely guide students to make connections between the past and the present, analyze, research and process evidence, hypothesize, understand and provide explanations as well as make judgments. In the case of Islamic Education, these processes can be implemented if the teacher involves the students to think actively in the teaching and learning (PdPc) of Seerah Nabi (Biography of Prophet Muhammad P.B.U.H). Such an approach allows the five stated skills to be applied by students (Zahara & Nik Azleena, 2007). Meanwhile, the TPACK component consists of three sub-components, namely, technological, pedagogical and content knowledge. All of these components are known as latent variables and their measurement was processed using questionnaire items.

There were many instruments developed, to measure these components in previous studies by earlier researchers, such as, a survey of the the willingness of history teachers to apply historical thinking skills to students (Nik Azleena Nik Pa (2006), historical thinking skills among prospective teachers in public institutes of higher learning (Zarina Mohd Yassin , 2013), validation of e-learning acceptance instruments (Ros Ayu Abdullah , 2015), evaluation of the implementation the education curriculum model-based Islamic secondary school Context-Input-Proses-Product (CIPP) (Azizi Jaafar, 2015) and instrument construction for TPACK components (Shukri Ismail, 2019). Some statements in these previously developed instruments were modified and adapted to suit this research. Awang (2010), Awang (2012a), Hoque and Awang (2016), Hoque et al. (2017) and Noor et al. (2015), assert that a researcher needs to re-run the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis if a researcher adapts instruments from previously established researches.

The EFA procedure was purposefully selected because it could be interpreted more easily and meaningfully by reducing the dimensions of the original data to some smaller components (Duntemen, 1989; Field, 2006; Lewis-Beck, 1994). CFA allows the researcher to establish whether a pool of observed variables, underlying broader theoretically derived concepts, can be reduced into a smaller number of latent factors. As such, CFA is used for several purposes including scale development and as a foundation for latent regression analysis and structural equation modelling (SEM). Data should be continuous and include a sufficient number of observed variables to allow the model to be "identified.". As for CFA, it was employed because it is a method of finding and determining significant indicator variables against latent variables before evaluating the dominant indicators that have been formed by EFA

Purpose Of The Study
Generally, this study was designed to confirm the dimensions and constructs of proposed items for the historical thinking skills, application of historical thinking skills and technological, pedagogical and content knowledge. Several aspects were emphasized namely the constructs for validity and reliability of historical thinking skills, application of historical thinking skills and technological, pedagogical and content knowledge as well as the compatibility of study data with the proposed measurement model. This study was also meant to identify the fitness of data set to the proposed measurement model or constructs. The purposed of this method to evaluate the level of significant data set either suitable to proposed model or not.   If the propose model not suitable or not fit with data set, this proposed model needed to modified or re-construct. This process will be do continuously until acceptable level were achieved.

Methodology

Study Design
This study will used quantitative study and employed a cross-sectional study design.

A cross-sectional study is a type of research design in which collecting data from many different individuals at a single point in time. In this study, a set of questionare will be deliver to the sample (Islam teacher at Kelantan).

Sample
The Islamic Educations teachers who teach upper secondary schools in the districts of Kelantan were chosen as the population of this research. The research samples consisted of 100 teachers were determined using stratified random sampling technique and the Krejcie and Morgan (1970) formula was applied to determine the sample size.   Data were gathered using a set of questionnaires from established instruments based on educational environment in Malaysia.

Questionnaire: Application of Historical Thinking Skills
The questionnaires consisted of 47 items with 3 conceptually distinct subscales that included Historical Thinking Skills (Chronology – 4 items , Rationalism – 4 items, Interpretation – 4 items, Imagination – 3items, Validity Evidence – 3 items), TPACK (Pedagogical knowledge – 6 items, Content Knowledge – 5 items, technological knowledge – 5 items,) and Application of Historical Thinking Skills (Chronology – 3 items, Rationalism – 3 items, Interpretation – 3 items, Imagination – 2 items, Validity Evidence – 2 items). The items were rated on a 5-point Likert scale ranging from 1 (disagree) to 5 (Totally agree).

Exploratory Factor Analysis (EFA)
Researches on historical thinking skills (KPS), application of historical thinking skills (TKPS) and TPACK (Pedagogical, Technological and content knowledge) rarely used SEM-based (Structural Equation Modelling) model constructed from the theoretical analysis of various relationships among the variables in a study. To confirmed the validity and reliability of questionnaire items we need to employ the right techniques to evaluate them.

In this study, 100 Islamic Education teachers were surveyed and the re-run of EFA on items measuring constructs was then conducted in pilot studies after taking into account the recommendations by Awang (2010); Awang (2012a) and Hoque et al. (2017). In this study, the items for the KPS, TKPS and TPACK constructs initially consisted of 47 items (refer figure

1). The KPS construct consisted of five sub-constructs namely Chronology, Rationalism, Interpretation, Imagination and Validity Evidence. The TPACK construct consisted of three sub-constructs which were Pedagogy, Content Knowledge and Technology. The third main construct was Application of Historical Thinking Skills. It contained five sub-constructs named Application of Chronology, Application of Rationalism, Application of Interpretation, Application of Imagination and Application of Validity Evidence.
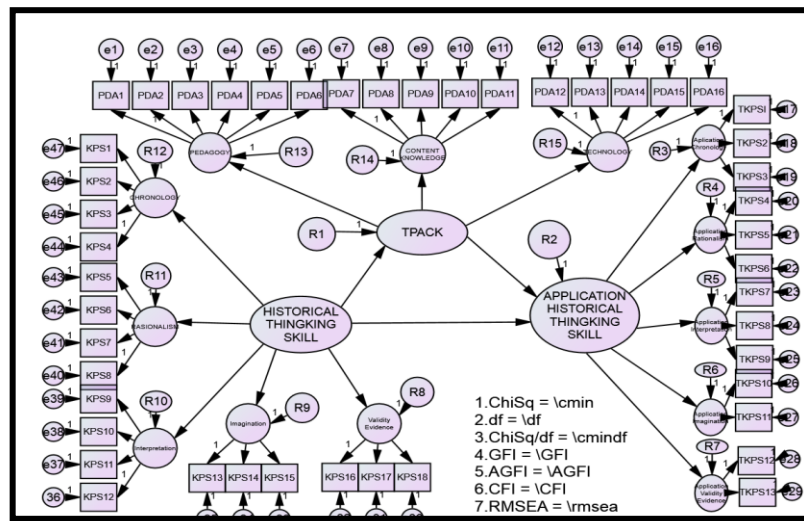

Figure 1: Proposed Structural Model

EFA for Constructs of Historical Thinking Skill (KPS)

Constructs of historical thinking skill (KPS) were initially measured using five sub-constructs which consisted of 18 items labeled as KPS1 to KPS18 (refer Figure 1). The interval scale between 1 to 5 was used to measure the items for each statement. The constructs of the historical thinking skills (KPS) with 18 items were analyzed through EFA procedure using the principal of Varimax Rotation. From the analysis, the P-Value was found to be less than 0.05, thus it shows that the Bartlett Test value was significant. The value of Kaiser-Meyer-Olkin (KMO) was measured at 0.954 which was above the minimum value of 0.6 (Awang, 2010;2012a; Hoque and Awang, 2016; Hoque et al., 2017). Therefore, both respected criteria, Bartlett Test and KMO value of > 0.6 from the observed data, were appropriate for Factor Exploration Analysis procedure (Awang, 2010;2012a; Hoque and Awang, 2016).

Table-1. Estimated Amount of Variance

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
1	13.875	77.083	77.083	13.875	77.083	77.083
2	.729	4.053	81.136			
3	.534	2.969	84.105			

Table 1 shows the findings of total variance explained from the construct of historical thinking skills measured by only one component. KPS which was the main construct initially had five sub-constructs with 18 items but this was modified to only one main construct keeping all the 18 items. The KPS constructs could be measured directly through 18 items: KPS11(.922), KPS16 (.916), KPS8 (.916), KPS15 (.909), KPS17 (.906), KPS10 (.901), KPS18 (.900), KPS13 (.899), KPS9 (.886), KPS1 (.876), KPS3 (.864), KPS7 (.863), KPS4 (.860), KPS14 (.856), KPS12 (.852), KPS5 (.842), KPS6 (.818) and KPS2 (.806). Table 2 shows the summary of EFA findings for KPS constructs.

Table 2: Component Position and Construct Items for Historical Thinking Skills (Before & After EFA)

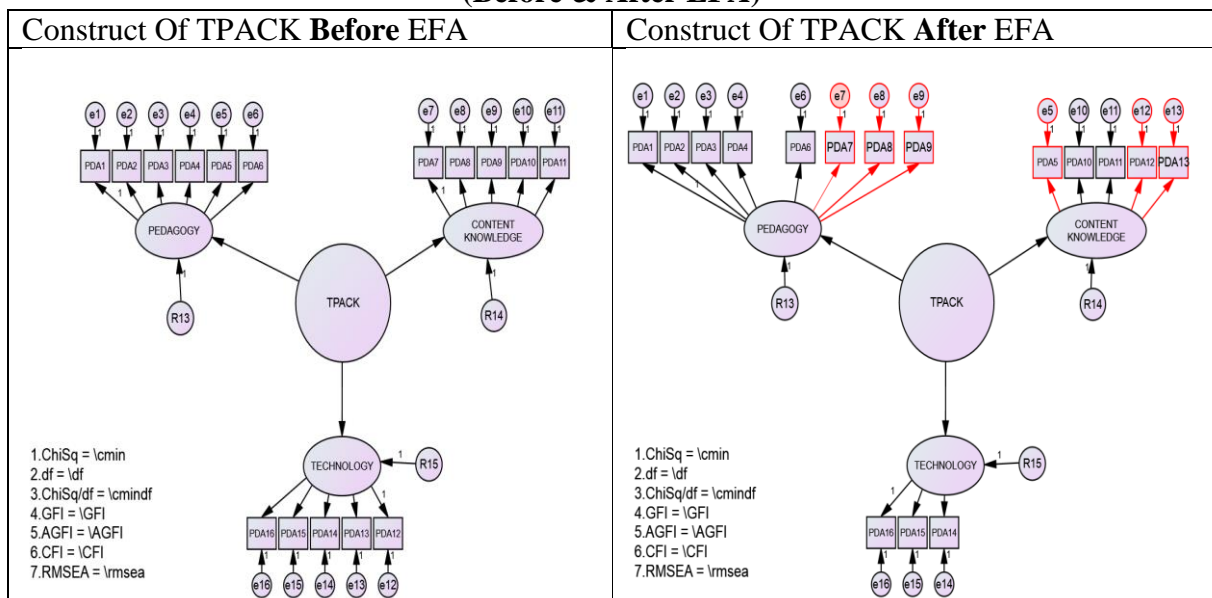| Construct of Historical Thinking Skills **Before** EFA	Construct of Historical Thinking Skills **After** EFA
KPS as the main construct with five sub-constructs and 18 Items.	KPS as the main construct with 18 Items.
Finding: The KPS constructs can be measured directly through 18 items	

EFA for TPACK Construct

Constructs of technological, pedagogical and content Knowledge (TPACK) were initially measured using three sub-constructs that consisted of 16 items labeled PDA1 to PDA16, (refer Figure 1). The finding of the analysis shows that P-Value was less than 0.05 thus it proved that the Bartlett Test value was significant and the value of Kaiser-Meyer-Olkin (KMO) was 0.954 which was above the minimum value of 0.6 (Awang, 2010;2012a; Hoque and Awang, 2016; Hoque *et al.*, 2017). Based on the findings for both criteria, Bartlett Test and KMO value> 0.6, it was proven that the observed data were appropriate for the Factor Exploration Analysis procedure (Awang, 2010;2012a; Hoque and Awang, 2016).

Table 3: Estimated Amount of Variance for TPACK Construct

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
1	9.901	61.884	61.884	6.474	40.461	40.461
2	2.028	12.674	74.558	4.512	28.201	68.662
3	1.313	8.205	82.763	2.256	14.101	82.763
4	.595	3.719	86.482			

Table 3 demonstrates the construct of TPACK measured in three sub-components. The construct of pedagogy measures as much as 40.461%, content knowledge 28.201% and technology measures as much as 14.101%. Hence, the minimum requirement of 60% was achieved when the total rotation sums of squared loadings equal 82.763% and this value is sufficient (Awang, 2010;2012a; Hoque and Awang, 2016; Hoque *et al.*, 2017). The three components are Component 1: PDA9 (.909), PDA8 (.890), PDA6 (.885), PDA7 (.841), PDA2 (.775), PDA1 (.771), PDA3 (.653), PDA4 (0.633); Component 2: PDA10 (.871), PDA11 (.856), PDA13 (.811), PDA12 (.799), PDA5 (.635) and Component 3: PDA15 (.931), PDA16 (.833), PDA14 (.657).

The Alpha Cronbach values must exceed the minimum of 0.7 for estimated internal reliability of the instruments. The value for each component of the pedagogical construct for items PDA1, PDA2, PDA3, PDA4, PDA6, PDA7, PDA8 and PDA9 was 0.968. For the content knowledge construct with items PDA5, PDA10, PDA11, PDA12 and PDA13 the value was 0.953 and the last component was technological construct with items PDA14, PDA15 and PDA16 was valued at 0.735. All the Alpha Cronbach values exceeded the minimum value of 0.7. This result supported the idea that the construct of Pedagogical, Technological and Content Knowledge can be applied in this study (Awang, 2010;2012a; Hoque and Awang, 2016; Hoque *et al.*, 2017). Table 4 shows the summary of EFA findings for TPACK constructs.

Table 4: Items and Positions for TPACK Construct
(Before & After EFA)

| Construct Of TPACK **Before** EFA | Construct Of TPACK **After** EFA |

TPACK is the main construct with three sub-constructs and 16 Items.	TPACK is still the main construct with three sub- constructs and 16 items but some items were moved to other constructs: i) PDA5 (Pedagogical Construct) moved to Content Knowledge Construct. ii) PDA12 and PDA13 (Technological Construct) moved to Content Knowledge Construct. iii) PDA7, PDA8 and PDA9 (Content Knowledge Construct) moved to Pedagogical Construct

EFA for Application of Historical Thinking Skill (TKPS) Construct

The construct for application of historical thinking skills (TKPS) was initially measured using five sub-constructs that consisted of 13 items labeled TKPS1 to TKPS13 (refer Figure 1). From the analysis, the finding for P-Value was less than 0.05 showing the Bartlett Test value was significant and the value of Kaiser-Meyer-Olkin (KMO) was 0.947 which was above the minimum value of 0.6 as needed (Awang, 2010;2012a; Hoque and Awang, 2016; Hoque *et al.*, 2017). The achievement of both criteria, Bartlett Test and KMO > 0.6, means the observed data were appropriate for the Factor Exploration Analysis procedure (Awang, 2010;2012a; Hoque and Awang, 2016).

The percentage of items measuring the purpose of study could be evaluated using the Total Variance Explained. Table 5 shows the total value of the variance estimated by the items used to measure the construct of application of historical thinking skills. This construct was measured using 13 items in 5 components initially, but it was changed to only one dimension at the final stage of analysis. The 13 items measuring the construct of application of historical thinking skills contributed 68.991% to sums of squared loadings. The minimum requirement of 60% was well achieved when the total rotation sums of squared loadings equal 68.991% and this value was sufficient (Awang, 2010;2012a; Hoque and Awang, 2016; Hoque *et al.*, 2017). (Awang, 2010;2012a; Hoque and Awang, 2016; Hoque *et al.*, 2017).

Table 5: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
1	8.969	68.991	68.991	8.969	68.991	68.991
2	.775	5.960	74.952			
3	.564	4.342	79.294			

Table 5 shows the construct of application of historical thinking skills measured using only one component. TKPS as the main construct with five sub-constructs and 13 items initially was converted to only one main construct with 13 items. The TKPS construct could be measured directly by the 13 items. The researchers had to determine whether the items selected to measure the component would meet the standard needed. The analysis revealed these results:

TKPS7 (.880), TKPS4 (.873), TKPS12 (.869), TKPS13 (.856), TKPS11 (.848), TKPS10 (.829), TKPS6 (.823), TKPS5 (.819), TKPS9 (.818), TKPS8 (.817), TKPSI (.801), TKPS2 (.789), TKPS3 (.769). All these items have factor loading exceeding the minimum limit of 0.6. As suggested by Awang (2010); Awang (2012a) and Hoque and Awang (2016); Hoque *et al.* (2017), items with a sum of less than 0.6 should be excluded as they do not contribute to the construction of the constructs. Hence, the items with a weighting factor of less than 0.6 were excluded from the questionnaire. The Alpha Cronbach value for the component of the application of historical thinking skills was 0.962 exceeding the value of minimum 0.7. This result supported the construct of application of historical thinking skills for further use in this study (Awang, 2010;2012a; Hoque and Awang, 2016; Hoque *et al.*, 2017).

Table 6: Component Positions and Items for The Construct of Application Historical Thinking Skills
(Before & After EFA)

Construct of Application of Historical Thinking Skills **Before** EFA	Construct of Application of Historical Thinking Skills **After** EFA
TKPS is the main construct with five sub-constructs and 13 items.	TKPS is the only main construct with 13 items.
Finding: The TKPS constructs can be measured directly using 13 items	

Confirmatory Factor Analysis (CFA).

In Exploratory Factor Analysis (EFA), data is simply explored to provide information about a number of factors or constructs required to represent the data. Confirmatory Factor Analysis, on the other hand, is a method of finding and determining significant indicator variables against latent variables and then evaluating the dominant indicators that have been formed by EFA. To fit the measurement model, the items that have low factor loading should be removed from the model through CFA. CFA has the ability to assess the criteria of unidimensionality, validity and reliability of the measurement model (construct) (Awang, 2012; 2014; 2015; 2015a, Hoque et al., 2017, Kashif et al., 2015; 2016; 2017, Mohamad et al., 2016, 2016a). While modelling the interrelation of their variables in a structural model (SEM), researcher could also assess validity and reliability after the unidimensionality assessment criteria has been done.

Latent construct that has acceptable factor loading items is considered as meeting the unidimensionality criterion. The level to achieve for new items should be greater than 0.5 and for established items it should be greater than 0.60 (Awang, 2012; 2014; 2015; 2015a). Three types of validity assessment required for each model are: i) Convergent Validity - this validity

is satisfied when all items in a measurement model are statistically significant (the items achieved their factor loading) and the value of Average Variance Extracted (AVE) should be 0.5 or higher. ii) Construct Validity - When the Fitness Indexes for all constructs achieved the required level, this validity is achieved. iii) Discriminant Validity - when the measurement model is free from redundant item, this validity is realized (Awang, 2011, 2012, 2014, 2015; Awang et al., 201 5a and Mohamad et al., 2016, 2016a). For reliability assessment, three criteria for each model are needed to identify: i) Internal reliability - when Cronbach's Alpha coefficient is greater than 0.70, this reliability is met. ii) Composite Reliability - the value of CR >0.6. shows there is good reliability and internal consistency for a latent construct, iii) Average Variance Extracted (AVE) - AVE of >0.5 is required, this indicates the average percentage of variation as explained by measuring items for a construct (Awang (2012; 2014; 2015; 2015a)). CFA can be done either through single measurement for every model or through pooled measurement model. In this research, the researchers decided to do pooled measurement model of historical thinking skills, TPACK and application of historical thinking skills.

Pooled CFA Measurement Procedure of Historical Thinking Skill (KPS), TPACK and Application of Historical Thinking Skill (TKPS).
The Pooled CFA measurement procedure would estimate the factor loading item of constructs, the correlation value between the constructs, and the fitness indexes of the measurement model.
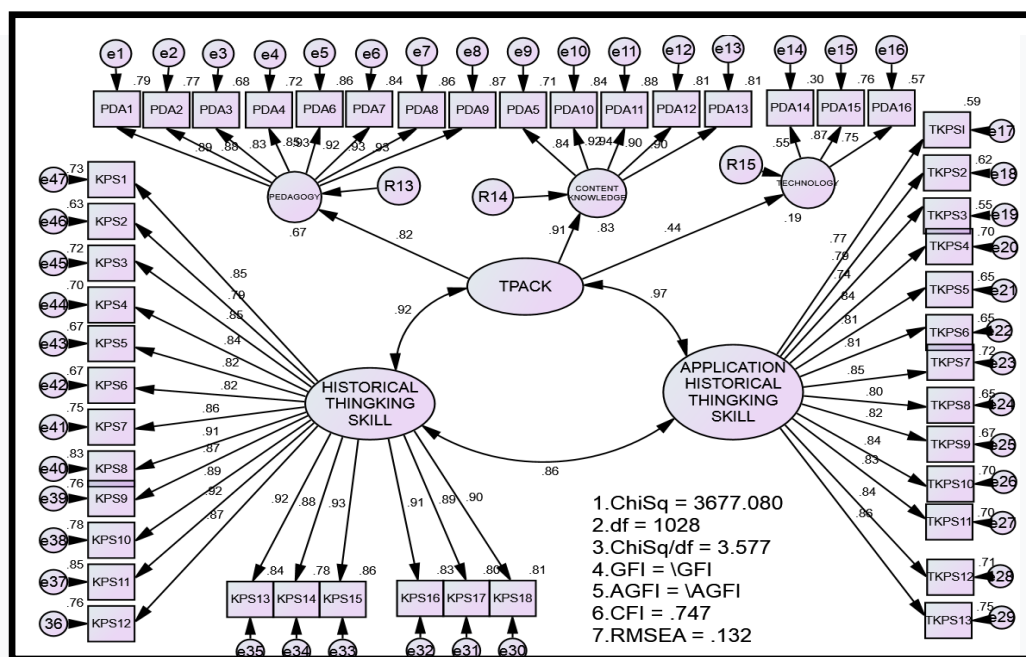

Figure 2: Pooled Measurement Model of KPS, TPACK and TKPS

Figure 2 shows that certain fitness indexes in pooled measurement model have failed to achieve the required level. Referring to the fitness indexes, it could be seen that: i) Absolute fit: RAMSEA=0.132>0.08 (unsatisfactory), ii) Incremental fit: CFI=0.747<0.90 (unsatisfactory), iii) Parsimonious fit: Chi/df =3.577<5.0 (satisfactory). In the fitness indexes, even though all the factor loadings for all items are greater than 0.60, two of the required categories (Absolute fit and Incremental fit) have not achieved the needed level. This could have been caused by redundancy between the two items.

Table 7: Modification Indexes

Item		Item	MI	Comment
e18	<-->	e17	24.536	
e1	<-->	e4	18.329	
e17	<-->	e18	45.724	MI>15, indicates items TKPS1 and TKPS2 are redundant

Table 7 illustrates the value of MI for correlated errors between each item. If MI is greater than 15, it means that redundant items exist in the model. The MI for e17 and e18 are 24.536 and 45.724 respectively, this indicates that both items are redundant. These items have caused the measurement model to have a poor fit and modification is needed by setting these two correlated measurement errors of redundant items as "free parameter" or deleting one of the two redundant items and run a new measurement model. The modifications have been done on the pooled measurement model and finally, the researchers got the pooled measurement model that met the required fitness indexes level as seen in Figure 3.
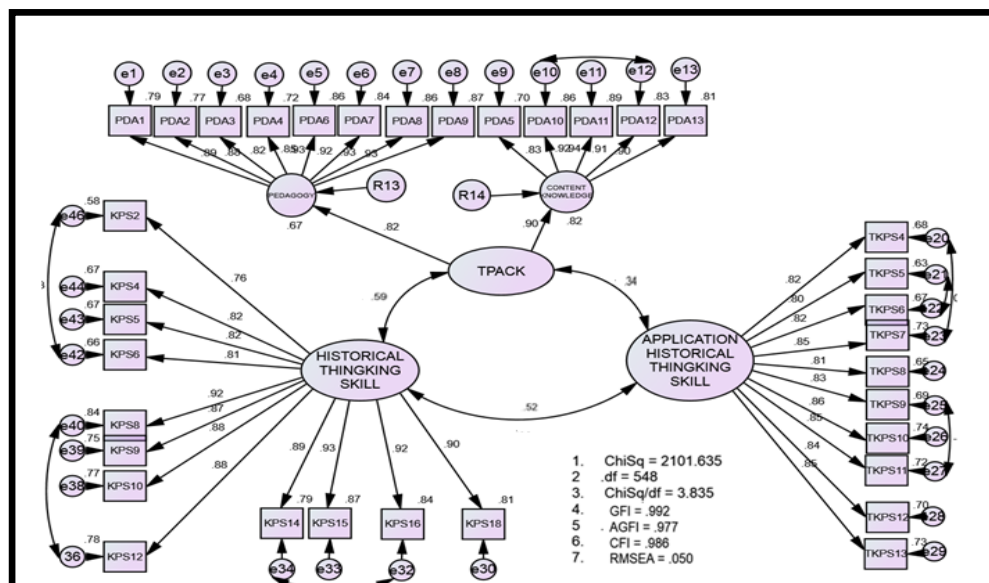

Figure 3: Pooled Measurement Model For Historical Thinking Skills, TPACK And Application Of Historical Thinking Skills.

Figure 3 above confirms that after the modifications of the model, all the fitness indexes have achieved the required level: i) Absolute fit: RAMSEA=0.05<0.08(satisfactory), ii) Incremental fit: CFI=0.966>0.90 (satisfactory), iii) Parsimonious fit: Chi/df =3.835<5.0 (satisfactory). The Technological construct has been deleted because it was not significant to the main construct and all of the factor loading of items were greater than 0.60.

The next step that the researchers needed was to assess the validity and reliability for the construct of historical thinking skills (KPS), TPACK and application of historical thinking skills (TKPS).

The Average Variance Extracted (AVE) and Composite Reliability (CR) are the important statistics that need to be calculated first. AVE and CR are important to identify whether the validity and reliability for constructs are achieved for the required criteria.

The result of Pooled CFA Measurement of KPS, TPACK and TKPS is displayed in Table 8.

Table 8: The CFA Results for the Measurement Model of KPS, TPACK and TKPS

Constructs	Item/Sub Construct	Factor Loading	CR >0.60	AVE >0.50	$\sqrt{AVE}$
Historical Thinking Skill (KPS)	KPS2	0.76	0.97	0.75	0.86
	KPS4	0.82			
	KPS5	0.82			
	KPS6	0.81			
	KPS8	0.92			
	KPS9	0.87			
	KPS10	0.88			
	KPS12	0.88			
	KPS14	0.89			
	KPS15	0.93			
	KPS16	0.92			
	KPS18	0.90			
Application Of Historical Thinking Skill (TKPS)	TKPS4	0.82	0.97	0.738	0.86
	TKPS5	0.80			
	TKPS6	0.82			
	TKPS7	0.85			
	TKPS8	0.81			
	TKPS9	0.83			
	TKPS10	0.86			
	TKPS11	0.85			
	TKPS12	0.84			
	TKPS13	0.85			
TPACK	Pedagogy	0.82	0.85	0.74	0.86
	Content Knowledge	0.90			

Based on the CFA results in Table 8, the researchers have made conclusions below on the Unidimensionality, Validity and Reliability of the KPS, TKPS and TPACK constructs:

i) Unidimensionality:
All factor loading items for historical thinking skills (KPS), application of historical thinking skills (TKPS) and TPACK have met their requirement level. All items have a factor loading above 0.60, so these items are significant to their respective measurement models. It can be concluded that all constructs comply with unidimensionality requirements.

ii) Reliability
Reliability can be achieved if all three reliability criteria for the measurement model are satisfied: a) Internal reliability - the Cronbach's Alpha coefficient items of the KPS, TKPS and TPACK constructs is greater than 0.70 (as discussed in EFA). b) Composite Reliability - The measurement of reliability and internal consistency for KPS, TKPS and TPACK constructs have the value of CR>0.60 (refer Table 8). c)Average Variance Extracted – The constructs of KPS, TKPS and TPACK have met the criteria because the value of AVE for each construct is greater than 0.50.

iii) Validity:
The measurement of validity model can be achieved if all three of the following validity criteria are satisfied. a) Convergent Validity - This validity was achieved when the AVE > 0.50 (KPS=0.75, TKPS=0.738, TPACK=0.74). b) Construct Validity - This validity was fulfilled when all the Fitness Indexes category have achieved the required level; Parsimonious Fit, Chisq/df=3.835 <5.00 (Satisfactory); Incremental Fit, CFI=0.985>0.90 (satisfactory); Absolute Fit, RMSEA=0.05< 0.08 (satisfactory). c) Discriminant Validity - This validity was met when all redundant items were removed or formed into item pairs (constrained as "free parameters") and the $\sqrt{}$ AVE value for KPS, TKPS and TPACK was greater than the correlation value between the constructs.

Table 9: The Discriminant Validity Indexes Summary

Construct	KPS	TKPS	TPACK
KPS	$\sqrt{AVE}$=0.86		
TKPS	correlation,r=0.52	$\sqrt{AVE}$=0.86	
TPACK	correlation,r=0.59	correlation,r=0.0.34	$\sqrt{AVE}$=0.86

Findings for the analysis of CFA Pooled Model show that the unidimensionality, validity and reliability of all measurement models have been achieved. Study could continue for Structured Equation Modelling (SEM) and hypothesis testing (Awang, 2012, 2014, 2015).

Conclusion
The findings from Exploratory Factor Analysis (EFA) have proven that the KPS component initially thought to be consisted of five sub-components (Chronology, Rationalism, Interpretation, Imagination, Exploring Evidence) was actually formed only by one component

with 18 items (Refer figure 2). At the Figure 1, the items for KPS were KPS1, KPS2…, KPS18. The findings of EFA also proved that the KPS application component believed to be consisted of five sub-components (Chronology Application, Rationalism Application, Interpretation Application, Imagination Application, Evidence-based Exploration Application) was also actually formed only by one main component which was KPS Application with 13 items. (Refer Figure 2). At the Figure 2, the items for TKPS were TKPS1, TKPS2,…, TKPS13. Hence, the biggest contribution of this study is that it has refuted the belief that KPS and Application of KPS had consisted of five sub-components. In reality the teachers evaluate all these sub-components using only one component. The findings of EFA and CFA analysis have also refuted the theory that the TPACK component consisted of three sub-components (Technology, Pedagogy and Content Knowledge). It actually consists of only two significant components namely Pedagogical and Content Knowledge components with 16 items. While EFA, the TPACK still have three sub component (Refer Table 4) but after CFA (Refer Figure 3), the measurement model Technology was deleted from model because not achieved their acceptable level of factor loading (less than 0.60).

Finally, resulting from EFA, historical thinking skills constructs have been changed to only one main construct with 18 items and application of historical thinking skills constructs have been altered to only one main construct with 13 items. As for the TPACK construct, the number of sub-constructs remained two but some items were moved to other constructs. Nonetheless, the number of items in TPACK construct was still 16. Initially, the number of constructs was 5 with 3 main constructs and 2 sub-constructs and the number of items was 47. After implementing CFA to the 3 main constructs (KPS, TKPS, TPACK) and 2 sub-constructs (Pedagogical and Content Knowledge) the number of items was lessen to 35 items. CFA was able to identify the unidimensionality, validity and reliability of KPS, TKPS and TPACK constructs. The unidimensionality for KPS, TKPS and TPACK constructs was achieved when the items have a factor loading above 0.60. The results of Cronbach's Alpha coefficient items were greater than 0.70, CR>0.60 and AVE >0.50 which show that the reliability criteria such as Internal reliability and Composite reliability were achieved for KPS, TKPS and TPACK constructs. The finding of EFA and CFA also proved that the validity criteria for KPS, TKPS and TPACK constructs like convergent validity, construct validity and discriminant validity have achieved the required Fitness Indexes category level when the value of AVE >0.50 and $\sqrt{AVE}$ was greater than correlation coefficient between KPS, TKPS and TPACK. Based on these findings, 35 items involved in the study are highly reliable to be used to measure historical thinking skill (KPS), application of historical thinking skills (TKPS) and TPACK.

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