

Leading sustainable schools in the Era of Education 4.0: Identifying school leadership competencies in Malaysian secondary schools

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Abstract

The purpose of the study was to develop an empirical School Leadership Competency Model for the era of Education 4.0 (SLCMEduc4.0) to identify school leadership competencies that facilitate and maximize effectiveness in leading sustainable schools in Malaysia. Exploratory Factor Analysis (EFA) was employed to identify the underlying factors whereas Confirmatory Factor Analysis (CFA) was applied to test the measurement models using Structural Equation Modelling. A total of 444 and 931 respondents completed the survey with usable data for EFA and CFA respectively. The results suggested that the SLCMEdu4.0 can be explained by eight factors namely; *Leading for Learning, Emotional Intelligence, Critical Thinking, Communication and Ethics, Collaboration, Decision Making and Problem Solving, Digital Dexterity and Entrepreneurial* with good fit statistics; normed $\chi^2=2.628$, TLI=.950, CFI=.954 and RMSEA=.042. With a total of 40 items, the model also features good convergent and discriminant validity and construct reliability. The SLCMEdu4.0 is a coherent premier model that provides useful feedback for practitioners in planning, designing and evaluating future professional development programmes for school leaders. The study encourages a fresh look at educational leadership development locally and globally specifically in enhancing the leadership development of Malaysian school leaders towards productive change in the era of Education 4.0.

Keywords: Fourth Industrial Revolution, Education 4.0, leading for learning, emotional intelligence, critical thinking, communication and accountability, collaboration, decision making and problem solving, digital dexterity and entrepreneurial.

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1 Introduction

The Fourth Industrial Revolution has already moved past our doorstep and has influenced unprecedented changes in every industry. The educational ecosystem is no exception and Education 4.0 has been developed to respond to these new demands so that the education arena can stay current and effective in a landscape of constant change (Tai & Omar, 2019). Schools are at the core of education and thus are facing multiple changes and challenges to prepare students in meeting changing education needs in the era of the Education 4.0. As front-line change agents in school reforms, school leaders have the critical task of developing an effective learning ecosystem to equip students holistically (Anastasiou and Papakonstantinou, 2015) to allow them to succeed in the era of the Fourth Industrial Revolution.

As such, the crucial task is now for the school leaders to balance external demands with the paramount need to reorganize and reengineer schools pertaining to learning and teaching processes (Brinia, 2018). In the light of the above, the capacity to act, rather than the capacity to think, becomes the critical measure for effective school leadership (Omar & Tai, 2019). Importantly, the success or failure of these actions would determine not only the future of the students, but also the power of the nation. Therefore, the need for effective school leadership with effective competence to meet the complex and multifaceted demands of the era of Education 4.0 is indisputable. This legitimizes the need for something 'new' in school leadership capacity especially the competence to best lead change in schools (Tai & Omar, 2019).

This situation has called for a closer examination of school leaders' competencies as their competence links significantly with student achievements (Tai & Omar, 2018). To this end, the question posed is whether Malaysian school leaders are sufficiently competent to lead school change effectively and transform the school system successfully. Although the need for effective school leadership for the era of Education 4.0 is widely acknowledged, there is much less certainty about which leadership behaviours are most likely to produce favourable outcomes. To equip school leaders with adequate competencies to lead school change effectively, we need a reliable and valid model to identify those critical leadership competencies that can help school leaders gauge school improvement and effectiveness in leading sustainable schools in the era of Education 4.0.

Although there are various models on school leadership competency, these models have been developed mostly in Western educational settings (Assari, et al., 2019). As the historical, cultural contexts and education system of Malaysia differ from Western settings, the lack of scientifically sound and locally developed model on school leadership competency for Education 4.0 necessitates a study to identify those critical competencies. Specifically, if school leadership is examined from a behavioural construct based on competencies, with a focus on the most critical competencies that can be learned, it is most likely that processes of school leadership development can be fine-tuned for greater efficiency (Tai et al.2014); particularly in enhancing leadership capacity to respond to the needs of the Education 4.0 and ultimately to transform the school system effectively. Therefore, to develop an indigenous school leadership competency model in the era of Education 4.0 from Malaysian perspective is imperative and appears to be a meaningful task.

2 The Fourth Industrial Revolution and Education 4.0

Industrial revolutions have evolved in several stages for 200 years since its first emergence. Every industrial revolution has had significant impact on global society, and the Fourth Industrial Revolution is no different. The main characteristic of the Fourth Industrial Revolution is the interconnectedness of the whole value chain in the global society that has weaved together supposedly autonomous systems created by intelligent networks of machines and data; the four crucial components for this new era are the internet of things, the internet of data, the internet of services, and the internet of people (Herold, 2016). Technology has become integrated into virtually every facet of life, influencing our lifestyles and values significantly.

To respond to the demands of Industry 4.0, Education 4.0 was developed and this has given a new impetus to educational transformation in terms of pedagogy, content, curricula and educational management. For instance, instead of traditional

teaching aids, technology-based tools and resources are being used to drive education in non-traditional ways (Tang, Wong & Cheng, 2015); teachers become facilitators of learning, rather than repositories of cultural wisdom to be delivered to their students (Dubovicki & Jukic, 2017). Instead of maintaining an exclusive focus on cognitive development, schools are places to construct knowledge and ideas (O' Flaherty & Beal, 2018). More importantly, the nature of learning is a uniquely personal and social activity between people that caters to every learner's changing needs, talent, passion and interest (Brown-Martin, 2018).

Therefore, it is believed that Education 4.0 will empower students towards innovations, resulting in raising achievement levels and greater student learning outcomes. Consequently, it creates trained, qualified professionals who are equipped with interdisciplinary thinking, social skills and other technical skills for a highly globalised and technological-driven world of work (Brown-Martin, 2018). Education is at the heart of preparing present and future generations to thrive in the competitive world (Mohamed, Valcke & De Wever, 2017). Transforming the education system from one that is based on facts and procedures, to one that actively applies knowledge to collaborative problem solving in the real world will be the main characteristic of Education 4.0 that will help overcome the challenges of Industry 4.0.

3 The conceptual framework of the study

In an attempt to identify competencies that predict effective school leadership in the era of Education 4.0 in Malaysia, few aspects need to be taken into consideration: a) the special features of the schools especially about its moral purpose and the core workforce is professional (Hallinger & Walker, 2017; Wendy Pan, Nyeu & Cheng, 2017); b) the major trends that have been identified occurring in the area of school leadership (Abrahamsen & Aas, 2016; Leithwood, Harris & Hopkins, 2008; Townsend, 2011); c) qualities of effective school leaders identified by extensive educational research (Bitterov et al., 2014; Day & Sammons, 2013; Drydale & Gurr, 2011; Freeman & Auster, 2011; Gray & Streshly, 2010; Hallinger & Huber, 2012; Welch & Hodge, 2018); d) the contextual changes and future challenges in the Malaysian education system (Ministry of Education Malaysia; 2016; Samuel, Tee & Pe Symaco, 2017); and e) future trends in leadership development across industries (Ng, 2015; Petrie, 2014; Shet et al., 2017).

Based on the above consideration and a review of the concerned literature, the conceptual framework of the study was developed based on the underpinned theories that evolved leadership theory (Day & Sammons, 2013; Northhouse, 2016) and competency theory (Cairns 2000; Boak & Coolican 2001). Indeed, leadership plays a critical role in any organizational development. The changing global conditions in the era of Industrial Revolution 4.0 such as the intensifying efficiency requirements, the pressing need for continuing learning and the advanced digital technologies call for new approaches to organizational leadership (Lappalainen, 2015). Over the last decade, research in leadership development has moved towards identifying the leadership competencies that help to accomplish organizational goals (Bitterova, Haskova & Pisonova, 2014; Shet, Patil & Chandawarkar, 2017). Generally, competencies are viewed as clusters of knowledge, skills, abilities and behaviours that demonstrate excellent performance (Duffy, 2009). These elements differentiate leaders from non-leaders (Bharwani & Talib, 2017; Bueno & Tubbs, 2005).

In the field of education, the leadership role is changing along with the shifting expectations for educational excellence. School leaders need to respond to the needs of the era of Education 4.0 with sufficient competencies so that they can be effective leaders to bring schools to the transformational edge and sustain the achievement continually. As effective leadership is of central concern in the school system (Ministry of Education, 2016), it is essential for school leaders to be agile and adapt their leadership practice to meet the needs of the students, stakeholders and the school systems in the era of Education 4.0 globally and locally. With the increasing demands for educational excellence, school leaders can only become effective leaders if they are able to gain new knowledge, skills and ability through effective professional development programmes or interventions systematically and continually.

Based on the above two main theories and the reviewing of the literature, the study with the variable such as school leadership competency for the era of education 4.0 was confined to 12 respective factors: *Leading for Learning, Emotional Intelligence, Integrity and Accountability, Critical Thinking, Communication, Collaboration, Creative and Innovative, Decision Making, Problem Solving, Managing Change, Digital Dexterity and Entrepreneurial*. The development of the School Leadership Competency Model for the era of Education 4.0 (SLCMEduc4.0) is an important effort for identifying the most effective competencies of school leaders in leading sustainable schools by taking into consideration the challenges of the era of Education 4.0 from the local educational perspective; thus the research question (RQ) was as follows:

RQ: Did the School Leadership Competency Model for the era of Education 4.0 can be explained by the following 12 factors: *Leading for Learning, Emotional Intelligence, Integrity and Accountability, Critical Thinking, Communication, Collaboration, Creative and Innovative, Decision Making, Problem Solving, Managing Change, Digital Dexterity and Entrepreneurial*?

4 Methodology

4.1 Population and Sample

The study was conducted to identify the critical competencies of school leaders that most influence and maximize school effectiveness in leading the sustainable schools in Malaysia for the era of Education 4.0. The population for the study was the educational practitioners in Malaysia. We defined educational practitioners in the study as those at the heart of education structure and interaction that included trainers of Institut Aminuddin Baki (IAB), the training arm of Ministry of Education for school leaders; the school leaders that included the school principals and senior assistants; and the teachers. The total number of IAB's trainers was 450 (IAB, 2018), school leaders 9,744 and secondary school teachers 237,317 (MOE, 2018) and thus given a total population of 247,511. With the above total population and based on the sample size calculation suggested by Cohen, Manion and Morrison (2011), 384 samples were needed for the study at the confidence level of 95% and error margin of 5%. As there was substantial amount of variation among the trainers of IAB, school

leaders and teachers, to ensure each of it had the opportunity to engage in the study, the samples were selected based on its availability respectively.

As Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were two important analyses for the research, there were two sets of different samples chosen for the study. As shown in Table 1, for EFA, only 100 trainers were selected from the total number of 450 IAB trainers (IAB, 2018) as respondents due to its limited trainers. The number of school leaders and teachers were chosen based on the 16 states in Malaysia. For each state, two schools were selected randomly or a total of 32 schools (16 x 2) were involved in the EFA. For the selection of school leaders, the school principal of each school and four senior assistants were identified as respondents or a total of 160 school leaders (32 x 5) were engaged in the EFA. Besides, ten teachers were also selected from each school as respondents, giving a total of 320 teachers (32 x 10) involved in the study. In other words, there were altogether 580 respondents (100+160+320) engaged in the survey. Importantly, it met the requirement of the sample size of 384 for the study and fell within the basic requirement as five times (72 items x 5= 360) of the total number of items identified as sample; this was the minimal requirement for factor analysis (Chua, 2009). A higher sample size was selected to ensure that even at a low response rate the desired minimum required returned sample size would be achieved.

Table 1. Total number of IAB trainers, school leaders and teachers engaged in EFA and CFA

Type of analysis	EFA		CFA	
	Number of identified respondents	Number of questionnaires returned with usable data	Number of identified respondents	Number of questionnaires returned with usable data
Educational practitioners				
IAB trainers	100	81	200	165
School leaders	160	131	320	261
Teachers	320	232	640	505
Total	580	444	1,160	931

For CFA, as shown in Table 1, the number of respondents was double in comparison with EFA. For IAB, 200 trainers were selected at random as respondents. In the selection of school leaders and teachers, four schools were chosen randomly from each state or a total of 64 schools (16 x 4) were involved in the CFA. Based on this, a total of 320 school leaders (64 x 5) and 640 teachers (64 x 10) were engaged in the study. In short, there were altogether 1,160 educational practitioners (200+320+640) involved in the survey. It met the requirement of the sample size of 384 for the study as well as the basic requirement with the consideration of evaluating the overall fit of the hypothesized models using Structural Equation Modelling (SEM) analysis (Byrne, 2001; Chua, 2009; Kline, 2011).

5 The development of School Leadership Competency Model for the era of Education 4.0 (SLCMEduc4.0)

To develop the SLCMEduc4.0, five main steps had been followed: a) to identify the content dimensions of SLCMEdu4.0 from a review of the literature; b) to develop items that measure the dimensions respectively; c) conducting pilot tests to measure the validity and reliability of the scale; d) to determine the extent to which the items

measure the concerned dimensions through EFA; and e) to confirm the items that measure the dimensions through CFA.

5.1 To identify the content dimensions of SLCMEduc4.0 from a review of the literature

To identify the content dimensions of SLCMEduc4.0, the researchers critically reviewed the relevant literature. As a result, as mentioned earlier, a total of twelve competencies have been identified for the study: *Leading for Learning, Emotional Intelligence, Integrity and Accountability, Critical Thinking, Communication, Collaboration, Creative and Innovative, Decision Making, Problem Solving, Managing Change, Digital Dexterity and Entrepreneurial.*

5.2 To develop items that measured the dimensions of SLCMEduc4.0

Following this, the second step --- by reviewing the concerned literature the researchers developed items that measured the 12 factors or dimensions of SLCMEdu4.0. The process yielded a final selection of 84 items with seven items for each dimension respectively.

5.3 Conducting pilot Tests to measure the validity and reliability of SLCMEdu4.0

Once the SLCMEdu4.0 was developed, it was examined rigorously through four pilot tests to ensure its validity and reliability. Firstly, the scale was evaluated by a panel of three experts in the area of educational management and measurement on content adequacy as suggested by Chen, Gully, and Eden (2001). Inter-rater agreement among the experts was applied and the item was deleted if negative comments were given by two of the experts. A total of 12 items were dropped due to the reasons of lengthy, redundant or difficult to understand. In other words, after the content adequacy test, 72 items were remained for further pilot tests.

Secondly, a pilot test to examine the clarity of the scale was conducted. It was presented to two trainers from IAB, school principals and teachers, respectively or a total of six respondents to evaluate the clarity of each item. No item was removed because all of the respondents were satisfied with the clarity of all the 72 items of SLCMEdu4.0. Thirdly, personal interviews with one lecturer from IAB, school principal and teacher respectively were performed as recommended by Bowen and Shoemakers (1998) to assess the SLCMEdu4.0 questionnaire format, syntax, the arrangement of the items, the design and time of completion. All the three respondents were interviewed once they completed the questionnaire and they had a good impression of the overall format and design of the SLCMEdu4.0 questionnaire.

Fourthly, a pilot field-test was employed on 20 IAB trainers, school leaders and teachers respectively or a total of 60 respondents to examine the internal consistency reliability of the instrument (Neuman, 2006). All items surpassed the statistical threshold --- the Cronbach's alpha for the 12 dimensions of SLCMEdu4.0 ranged from .958 to .981 and the average Cronbach's was .975. All the items also met the statistical requirement of more than 0.4 (Kim & Mueller, 1978). This indicated that the overall reliability for SLCMEdu4.0 was high and therefore no item was deleted.

5.4 Exploratory factor analysis on SLCMEdu4.0

Following this, EFA was performed to determine the extent to which the 72 items measure the concerned dimensions of SLCMEdu4.0. In other words, EFA was employed to identify the underlying dimensions or factors in the data. As mentioned earlier, the survey field test was conducted on a total of 580 educational practitioners, which included 100 trainers from IAB, 160 school leaders and 320 teachers. Eventually, as shown in Table 1, there were 81 IAB trainers (81%), 131 school leaders (81.88%) and 232 teachers (72.50%) or a total of 444 respondents returned their questionnaires with useful data, with a total response rate of 76.55%.

The 72 items of the SLCMEdu4.0 were subjected to Principal Components Analysis (PCA). Before conducting the PCA, the suitability of data for factor analysis was evaluated. The correlation matrix with the coefficients of .4 and above was adequate (Kim & Mueller, 1978). The communalities values all exceeded .6, which implied that the sample size was enough and adequate (Hair, Black, Babin & Anderson, 2014). The Kaiser-Meyer-Okin value was .971 surpassed the recommended threshold of .6 (Kaiser, 1974). The Barlett's Test of Sphericity supported the factorability of the correlation matrix as it reached statistical significance, there was $p < .05$; this implied that the correlation between items was eligible to run the factor analysis.

Further, as shown in Table 2, the PCA revealed that there were ten factors with eigenvalues exceeding 1, explaining a total of 67.12 per cent of the variance. However, the rotation sums of squared loadings demonstrated that only eight main factors contributed more than 6.00 per cent of the variance. As the ninth (3.12%) and the tenth factor (2.20%) captured less than five per cent of the variance, the researchers decided not to retain these two factors. Following this, Varimax rotation was employed and the rotated solution revealed that the eight factors explained a total of 71.89 per cent of the variance that surpassed the cut off value of 50 per cent as suggested by Streiner (1994) (Table 3).

Table 2. Total Variance Explained of SLCMEdu4.0 (1)

Com- ponent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	33.502	46.531	46.531	33.502	46.531	46.531	7.488	10.400	10.400
2	2.822	3.920	50.450	2.822	3.920	50.450	6.638	9.219	19.619
3	2.030	2.819	53.269	2.030	2.819	53.269	6.198	8.608	28.227
4	1.921	2.668	55.937	1.921	2.668	55.937	5.596	7.772	35.998
5	1.632	2.266	58.203	1.632	2.266	58.203	5.090	7.070	43.068
6	1.496	2.077	60.281	1.496	2.077	60.281	4.559	6.333	49.401
7	1.404	1.950	62.231	1.404	1.950	62.231	4.508	6.261	55.662
8	1.275	1.771	64.002	1.275	1.771	64.002	4.428	6.151	61.812
9	1.178	1.637	65.639	1.178	1.637	65.639	2.244	3.116	64.929
10	1.069	1.485	67.123	1.069	1.485	67.123	1.580	2.195	67.123
11	.925	1.284	68.408						
12	.889	1.234	69.642						
13	.834	1.158	70.800						
14	.801	1.112	71.912						
15	.787	1.092	73.004						
16	.750	1.042	74.046						
17	.707	.981	75.028						
18	.699	.971	75.999						
19	.674	.936	76.935						

Note. Extraction Method: Principal Component Analysis.
Component 21 to 72 were omitted from the list.

Table 3. Total Variance Explained of SLCMEdu4.0 (2)

Com ponent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.697	46.743	46.743	18.697	46.743	46.743	4.382	10.955	10.955
2	2.371	5.928	52.671	2.371	5.928	52.671	3.869	9.671	20.627
3	1.596	3.989	56.660	1.596	3.989	56.660	3.648	9.121	29.748
4	1.531	3.827	60.487	1.531	3.827	60.487	3.607	9.019	38.766
5	1.394	3.485	63.972	1.394	3.485	63.972	3.596	8.989	47.755
6	1.149	2.872	66.844	1.149	2.872	66.844	3.384	8.459	56.214
7	1.015	2.537	69.380	1.015	2.537	69.380	3.302	8.255	64.469
8	1.003	2.508	71.888	1.003	2.508	71.888	2.968	7.419	71.888
9	.773	1.933	73.821						
10	.653	1.632	75.453						
11	.572	1.430	76.883						
12	.568	1.419	78.303						
13	.541	1.352	79.655						
14	.507	1.267	80.921						
15	.476	1.189	82.110						
16	.448	1.119	83.229						
17	.428	1.070	84.299						
18	.420	1.050	85.349						
19	.407	1.018	86.366						
20	.396	.989	87.356						

Note. Extraction Method: Principal Component Analysis.
Component 21 to 40 were omitted from the list.

As shown in Table 3 and 4, Factor 1 contributing 10.96 per cent, termed *Digital Dexterity*, contained five items (DID3, DID4, DID2, DID1 and DID5); factor 2 contributing 9.67 per cent, labelled as *Leading for Learning*, consisted of five items (LEL2, LEL3, LEL4, LEL1 and LEL5); factor 3 contributing 9.12 per cent, termed *Collaboration*, comprised five items (COL2, COL3, COL1, COL4 and COM7); factor 4 contributing 9.02 per cent, labelled as *Emotional Intelligence*, encompassed five items (EIN7, EIN5, EIN6, EIN4 and EIN2); factor 5 contributing 8.99 per cent, termed *Critical Thinking*, contained five items (CRT2, CRT1, CRT3, CRT5 and CRT4); factor 6 contributing 8.46 per cent, labelled as *Entrepreneurial*, consisted of five items (ENT3, ENT1, ENT4, ENT2 and ENT5); factor 7 contributing 8.26 per cent, termed *Decision Making and Problem Solving*, comprised five items (DEM7, DEM6, DEM4, DEM5 and PSO3); and factor 8 contributing 7.42 per cent, labelled as *Communication and Ethics*, encompassed five items (COM2, COM1, COM3, INA4 and INA6). In sum, a total of 40 items of SLCMEdu4.0 were retained for the final survey or CFA with loadings ranging from .491 to .810 (Table 4).

After developing the factor internal consistency, each loaded factor was assessed by Cronbach's alpha measure and the results were: .919 for *Digital Dexterity*; .855 for *Leading for Learning*; .900 for *Collaboration*; .908 for *Emotional Intelligence*; .895 for *Critical Thinking*; .919 for *Entrepreneurial*; .878 for *Decision Making and Problem Solving*; and .874 for *Communication and Ethics*. The

Cronbach's alpha for SLCMEdu4.0 was .970. These measures demonstrated strong reliability for each construct and the SLCMEdu4.0 as well. Table 5 displays the related 40 selected items for final survey of SLCMEdu4.0, its initial construct before performing PCA, the factor loading and Cronbach's alpha value for each factor.

Table 4. Rotated Component Matrix^a of SLCMEdu4.0

Item	Component							
	1	2	3	4	5	6	7	8
DID3	.784							
DID4	.782							
DID2	.779							
DID1	.764							
DID5	.740							
LEL2		.776						
LEL3		.767						
LEL4		.643						
LEL1		.637						
LEL5		.617						
COL2			.741					
COL3			.731					
COL1			.681					
COL4			.667					
COM7			.631					
EIN7				.810				
EIN5				.790				
EIN6				.699				
EIN4				.676				
EIN2				.520				
CRT2					.750			
CRT1					.750			
CRT3					.695			
CRT5					.641			
CRT4					.625			
ENT3						.704		
ENT1						.699		
ENT4						.649		
ENT2						.639		
ENT5						.625		
DEM7							.706	
DEM6							.678	
DEM4							.673	
DEM5							.639	
PSO3							.530	
COM2								.767
COM1								.709
COM3								.624
INA4								.498
INA6								.491

Note. Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 7 iterations.

DID= Digital Dexterity; LEL=Leading for Learning; COL=Collaboration; EIN=Emotional Intelligence; CRT = Critical Thinking; ENT= Entrepreneurial; DEM=Decision Making; PSO= Problem Solving; COM= Communication; INA=Integrity and Accountability

Table 5. Selected Items of SLCMEdu4.0 for Final Survey, Its Initial Construct, Factor Loading and Cronbach's Alpha

Factor/ Dimension	Item Code (EFA)	Item	Initial Construct Before PCA	Factor Loading	Cron- bach's Alpha
Digital Dexterity	DID3	Able to foster a digital mindset through leading by example	DID	.784	.919
	DID4	Able to develop digital skills across the organization through professional development programmes	DID	.782	
	DID2	Able to establish a digital transformation strategic plan for digital enhancement among the staff	DID	.779	
	DID1	Possess a strong understanding of available digital capabilities in enhancing teaching and learning	DID	.764	
	DID5	Able to help teachers to integrate digital technologies for quality teaching and learning	DID	.740	
Leading Learning	LEL2	Able to nurture work cultures in building professional communities that value in-depth learning	LEL	.776	.855
	LEL3	Seeking ways to develop teacher to their full potential in instructional practices	LEL	.767	
	LEL4	Able to mobilize available resources to help teachers in teaching and learning	LEL	.643	
	LEL1	Using instructional expertise instead of position to enhance organization's learning	LEL	.637	
	LEL5	Using evidence to evaluate practice for continuous improvement of teaching and learning.	LEL	.617	
Collaboration	COL2	Able to leverage cross-functional collaboration across departments to enhance school management	COL	.741	.900
	COL3	Able to promote collaborative relationships between staff and stakeholders to improve student learning	COL	.731	
	COL1	Able to create opportunities to foster collaboration among the staff to improve learning	COL	.681	
	COL4	Able to establish collaborative relationships with local community in addressing change	COL	.667	
	COM7	Able to communicate frequently about student learning with various stakeholders	COM	.631	

Note. DID= Digital Dexterity; LEL=Leading for Learning; COL=Collaboration; COM= Communication

Table 5. Selected Items of SLCMEdu4.0 for Final Survey, Its Initial Construct, Factor Loading and Cronbach's Alpha (Continued)

Factor/ Dimension	Item Code (EFA)	Item	Initial Construct Before PCA	Factor Loading	Cron- bach's Alpha
Emotional Intelligence	EIN7	Able to help the staff to find relief when they are having a tense relationship among themselves.	EIN	.810	.908
	EIN5	Able to build a sense of trust among the staff while managing conflicts	EIN	.790	
	EIN6	Having the capacity to help the staff to stay confident while dealing with frustration	EIN	.699	
	EIN4	Able to promote empathy among the staff to understand others' perspectives	EIN	.676	
	EIN2	Able to cheer himself/herself up whenever encounter discouraging comments	EIN	.520	
Critical Thinking	CRT2	Able to spot patterns in the given information and come up with a solution	CRT	.750	.895
	CRT1	Able to evaluate information objectively so as to make a reasoned judgment	CRT	.750	
	CRT3	Able to take into consideration multiple perspectives before making any judgment	CRT	.695	
	CRT5	Able to re-evaluate a point of view in light of new information	CRT	.641	
	CRT4	Able to set aside his/her own personal biases that may cloud his/her judgment	CRT	.625	
Entrepreneurial	ENT3	Able to capture opportunities that are best able to drive organization's success	ENT	.704	.919
	ENT1	Having a breadth of transferrable skills that can be applied to different situations	ENT	.699	
	ENT4	Able to adapt to changing environment to keep the stakeholders engaged.	ENT	.649	
	ENT2	Able to see many options in every situation in school change	ENT	.639	
	ENT5	Having the courage to commit through all of the challenges in addressing any school change	ENT	.625	

Note. EIN=Emotional Intelligence; CRT= Critical Thinking; ENT= Entrepreneurial

Table 5. Selected Items of SLCMEdu4.0 for Final Survey, Its Initial Construct, Factor Loading and Cronbach's Alpha (Continued)

Factor/ Dimension	Item Code (EFA)	Item	Initial Construct Before PCA	Factor Loading	Cron- bach's Alpha
Decision Making & Problem Solving	DEM7	Promote data-driven decision making in the school community	DEM	.706	.878
	DEM6	Able to make sound decisions although with limited resources	DEM	.678	
	DEM4	Taking decisions unhesitatingly although under pressure	DEM	.673	
	DEM5	Able to deal constructively with own mistakes in decision making	DEM	.639	
	PSO3	Able to solve problem constructively although under stress	PSO	.530	
Communication & Ethics	COM2	Able to express disagreement in a tactful manner even under pressure	COM	.767	.874
	COM1	Able to deal tactfully with staff in daily communication	COM	.709	
	COM3	Able to convey the message effectively while resolving a controversial issue	COM	.624	
	INA4	Able to enforce the ethical standards in school community without exception	INA	.498	
	INA6	Creating opportunities for teachers to have voice in decisions about issues of teaching and learning	INA	.491	

Note. DEM=Decision Making; PSO= Problem Solving; COM= Communication; INA=Integrity and Accountability

5.5 *Confirmatory factor analysis on SLCMEdu4.0*

The CFA was the last analysis for the scale development of SLCMEdu4.0. As mentioned above, there were altogether 1,160 respondents involved in the survey that included 200 IAB trainers, 320 school leaders and 640 teachers. Eventually, as shown in Table 1, there were 165 IAB trainers (82.50%), 261 school leaders (81.56%) and 505 teachers (78.91%) or a total of 931 respondents returned their questionnaires with useful data, with a total response rate of 80.26%. The demographic characteristics of the respondents for CFA are shown in Table 6.

Table 6. *Demographic Characteristics of the Respondents for CFA*

	Category	Frequency	Per cent (%)
Gender	Male	303	32.55
	Female	628	67.45
Age	21-30	67	7.20
	31-40	222	23.84
	41-50	316	33.94
	51-60	326	35.02
	Highest Education Level	Certificate/Diploma	5
	First Degree	623	66.92
	Master	298	32.00
	Ph.D	5	0.54
Years in Present Job	1-5	121	13.00
	6-10	162	17.40
	11-15	172	18.47
	16-20	150	16.11
	>20	326	35.02
School Location	Urban	567	60.90
	Rural	364	39.10

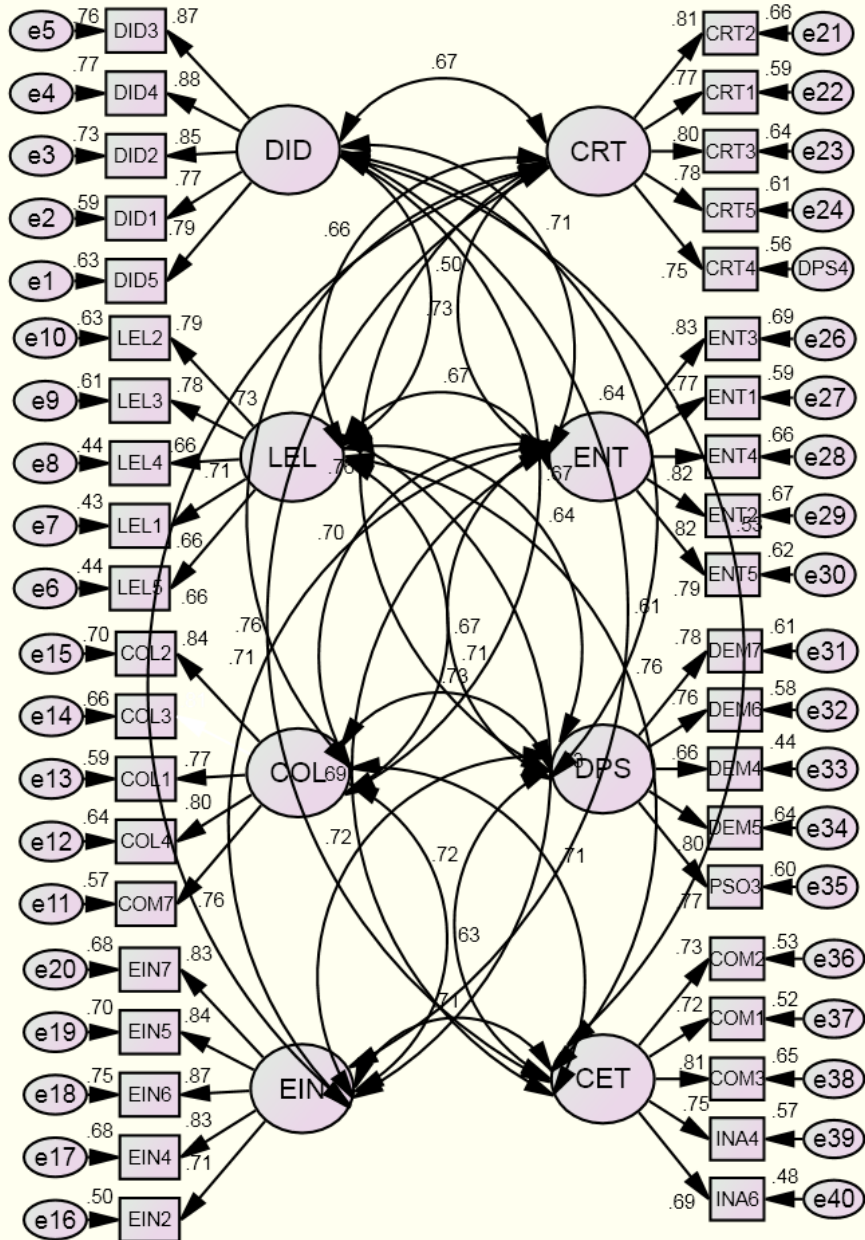
In order to examine the factorial validity of the first and second order measurement models of SLCMEdu4.0, Structural Equation Modelling using AMOS with maximum likelihood was employed. The adequacy of the measurement models were evaluated according to the criteria of the model fit, convergent validity, discriminant validity and construct reliability, respectively. The models were re-specified to provide a more parsimonious one.

5.5.1 *The First-Order Measurement Model of SLCMEdu4.0*

As shown in Figure 1, the TLI (.941) and CFI (.946) fit indicators surpassed the threshold of .90, indicating a reasonable fit. The root-mean square error of approximation (RMSEA=.046) was well above the suggested .06 cut off value of the study. With a value of 2.946, the normed chi-square exceeded the required threshold of less than five and indicated high goodness-of-fit. However, there was room for improvement especially in enhancing TLI and CFI of the model for better fit and thus

Figure 1. The first order measurement model of SLCMEdu4.0

Chi-square=2097.552
 df=712
 p=.000
 normed chi-square=2.946
 TLI=.941
 CFI=.946
 RMSEA=.046



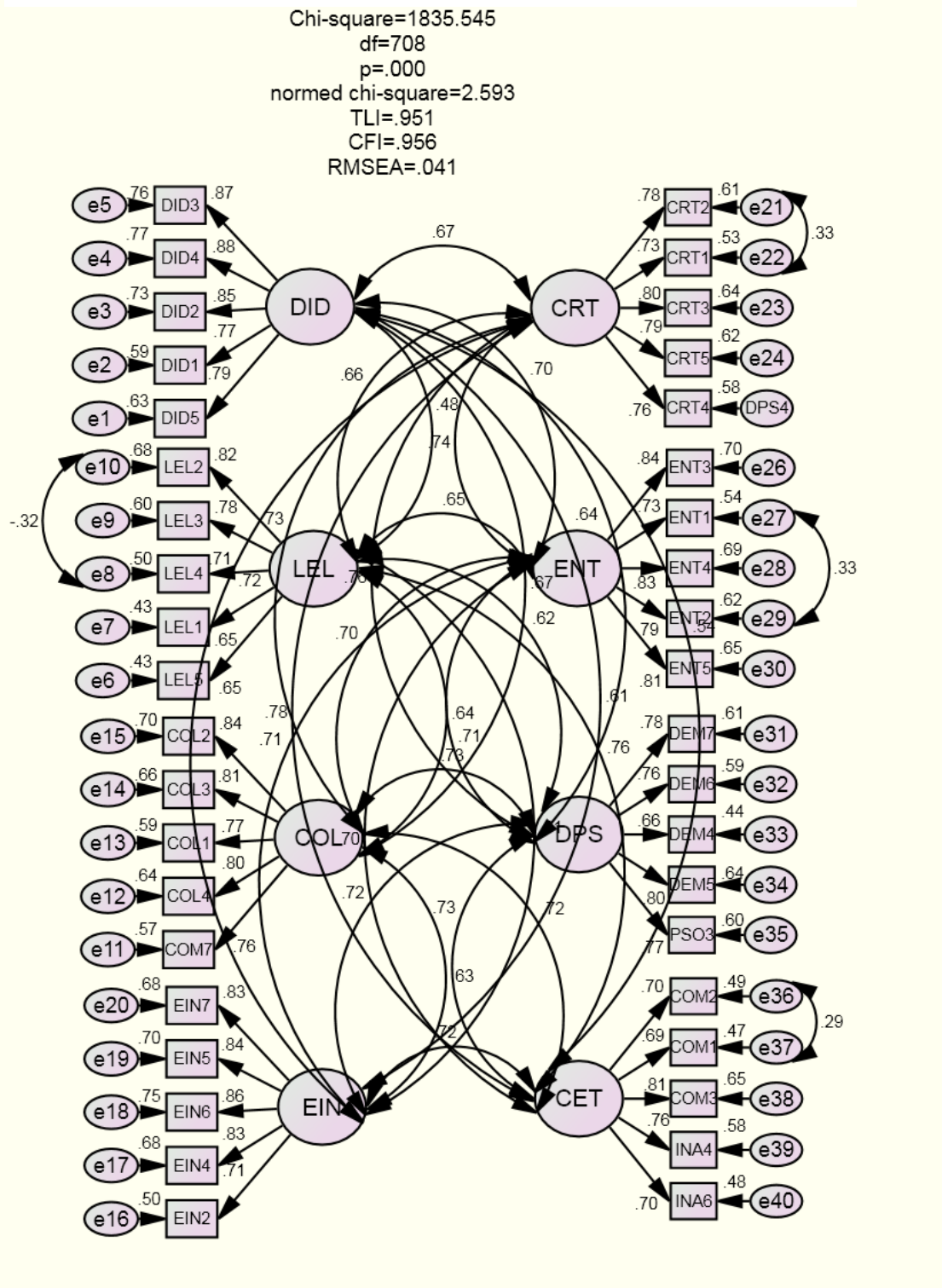
Note. DID= Digital Dexterity; LEL=Leading for Learning; COL=Collaboration; EIN=Emotional Intelligence; CRT=Critical Thinking; ENT= Entrepreneurial; DEM=Decision Making; PSO= Problem Solving; COM= Communication; INA=Integrity and Accountability; DPS=Decision Making and Problem Solving; CET=Communication and Ethics

the model was re-estimated. Based on the highest modification index (MI) for each re-estimation, as shown in Figure 2, four pairs of error terms i.e. e27 and e29 (MI=69.797); e21 and e22 (MI=63.745); e36 and e37 (MI=56.810); and e8 and e10 (MI=32.980) were correlated; the corrections were done one by one because any correlation or change may affect other parts of the model simultaneously. The revised model indicating a very good fit with TLI=.951, CFI=.956, RMSEA=.041 and the normed chi-square=2.593; the estimated model reproduces the sample covariance matrix with excellent fit.

5.5.2 *The Second-order measurement model of SLCMEdu4.0*

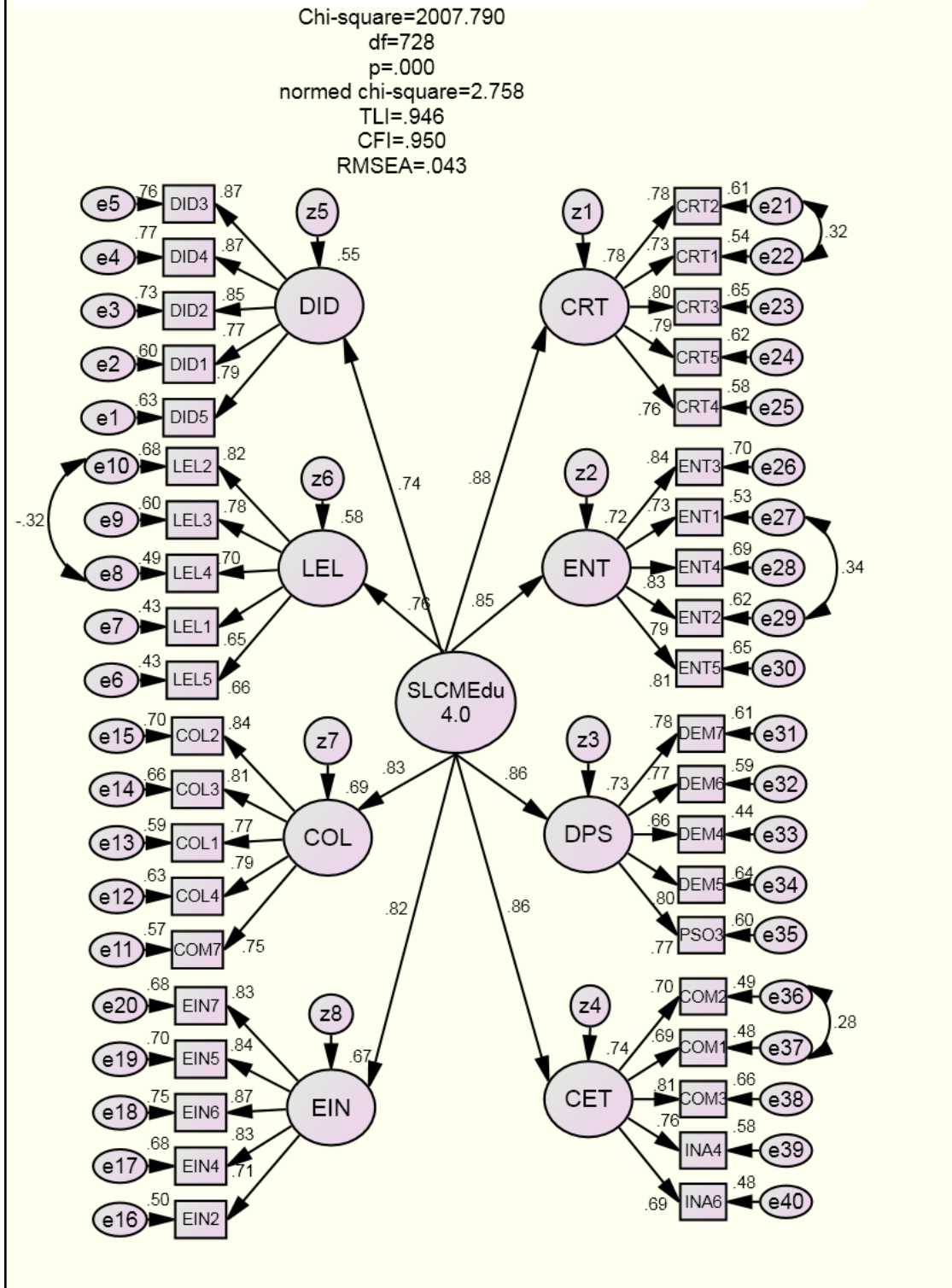
As shown in Figure 3, the SLCMEdu4.0 was examined at a higher level. The TLI (.946) and CFI (.950) fit indicators met the guidelines of greater than .90, indicating a reasonable fit. The RMSEA also showed an excellent fit with a value of .043. The normed chi-square was 2.758, suggested a good model fit. To further improve the model fit, the model was re-estimated. Based on the highest modification index (MI), as shown in Figure 4, z4 was correlated to z5 (MI=48.532) and e12 was correlated with e13 (MI=32.890). The revised model indicated a very good fit with TLI=.950, CFI=.954, RMSEA=.042 and the normed chi-square=2.628. Similarly, the second-order of SLCMEdu4.0 was free from offending values with all fit statistics well above the set threshold. The results of the study demonstrated a good factorial validity, suggesting that the core of the SLCeEdu4.0 could be best represented by eight factors: *Digital Dexterity, Leading for Learning Collaboration, Emotional Intelligence, Critical Thinking, Entrepreneurial, Decision Making and Problem Solving and Communication and Ethics.*

Figure 2. The re-estimated first order measurement model of SLCMEdu4.0



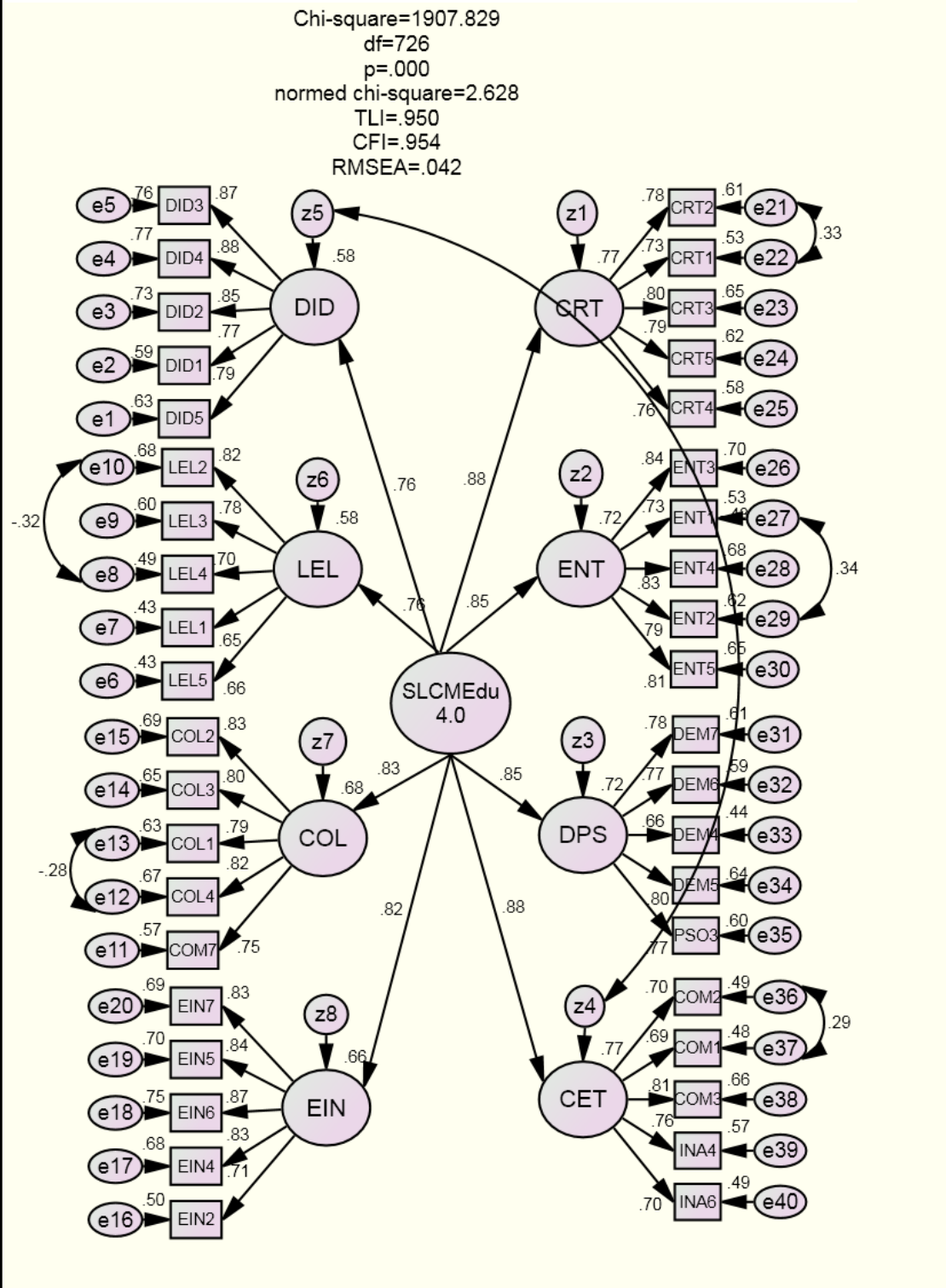
Note. DID= Digital Dexterity; LEL=Leading for Learning; COL=Collaboration; EIN=Emotional Intelligence; CRT= Critical Thinking; ENT= Entrepreneurial; DEM=Decision Making; PSO= Problem Solving; COM= Communication; INA=Integrity and Accountability; DPS=Decision Making and Problem Solving; CET= Communication and Ethics

Figure 3. The second order measurement model of SLCMEdu4.0



Note. DID= Digital Dexterity; LEL=Leading for Learning; COL=Collaboration; EIN=Emotional Intelligence; CRT= Critical Thinking; ENT= Entrepreneurial; DEM=Decision Making; PSO= Problem Solving; COM= Communication; INA=Integrity and Accountability; DPS=Decision Making and Problem Solving; CET=Communication and Ethics

Figure 4. The re-estimated second order measurement model of SLCMEdu4.0



Note. DID= Digital Dexterity; LEL=Leading for Learning; COL=Collaboration; EIN=Emotional Intelligence; CRT= Critical Thinking; ENT= Entrepreneurial; DEM=Decision Making; PSO= Problem Solving; COM= Communication; INA=Integrity and Accountability; DPS=Decision Making and Problem Solving; CET=Communication and Ethics

5.5.3 *Convergent Validity*

To measure the convergent validity of SLCMEdu4.0, firstly the standardized factor loading estimates were examined so as to ensure that all its loadings were significant (at least .60) (Awang, 2012). As shown in Table 7, it was ranged between .65 and .88. Besides, the critical ratios were examined and were outside the ± 1.96 z-value range and *p*-value was below .05. All these provided initial evidence for convergent validity (Ghouri, Tai, Nik Kamal and Akhtar, 2019; Holmes-Smith, 2001) of SLCMEdu4.0.

Next, the evaluation of Squared Multiple Correlations or SMC (Table 7) was conducted and it was found that six estimates were below the recommended acceptance level of .50 (Hair et al., 2014) i.e. LEL5 (.43), LEL1 (.43), DEM4 (.44), COM1 (.48), COM2 (.49) and INA6 (.49). To decide whether to delete or retain the above six items, the Average Extracted Variance or AVE were scrutinized. The AVEs of the eight constructs were well above the threshold of 50% (DID=70%; LEL=53%; COL=64%; EIN=66%; CRT=60%; ENT=64%; DPS=58%; and CET=54%), suggesting adequate convergence or less error remains in the items than variance, as explained by the latent factor structure imposed on the measure (Hair et al., 2014). Therefore, all the six items were retained to support content validity of SLCMEdu4.0.

The following step was to assess the construct reliability of SLCMEdu4.0; high composite reliability index (CRI) indicates that the measures all consistently represent the same latent construct (Hair et al., 2014). The results in Table 7 demonstrated that all CRI surpassed the 0.60 cut off value (Awang, 2012) (DID=0.73; LEL=0.60; COL=0.69; EIN=0.71; CRT=0.66; ENT=0.69; DPS=0.64; and CET=0.61) and thus providing substantial evidence of convergent validity. Consequently, all the eight constructs of SLCMEdu4.0 with 40 items were retained. Table 8 summarizes the assessments of the convergent validity of SLCMEdu4.0.

Table 7.

Standardized Factor Loadings, Squared Multiple Correlations, Average Variance Extracted and Composite Reliability Index of SLCMEdu4.0

	DID		LEL		COL		EIN		CRT		ENT		DPS		CET	
	SFL	SMC	SFL	SMC	SFL	SMC	SFL	SMC	SFL	SMC	SFL	SMC	SFL	SMC	SFL	SMC
DID3	.87	.76														
DID4	.88	.77														
DID2	.85	.73														
DID1	.77	.59														
DID5	.79	.63														
LEL2			.82	.68												
LEL3			.78	.60												
LEL4			.71	.50												
LEL1			.65	.43												
LEL5			.65	.43												
COL2					.83	.69										
COL3					.80	.65										
COL1					.79	.63										
COL4					.82	.67										
COM7					.75	.57										
EIN7							.83	.69								
EIN5							.84	.70								
EIN6							.87	.75								
EIN4							.83	.68								
EIN2							.71	.50								
CRT2									.78	.61						
CRT1									.73	.53						
CRT3									.80	.65						
CRT5									.79	.62						
CRT4									.76	.58						
ENT3											.84	.70				
ENT1											.73	.53				
ENT4											.83	.68				
ENT2											.79	.62				
ENT5											.81	.65				
DEM7													.78	.61		
DEM6													.77	.59		
DEM4													.66	.44		
DEM5													.80	.64		
PSO3													.77	.60		
COM2															.70	.49
COM1															.69	.48
COM3															.81	.66
INA4															.76	.57
INA6															.70	.49
AVE	70%		53%		64%		66%		60%		64%		58%		54%	
CRI	0.73		0.60		0.69		0.71		0.66		0.69		0.64		0.61	

Note. SFL=Standardized Factor Loadings; SMC=Squared Multiple Correlations; AVE=Average Extracted Variance; CRI=Composite Reliability Index; DID= Digital Dexterity; LEL=Leading Learning; COL= Collaboration; EIN=Emotional Intelligence; CRT= Critical Thinking; ENT= Entrepreneurial; DEM=Decision Making; PSO=Problem Solving; DPS=Decision Making and Problem Solving; COM=Communication; CET=Communication and Ethics; INA=Integrity and Accountability

Table 8.
Summarized Assessments of Convergent Validity for SLCMEdu4.0

Construct	Item	SFL	CR	SMC	AVE	CRI	Final Decision
DID	DID3	√	√	√			
	DID4	√	√	√			
	DID2	√	√	√	√	√	
	DID1	√	√	√			
	DID5	√	√	√			
LEL	LEL2	√	√	√			
	LEL3	√	√	√			
	LEL4	√	√	√	√	√	
	LEL1	√	√	X ^a			Retained
	LEL5	√	√	X ^b			Retained
COL	COL2	√	√	√			
	COL3	√	√	√			
	COL1	√	√	√	√	√	
	COL4	√	√	√			
	COM7	√	√	X ^b			Retained
EIN	EIN7	√	√	√			
	EIN5	√	√	√			
	EIN6	√	√	√	√	√	
	EIN4	√	√	√			
	EIN2	√	√	√			
CRT	CRT2	√	√	√			
	CRT1	√	√	√			
	CRT3	√	√	√	√	√	
	CRT5	√	√	√			
	CRT4	√	√	√			
ENT	ENT3	√	√	√			
	ENT1	√	√	√			
	ENT4	√	√	√	√	√	
	ENT2	√	√	√			
	ENT5	√	√	√			
DPS	DEM7	√	√	√			
	DEM6	√	√	√			
	DEM4	√	√	X ^c	√	√	Retained
	DEM5	√	√	√			
	PSO3	√	√	√			
CET	COM2	√	√	X ^d			Retained
	COM1	√	√	X ^e			Retained
	COM3	√	√	√	√	√	
	INA4	√	√	√			
	INA6	√	√	X ^f			Retained

Note. SFL= Standardized Factor Loadings; CR=Critical Ratio; SMC=Square Multiple Correlations; AVE=Average Variance Extracted; CRI= Composite Reliability Index; DID= Digital Dexterity; LEL=Leading Learning; COL= Collaboration; EIN=Emotional Intelligence; CRT= Critical Thinking; ENT= Entrepreneurial; DPS=Decision Making and Problem Solving; CET=Communication and Ethics
SMC^{a&b} =.43; SMC^c =.44; SMC^{d&f} =.49; SMC^e =.48

5.5.4 Discriminant validity

As shown in Table 9, discriminant validity of SLCMEdu4.0 was calculated by comparing the AVEs and the square of the correlations between the constructs (Hair et al., 2014; Holmes-Smith, Coote & Cunningham, 2006). Out of twenty-eight cases, there were four cases with weak discriminant validity: the share variance between DPS and LEL (.58), DPS and EIN (.55), CET and EIN (.58), and ENT and CRT (.61) as they were greater than the lowest value of the AVE i.e. .53 (the share variance between LEL and LEL). However, there was no insufficient discriminant validity with the other twenty-four cases. In fact, according to Hair et al (2014) and Kline (2011), as long as the AVE of the factor was greater than 0.50, it will hold discriminant validity. Therefore, it can be claimed that the SLCMEdu4.0 features discriminant validity.

Table 9.
Average Variance Extracted and Shared Variance Estimates of SLCMEdu4.0

	DID	LEL	COL	EIN	CRT	ENT	DPS	CET
DID	.70	.23	.42	.40	.45	.49	.41	.29
LEL	.48	.53	.37	.44	.44	.38	.58*	.52
COL	.65	.61	.64	.49	.52	.51	.52	.50
EIN	.63	.66	.70	.66	.52	.52	.55*	.58*
CRT	.67	.66	.72	.72	.60	.61*	.50	.49
ENT	.70	.62	.71	.72	.78	.64	.53	.44
DPS	.64	.76	.72	.74	.71	.73	.58	.37
CET	.54	.72	.71	.76	.70	.66	.61	.54

Note. Correlations are below the diagonal, squared correlations are above the diagonal, and AVE estimates are presented on the diagonal

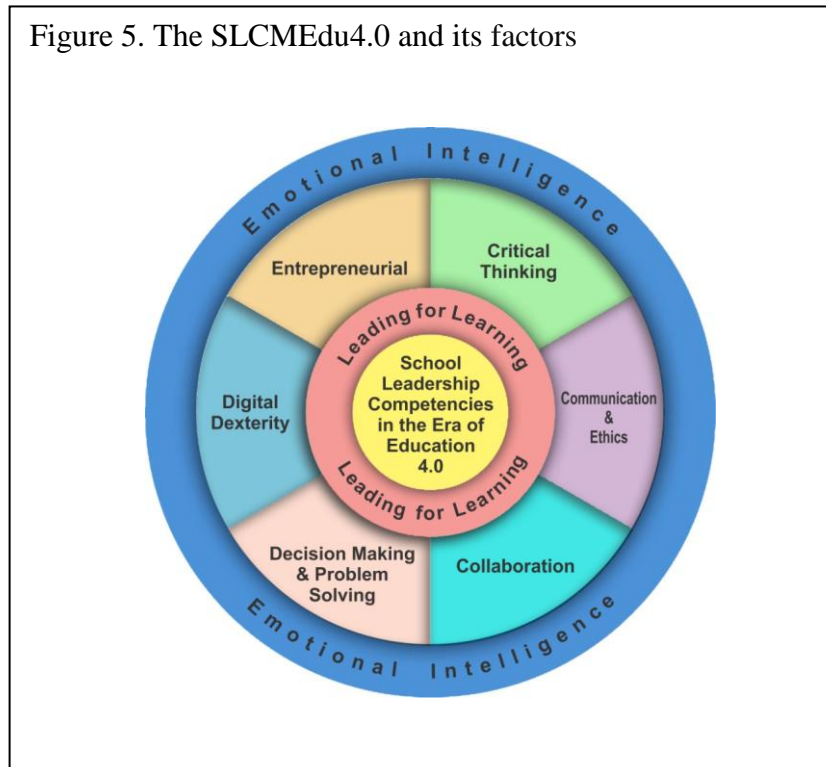
DID= Digital Dexterity; LEL=Leading for Learning; COL= Collaboration; EIN=Emotional Intelligence; CRT=Critical Thinking; ENT= Entrepreneurial; DPS=Decision Making and Problem Solving; CET= Communication and Ethics

* share variance with weak discriminant validity

6 Summary of the findings

The results suggested that instead of 12 factors, the SLCMEdu4.0 could be explained by eight factors namely: *Digital Dexterity, Leading for Learning, Collaboration, Emotional Intelligence, Critical Thinking, Entrepreneurial, Decision Making and Problem Solving and Communication and Ethics*. Among these, the initial two factors, *Decision Making and Problem Solving* were merged as one factor and labelled as *Decision Making and Problem Solving*. Likewise, another two factors ---- *Communication and Integrity and Accountability* were merged as one factor namely, *Communication and Ethics*. Besides, there were two factors; *Creativity and Innovation* as well as *Managing Change* were discarded from the model. In short, the overall fit of the model was adequate and the 40-item measure was found to feature good convergent validity, discriminant validity and construct reliability. Based on these results, RQ1 (Did the School Leadership Competency Model for the era of Education 4.0 can be explained by the following 12 factors?) was thus answered. The eight main factors of SLCMEdu4.0 are displayed in Figure 5.

Figure 5. The SLCMEdu4.0 and its factors



7 DISCUSSION

As shown in Figure 5, a total of eight core competencies had been identified for the school leaders in leading sustainable schools in the era of Education 4.0. The inner circle illustrates the core focus of the school leaders' competency --- *Leading for Learning*. In the pursuit of teaching and learning excellence, a revolution is taking place in school leadership in the face of Education 4.0. While instructional leadership remains a crucial aspect in the school setting, instead of 'knowledge feeding', school leaders need to be competent in how to lead and influence teachers to play their rightful role in constructing knowledge on teaching and learning (Wendy Pan et al., 2017). Leading for deeper learning outcomes and engaging and scaling deeper learning is the main task of the school leaders. Indeed, all change involves learning. There needs to be a deep personal desire to learn and a commitment to create and sustain a learning environment that helps teachers to learn. In this respect, the school leaders are learners first, leaders second; their leadership occurs as a by-product of their learning that opens many new possibilities for enhancing school performance and effectiveness.

Emotional Intelligence is located at the base of the whole model as it is the basic competence that school leaders need to apply across the complete terrain of the organization. It is a set of abilities involved in reasoning about emotions, and using emotions to inform cognitive activities such as reasoning and problem solving (Omar & Tai, 2018). Schools are basically organizations interlocked with wider social, cultural, economical and political power relationships and thus emotions are constantly at play. Intense emotional reactions and job stress are often the result when leaders try to cope with emotional dissonance arising from a constant changing environment. To maintain emotional equilibrium to address the emotional well being of the staff and students, being emotionally competent is a central

concern of school leadership development; cognition alone would not be sufficient to help school leaders handle complicated problems in the era of Education 4.0. This is the interpersonal and adaptive competence with which the school leaders conduct themselves within the working environment that makes human work more efficient.

There are another six important competencies for school leaders in leading sustainable schools in the Era of Education 4.0. *Critical Thinking* refers to the ability to analyze, evaluate, synthesize and using various types of reasoning as appropriate to the situation (Joe, 2011); it is about reasonable reflective thinking. School leaders who are strong critical thinkers see things from different perspectives and used to contextualize their worldview within a bigger picture. Particularly, critical thinkers consistently attempt to lead their organizations rationally, reasonably and empathetically as they strive to minimize the power of their egocentric and socio-centric tendencies (Mason, 2007); these entail effective communication and problem-solving abilities. As school leaders are the strategy planners and change agents of any school reform, to avoid falling prey to mistakes in reasoning and irrationality, it is crucial for school leaders to improve their reasoning skills so as to be effective in leading sustainable schools in the era of Education 4.0.

Communication and Ethics refers to the extent of how school leaders are able to communicate effectively their vision and beliefs by direction, words and deeds in achieving the school goals (Smith & Riley, 2012) and pride themselves in holding all teachers and students to a high standard of ethics. Communication is a social matter in which negotiating differences in understanding among communicators is a primary priority; it is crucial to decision making because the decision making process is increasingly interactive in the era of Education 4.0 that strive for accuracy and excellence. Meanwhile, as schools are organizations that contribute to the moral education of the young, school leaders have to prove that they are able to communicate effectively and build an accountability system in the day-to-day management; an accountability system is compelling, providing an irresistible rationale for educational reform. In fact, the moral imperative of professional leadership is at the core of leadership through effective communication (Lee, 2015).

Collaboration focuses on leadership practice that the relationships among school leaders, staff and stakeholders are more about interactions than actions. Successful schools in the era of Education 4.0 demand that school improvement and effectiveness are a collective rather than an individual enterprise. Working together collaboratively can result in greater accomplishments and efficiency in comparison with each individual working alone. Partnerships, coalitions and networks are powerful initiatives that provide great opportunities and various perspectives for problem solving and innovation. Importantly, efficient collaboration results in the engagement of the staff and the stakeholders, attraction and retention of talent and an increased velocity of the organization in the changing environment. School leaders need to acquire the understanding, skills, and experience to collaborate successfully, and specifically to move away from being the sole decision maker to involving others in the decision making process that foster and sustain school effectiveness (Slater, 2005).

Decision Making and Problem Solving is the competence of making a choice among alternative courses of action (Smith & Riley, 2012) that creates the right conditions for problem solving that enhances school effectiveness. Due to the more complex operational milieu in which school leaders are now working, school leaders need to confront and resolve conflicting interests as they endeavour to balance a variety of values and expectations in their decision-making. A skilful school leader needs to optimize his most valued beliefs, responsibilities and obligations to make good decisions that can turn problems into opportunities or at least minimize adverse consequences. As school leaders are those who spend a lot of time solving instructional problems in the school, and whose performances in

solving those problems have a tangible effect on the results of the students at the school, they need an expert's ability to use particular processes to help the school to be more effective and successful in the Era of Education 4.0.

Digital Dexterity is the ability to exploit existing and emerging technologies for better learning and teaching outcomes. It must be a priority as it is a key competency to educational quality; the Era of Education 4.0 is all about embracing digital technology. Hence, it is crucial for school leaders to make meaningful progress on digital transformation in the organization or it will be left behind. It requires school leaders to foster a digital culture in the organization through leading by example by changing the beliefs, mindsets, and behaviours of the staff. Just possessing digital vision and a strong understanding of the available digital capabilities in enhancing teaching and learning is inadequate; school leaders are required to create the environment needed for digital dexterity to thrive, develop teachers' competencies that drive digital dexterity and increase pedagogically, the meaningful use of ICT in class and out of class. This promotes teaching and learning that are appropriate for the needs of 21st-century students. *Digital Dexterity* is the cornerstone of a modern and effective digital learning organization in the era of Education 4.0.

Entrepreneurial is defined as the ability to organize and manage school enterprisingly with considerable initiative and risk to create new opportunities for the betterment of the school (Akbar & Haitham Obaid, 2014). Being entrepreneurial means the school leaders know the education industry inside out and are able to creatively and constructively manage the challenges and risks of a performance oriented era. They abhor stagnation, and hunger for making schools better; they are in-tune with their passion and are optimistic about all possibilities and will push the boundaries of what was once thought impossible. Importantly, school leaders with the entrepreneurial spirit recognize the fact that execution is everything when it comes down to success or failure. This ability or competency helps school leaders to be sensitive and responsive to issues of context and points to the progressive and transformative possibilities; it is therefore imperative for school leaders to equip themselves with this competence in this era of Education 4.0.

Apart from the identified eight factors, there were two factors, *Creativity and Innovation* and *Managing Change* that were discarded from the model. *Creativity and Innovation* is the competence to demonstrate originality and inventiveness in work. Creativity is the ability to think outside the box and conceive new ideas, methods, materials, products and actions whereas innovation involves the creation of new knowledge or new combinations of old insights to make tangible and useful contribution in enhancing organizational effectiveness (Mainemelis, Kark & Epitropaki, 2015; Moos, 2015). *Managing Change* refers to the competence to induce change, getting others to change, upholding and champion constant change in schools (Tai, Omar, Mohamad Sahari & Khuan, 2014). The process of leading and managing change in the current era is becoming more complex and school leaders are responsible for the changes as well as being accountable for the results.

One possible reason why these two factors were found to be non significant for SLCMEdu4.0 was that the characteristics of these two factors probably may subsume into the factor of *Entrepreneurial* --- the ability to creatively manage the challenges and risks so as to create opportunities or make change for the betterment of an organization. Although there were distinct differences among *Entrepreneurial*, *Creativity and Innovation* and *Managing Change*, however, in the factor analysing process of EFA and CFA, the two important criteria of parsimony (a model with relatively few factors) and plausibility (that there are enough factors to adequately account for correlations among measured variables) were considered so as to arrive at a solution with the best simple structure of a model.

8 Theoretical and Practical Implications

There are several important contributions of the study that need to be highlighted. Firstly, the model development of SLCMEdu4.0 is an important effort to identify the most effective competencies of school leaders in leading sustainable schools in the Era of Education 4.0 from a local educational perspective. This pioneer research in the Malaysian educational context is parallel to the 5th shift of the eleven operational shifts prioritized in the Malaysia Education Blueprint 2013-2025 ---'Ensure high-performing school leaders in every school'. It is timely and would contribute to school improvement and overall effectiveness of schools across the nation whereby effective school leadership is linked significantly to their specific professional competencies.

Secondly, from a human resource development perspective, the model is an effective training needs analysis tool that can provide useful feedback and direction in designing future training programmes for school leaders in enhancing their competencies in school effectiveness. These critical competencies can be learned and fine-tuned, permitting greater specificity in learning outcomes. A greater understanding of the impact of these competencies can help the Ministry of Education to engage resources more effectively to equip school leaders with relevant competencies in meeting the needs and challenges of Education 4.0. Similarly, the study will equip the State Department of Education and District Department of Education with information about how to effectively manage school leaders' professional development programmes; professional development is a coherent part of school reform that promotes and maximizes the individual and shared learning of the school leaders.

Thirdly, the development of SLCMEdu4.0 will expand the school leaders' understanding about the critical competencies and its importance in leading sustainable schools in the Era of Education 4.0. Specifically, knowledge of relevant competencies that significantly influence school improvement and effectiveness and the awareness of acquiring these competencies can help school leaders to best lead change in schools. It serves as a roadmap that provides measurable actions and behaviours associated with school leadership functions that could assist in facilitating the change process in the Era of Education 4.0. As school leaders are the change agents in school reforms, they need to ensure that these critical competencies are put in place to transform the school system effectively and sustainably.

Fourthly, the SLCMEduc4.0 can also be used as an important indigenous model in conducting educational leadership courses and postgraduate studies offered by the local universities. Theoretically, the SLCMEduc4.0 would add to the body of knowledge on educational leadership, and expand and enhance the understanding of the students on school leadership professional development within a local context. In terms of practicality, the SLCMEduc4.0 is a premier empirical model as well as a promising new measure for examining school leadership competency in the Malaysian context. With good validity and reliability, this instrument can provide local as well as international researchers with a more evidence-based and timely assessment.

9 Conclusion

The increasing demands for school reforms in the era of Education 4.0 continuously challenge the roles of school leaders. As schools continually embark on programmes pertaining to school effectiveness, it is a *sin quo non* for school leaders to equip themselves with subsequent critical competencies so as to perform effectively in leading sustainable schools in the Era of Education 4.0. Schools require effective leaders if they are to provide

the best possible education for students. However, no school leader will embrace any school change if he or she is unable to perform the new task competently. As a whole, the study successfully developed a premier, coherent and empirically tested SLCMEduc4.0 within the Malaysian education context. It is timely and will benefit educational practitioners in planning, designing, implementing and evaluating future training programs for school leaders in leading sustainable and effective schools. The study encourages a fresh look at educational leadership development locally and globally and would enhance leadership development of Malaysian school leaders towards productive change in the era of Education 4.0.

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