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Development of Quality Early Childhood Care and Education (QECCE) Scale: Factor Structural and Psychometric Properties

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Abstract: This research is to design and develop an initial psychometric evaluation of the Quality Early Childhood Care and Education (QECCE) scale. The procedure of developing the QECCE item scale was conducted by using the sequential missed method research approach. The study involved 2464 samples. Systematic reviews were carried out to identify the related constructs for the items, and discussion with expert panels for its validity has been done, followed by an examination of the psychometric quality of the items. The exploratory factor analysis (EFA) generated a four factoring model with 22 items. Confirmatory factor analysis (CFA) has proven all the items achieve the minimum thresholds of model fit. Based on structural equation modeling (SEM) outputs, the QECCE scale successfully explained 63.25% of the total variance. On this basis, the QECCE scale is a valid and reliable survey instrument specifically for assessing the quality of Malaysian ECCE. The study confirmed that the predictors for examining the QECCE were Centre Management (CM), Safety, Health, and Nutrition Management (SHNM), Leadership and Professional Development (LPD), and Parent and Community Involvement (PCI).

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1. Introduction

The Malaysian government has taken various ways and approaches to ensure the highest quality of early childhood care and education (ECCE). In order to achieve the objectives of a better quality of ECCE, the Malaysian government has invested lots of many to prepare child-carers and preschool teachers with 21st pedagogical practices and, at the same time ensuring a higher level of quality of ECCE in Malaysia. These include adopting a holistic approach in terms of ensuring overall balanced child development without comprising a single domain.

Along the same lines, Malaysia's annual budget has offered incentives to manufacturers and corporations to have workplace childcare facilities and capital investment in the safety and facilities at childcare centers. The success of achieving a high quality of Malaysian ECCE depends strongly upon the engagement of child-carers, preschool teachers and parents, and community. Besides, many studies have suggested the importance of the management of childcare centers and preschools in ensuring the quality of ECCE (Colmer, 2017; Elina Fonsén & Tuulikki Ukkonen-Mikkola, 2019; Kaye, 2017; Darlyne, Mariandl, Melissa & Sarah, 2017; Zinsser & Zinsser, 2016).

Furthermore, Malaysia has implemented policies, increased funding, as well as enhanced capacity-building programs towards a strong foundation for the development and expansion of ECCE. The government has further ensured that ECCE is available to all through initiatives under the National Key Result Area (NKRA), Public-Private Partnership, increase access to ECCE under the NKEA, through rapid scale-up of private childcare centers and preschools as well as ECCE training centers (Malaysia Education Blueprint 2013-2025). The establishment of childcare centers also raises female workforce participation that has increased the national economy. This is in line with the findings from The United Nations Children's Fund (UNICEF). The findings indicated that quality childcare and education to be significantly related to the reduction in absenteeism, parent and community involvement, safety, health, and nutrition management. (Cole, Vidgen & Cleland, 2017; Jacobsen, Vale, Sambell & Devine, 2018; Katherine & Anthony, 2016).

On this basis, having a valid and reliable instrument designed specifically for assessing the quality of Malaysian childhood care and education (ECCE) could provide an insight into issues relating the Malaysia setting of childhood care and education and may furnish sufficient information for policymakers and teacher educators to design a curricula and syllabi which not only can improve the learning experience while they are in teacher education program but also ensure they are capable of engaging the new technologies in future teaching and learning activities.

2. Literature Review

As one of the essential entry points among the 13 Entry Points Projects (EPP) under the National Key Economic Areas (NKEA) in Malaysia, the provision of ECCE should extend from accessibility of quality ECCE to its sustained development. While having access to ECCE is an urgent need of some two million pre-school children, monitoring the growth of the care and education industry seems equally pressing; This monitoring should involve long-term, multi-prong research, and development of quality ECCE that focuses not only on the provision of ECCE services but its educational, social and economic returns.

In Malaysia, the current state of ECCE is at a crossroads. At the national level, ECCE-NKEA is a policy that transcends the early care-education provision across multi sectors from urban through rural to the interior, with the annual national budget even offering incentives to manufacturers and corporations to have workplace childcare facilities. Research findings carried out by UNICEF as early as the 1970s have shown that providing quality child care services will increase productivity through reduction in absenteeism, parental peace of mind, lower or distress and enhance family bonding, which will contribute to the increment of Gross National Income (GNI) of 2 billion by 2020 under EPPI. The development, implementation and follow-up of the national pre-school curriculum (NPCS) for the four to six (4-6) and PERMATA for the under-four (0-3) year old children reflect the developmental breadth that ECCE has reached and progressed in the last one decade.

While young children under-seven-year-olds have universal access to ECCE, quality and high-quality ECCE seem to be the next natural step in its development. Taking the US context as a case in point, as early as the 1960s, the US High Scope Program had shown that with every dollar invested in high-quality ECCE, the returns on the investment were calculated to be seventeen dollars. This, by any measure, is an impressive return. Where societies are experiencing the greying and aging population, the very young from ages zero to three have become an investment of the nation's future wealth. While education should not be seen primarily through the economics lens only, here, it seems it is a worthwhile investment in three-year-olds who in 20 odd years' time, will take their place in the nation's workforce to drive its economy. One should also take heed from current neuroscience research findings which suggest the long-term adverse effects on the intellectual and emotional development of children exposed to improper care when young.

3. Research Objectives

In response to the empirical study gaps and to make up the insufficiency of related research, it seems having an explicit measurement and scale to assess the quality of Malaysian childhood care and education (ECCE) is a worthwhile issue of inquiry and focuses in. Indeed, with the high reliability and validity of the instrument for examining the quality of Malaysia ECCE is urgent needed by Ministry of Education, Malaysia to identify whether investments in ECCE are worthwhile, and if so, is it able to reflect the meaning of a quality program that is in line with the investment. Funders need to be assured that their funds are

supporting quality programs and are particularly interested in the issue of cost-effectiveness. Furthermore, it is noteworthy to point out that valid and reliable instruments could serve as a blueprint for developing criteria that can be used to define effective program models for educators desiring to embark on ECCE programs in Malaysia. An understanding of what constitutes quality within the program would assist them in creating a desirable program, especially in the Malaysia context.

Furthermore, with the explicit measurement and scale, it can help in the process of understanding and investigating the teaching and practices of early childhood teachers in different ECCE settings. In addition, it examines whether the carers/teachers have effectively applied their knowledge of ECCE in their daily involvement with the children and how they manage their centers. Thus, the study will cover the teaching and learning process: identify the standards and quality of teaching and learning systematically, resources and materials available, and evaluation and assessment on various aspects of child development (physical, socio-emotional, cognitive, spiritual, language). It also probes into the roles and responsibilities of carers/teachers: using standards to rate the carers/teachers as the instructor, counselors, community organizer, and manager. The instrument and scale also developed further look into the interactions between the carers/teachers with the child and carers/teachers with parents. Indeed, the study will evaluate the environment and facilities of the settings such as safety, indoor, outdoor setup and facilities.

4. Methodology

4.1 Development of the QECCE items

The procedure of developing the QECCE item scale was conducted by using the sequential mixed-method research approach. The sequential mixed method has been widely employed by many empirical studies in the process of developing items in the educational setting (Teo, 2010). Systematic reviews of literature were carried out on a similar field was carried out, especially issues related to center management, safety, health, leadership, professional among childcare and preschool context have been focused (Darlyne et al., 2017; Jacobsen et al., 2018; Judy & Judith, 2017; Kaye, 2017; Knauf, 2017; Zeynep & Çiğdem, 2016).

Besides focusing on the reviewing of related pieces of literature in developing a holistic framework of the QECCE scale, a total of 3 preschool teachers and 2 preschool administrators were interviewed to help to build the item pool and get a better understanding of the predictors towards quality of Malaysian ECCE before beginning drafting the items for QECCE scale. These participating preschool teachers and administrators were selected through colleagues and personal contact. A total of 34 items was created in the first draft to assess the quality of Malaysian ECCE. Next, before an investigation of the QECCE scale psychometric quality was carried out, the content and criterion validities will be assessed.

Researchers have drafted the items based on the experts' feedback, and it was given to the focus group respondents to provide an initial inspection of the items. Alongside, draft items form of the QECCE scale was consulted to expert

panels for its validities and reliabilities of the items. Based on the feedback from the student teachers and expert panels, the first draft of the QECCE scale was modified. By extraction of disapproval items, a 22-item concerning the quality of the Malaysian ECCE scale was created. QECCE scale was designed based on a four-point Likert scale with responses between “never” (1) to “Often” (4). QECCE scale was designed with a four-point Likert scale to minimize the social desirability bias (Creswell, 2014; Matell & Jacoby, 1972).

In the analysis phase, researchers have carried out confirmatory factor analysis (CFA), an exploratory factor analysis (EFA) have analyzed to ensure all the suggested items and constructing have received the minimum thresholds. Those phases are commonly applied in designing and developing an instrument for examining the psychometric properties of the items created (Wong, Teo & Goh, 2014; Wong, Hwang, Goh & Khadijah, 2018; Wong, Mohd Sahandri & Pauline, 2016).

4.2 Participants and Data Collection Methods

In the process of selection of the samples, the researcher has focused on two major stages, which are:

- a) sample size and
- b) sampling design.

Those two stages were vital in the selection of the samples as they established the representativeness of the samples from the actual population. Some criteria were adopted to determine the actual accessible population. The criteria were considered appropriate and relevant in the context of the study as they ensured that the respondents belonged to the fresh graduate group. Participation by the carers and teachers was wholly voluntary. This table provides a general scientific guideline for sample size decisions. In anticipating that the response rate, in the Malaysia context, might be low, thus researcher has decided to increase the sample size. Wong et al. (2018) have suggested that a researcher needs to set the expectation for the response rate in order to identify the number of questionnaires needed to be distributed. Random sampling was used in this study. The population of the study included all teachers and administrators from private and government preschools in Malaysia. In this study, the samples involved were preschool teachers and administrators in Malaysia. Among these participants, 1956 (79.3%) were preschool teachers and 508 (20.6%) from preschool administrators. The respondents are a fully voluntary basis, and they have been informed that there will be no course credits given. All participants have been acknowledged of the objectives of the research and told of their rights to withdraw as samples anytime they want.

5. Analysis and discussion

5.1 Item Psychometric Qualities

When design and develop a high reliability and validity QECCE scale, exploratory factor analysis (EFA) was carried out in the study to examine its factor loadings of the items. Thereafter, all the 22 items were retained for confirmatory factor analysis (CFA) to identify its psychometric properties.

5.2 Exploratory Factor Analysis (EFA)

Prior to carrying out the exploratory factor analysis, it is a common way of developing an instrument to assess the data set for its suitability. Factor analysis for the 22 items of the QECCE scale has been carried out.

Varimax (Kaiser Normalisation) has been used on the 22 items of the QECCE scale. According to Kaiser (1960), when the Eigen index is greater than 1 should be reached to categorize the scale of each component. According to the findings of this study, the QECCE scale has extracted 4 factors and all the factors with eigenvalues > 1.0. Table 1 indicates that all 4 factoring variables in the QECCE successfully projected 63.25% of the total variance assumed from the suggested items.

As the results are shown the eigenvalue of 7.34, and it successfully described 16.82% of the total variance for the first factor, while the second factor with an eigenvalue of 3.44 (17.62% of the total variance). For the third, the total variance contributed was 16.23%, with an eigenvalue of 2.07. The last factor contributed 9.68% towards the total variance of the QECCE scale. Furthermore, the Kaiser-Meyer-Olkin (KMO) is 0.915. On this basis, 4 constructs were named. There were Centre Management (CM) (6 items), Safety, Health, and Nutrition Management (SHNM) (6 items), Leadership and Professional Development (LPD) (3 items), and Parent and Community Involvement (PCI) (7 items).

Table 1. Eigenvalues and Explained Variances of the Four-Factor Structure

Components	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Sum	Variance in Percentage	Cumulative	Sum	Variance	Cumulative %
1.	7.343	33.376	33.376	4.336	19.710	19.710
2.	3.449	15.679	49.055	3.878	17.627	37.337
3.	2.072	9.419	58.474	3.570	16.227	53.564
4.	1.051	4.776	63.250	2.131	9.686	63.250
5.	.797	3.625	66.875			
6.	.706	3.209	70.083			
7.	.686	3.119	73.203			
8.	.619	2.811	76.014			
9.	.596	2.709	78.723			
10.	.545	2.478	81.201			
11.	.477	2.169	83.370			
12.	.465	2.112	85.482			
13.	.443	2.014	87.496			
14.	.425	1.932	89.428			
15.	.403	1.833	91.261			
16.	.378	1.717	92.978			
17.	.333	1.514	94.492			
18.	.312	1.419	95.911			
19.	.259	1.176	97.087			
20.	.230	1.047	98.134			
21.	.216	.982	99.115			
22.	.195	.885	100.000			

Table 2. Factor Loadings, Mean and Standard Deviation of the Corresponding Items

Construct	Item		Loading
Centre Management (CM)	CM1	My childcare/preschool has skilled childcare providers/teachers in handling basic first aid.	.816
	CM2	My childcare/preschool has skilled childcare providers/teachers to handle emergency situations when needed.	.823
	CM3	My childcare/preschool has a comprehensive, structured, and easily accessible records management.	.711
	CM4	My childcare/preschool conducts periodic inspections for pest control.	.674
	CM5	My childcare/preschool has a well-managed and organized space.	.652
	CM6	My childcare/preschool has a well-managed and organized space.	.633
Safety, Health and Nutrition Management (SHNM)	SHNM1	My childcare/preschool ensures that children are being monitored at all times.	.774
	SHNM2	My childcare/preschool does not allow sick children to attend class.	.790
	SHNM3	My childcare/preschool ensures children's personal hygiene is monitored.	.875
	SHNM4	My childcare/preschool ensures that childcare providers/teachers conform to the guidelines in recognizing to recognize early signs of common illnesses and infectious diseases among children.	.825
	SHNM5	My childcare/preschool ensures that the floor (dining room, bathroom, study room) is always dry.	.831
	SHNM6	My childcare/preschool ensures that periodic dental check-ups are conducted by health officers.	.548
Leadership and Professional Development (LPD)	LPD1	My childcare/preschool provides feedback to improve the work quality of the staff.	.761
	LPD2	My childcare/preschool provides opportunities for staff to lead activities and programs.	.785
	LPD3	My childcare/preschool involves the staff in decision making.	.702
Parent and Community Involvement (PCI)	PCI1	My childcare/preschool arranges Parents-Teachers Association (PTA) meetings.	.751
	PCI2	My childcare/preschool involves parents in organized voluntary works (e.g., making teaching aids, generate financial sources).	.804
	PCI3	My childcare/preschool receives cooperation from local communities during TASKA/TADIKa activities.	.803

	PCI4	My childcare/preschool organizes parenting programs (e.g., how to teach children, motivation, etc.).	.771
	PCI5	My childcare/preschool involves local communities (e.g., health department, fire, and rescue department, police department) in activities and programs.	.681
	PCI6	My childcare/preschool receives donations (e.g., teaching aids, finance, equipment) from parents.	.638
	PCI7	My childcare/preschool involves parents in organized activities (e.g., Graduation Day, field trip, Sports Day).	.608

5.3 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was carried out towards the four-factor loadings (22-items scale) underlying structural equation modeling (SEM - AMOS) software.

Table 3 shows that all standardized estimated weights were good indexes (.88 to .57). The results indicated that the estimated weights for each construct are considered valid and accepted (Hair et al., 2014). Besides that, the multiple square correlations (R^2) of all the 22 items were between .30 to .78 and thus suggesting that the suggested items have successfully explained by their predictors for quality of Malaysian ECCE at the range from 30% to 78%.

Table 3. Results of the Suggested Measurement Model Based on the 22 Items

Latent Variable of QECCE scale	Item	SE	R^2	Average Variance Extracted ^b ($\geq .50$)*	Composite Reliability ^c ($\geq .50$)*
Centre Management (CM)	CM1	0.78	0.61	.50	.85
	CM2	0.81	0.66		
	CM3	0.73	0.54		
	CM4	0.58	0.34		
	CM5	0.62	0.38		
	CM6	0.69	0.48		
Safety, Health and Nutrition Management (SHNM)	SHNM1	0.79	0.62	.62	.90
	SHNM2	0.74	0.55		
	SHNM3	0.88	0.78		
	SHNM4	0.86	0.73		
	SHNM5	0.85	0.73		
	SHNM6	0.57	0.32		
Leadership and Professional Development (LPD)	LPD1	0.87	0.75	.68	.85
	LPD2	0.88	0.78		
	LPD3	0.70	0.50		

Parent and Community Involvement (PCI)	PCI1	0.68	0.46	.51	.86
	PCI2	0.77	0.60		
	PCI3	0.77	0.60		
	PCI4	0.75	0.56		
	PCI5	0.66	0.44		
	PCI6	0.59	0.35		
	PCI7	0.74	0.54		

As it is seen in Table 4, the suggested model reach the minimum thresholds usually requested for a satisfactory model's fit ($R^2= 2534.66^*$, $p<0.00$; $R^2/df=12.486$; $GFI=.909$; $CFI=.920$; $TLI=.908$ and $RMSEA = 0.068$).

Table 4. Good-of-Fit Indices for the Measurement Model

Fit indices	Values	Criteria ^a
χ^2 Statistic	2534.66*	Insignificant but significant p -value can be expected.
χ^2/df	12.486	<3
RMSEA	0.068	<0.08
GFI	0.909	≥ 0.90
CFI	0.920	≥ 0.90
TLI	0.908	≥ 0.90

5.4 Discriminant and its Convergent Validities

As common practices in the process of developing items, the study was carried out discriminant and convergent validities for the QECCE scales. These were done by analyzing Average Variance Extracted (AVE) and validities of its discriminant of each construct (Wong et al. 2019). Table 3 shows all the Cronbach Alpha indexes within .85 to .90, showing satisfactory reliability for all four constructs.

Alongside the AVE for each measure is above .50, which has indicated that the predicted factors were explained by the items. The findings of the validity of the discriminant showed in Table 5. According to Teo (2009 & 2010), the construct indicated higher significant related to its indicators that another predictor.

From Table 5, it can be seen that the indexes are higher than the off-diagonal elements. The discriminate validities have accounted through the 4 factors model with 22 suggested items which were Centre Management (CM) (6 items); Safety, Health and Nutrition Management (SHNM) (6 items); Leadership and Professional Development (LPD) (3 items) and Parent and Community Involvement (PCI) (7 items).

Table 5. Discriminant Validity for the Measurement Model

	SHNM	CM	LPD	PC
SHNM	(0.789)			
CM	0.489	(0.708)		
LPD	0.660	0.592	(0.822)	
PC	0.154	0.274	0.242	(0.685)

6. Limitations of the Study

It is important to state the limitations of the study to frame the above discussions, recommendations, and conclusion within its proper context and perspective. Among the limitations identified were:

- a) The questionnaire used in this study may not be able to measure all aspects of the variables concerned. Cultural biases will be assumed in this study, and therefore, it is subject to its weaknesses.
- b) The variables included in this study were Centre Management (CM) (6 items), Safety, Health, and Nutrition Management (SHNM) (6 items), Leadership and Professional Development (LPD) (3 items), and Parent and Community Involvement (PCI) (7 items). There may be other variables affecting the Quality Early Childhood Care and Education (QECCE) scale.
- c) There are no known comprehensive theories and models by local scholars that can provide an explicit basis in explaining the Quality Early Childhood Care and Education (QECCE) scale. Theories and models that were conceptualized by western scholars have been adopted and adapted to give a possible theoretical foundation of the study. Thus, cross-cultural differences are assumed in this study.
- d) The time-lapse between the data collection time (in 2017) exists. Thus, in this study, it is assumed that external factors would not affect the levels of learning outcomes.
- e) The population of this study is only included in Malaysian samples, teachers, and staff from private and government preschool schools. Therefore, the findings derived from the analyses might not adequately reflect the perceptions of other countries.

7. Conclusion

The aim of this study is to develop and provide an initial psychometric property evaluation of a scale to assess the quality of Malaysian early childhood care and education. This scale provides a better understanding of factors contributing to the quality of ECCE in the Malaysia context.

A total of 34 items was developed at the first stage and studied by expert panels for its validities and identify whether or not the contents suggested were in line with the quality of ECCE contexts and settings. By extraction of disapproval items, a 22-item concerning the quality of the Malaysian ECCE scale has been assessed by Exploratory Factor Analysis and Confirmatory Factor Analysis.

Based on EFA, indicated the items in the QECCE consist of four-factor structure Centre Management (CM) (6 items); Safety, Health and Nutrition Management (SHNM) (6 items); Leadership and Professional Development (LPD) (3 items) and Parent and Community Involvement (PCI) (7 items). The results show that the QECCE scale described 63.25% of the total variance in measuring the quality of early childhood and care education.

Based on the EFA and CFA analysis, it has been shown that the four factors structure has perfect standardized loadings for each construct. Alongside this, the absolute fit indexes are exceeded the minimum thresholds for the acceptable model fit. ($R^2= 2534.66^*$, $p<0.00$; RMSEA = 0.068; $R^2/df=12.486$; CFI=.920; TLI=.908 and GFI=.909). Furthermore, the outputs of convergent validities and discriminant validities were evidence to show that the QECCE scale has achieved satisfactory of the all 4 factoring constructs proposed.

In line with this, it was confirmed that the four factoring structures of the QECCE scale is reliable and useable as a scale to measure the quality of Malaysian ECCE. The findings not surprising, given the fact that center management, safety, health, leadership, professional among childcare and preschool are the dominant predictors towards the quality of ECCE in the nation. It is well documented in the relevant literature that those predictors were important in influencing the quality of education (Darlyne et al., 2017; Fonsén & Ukkonen-Mikkola, 2019; Jacobsen et al., 2018; Judy & Judith, 2017; Kaye, 2017; Knauf, 2017; Zeynep & Çiğdem, 2016). Thus, the factors contributing to the quality of Malaysia ECCE were in line with many previous studies done by the west scholars.

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