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Factor Analysis on The School Innovation Culture Scale in The Malaysian Context

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Abstract

Innovation culture is the key to today's educational advancement and reformation. If we want the educational system to be more open to new ideas in innovation, it is therefore necessary to develop a foundation of shared values, norms and practices within the school community. Thus, this study used the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) methods to build and validate the instrument in innovation culture, consists of 44 items based on Martins and Terblanche theory. Statistical Packages for the Social Sciences version 26 and Structural Equation Modelling version 24.0 were used to evaluate the data. The questionnaire was distributed to 478 teachers in Sabah, Malaysia. The Exploratory Factor Analysis (EFA) developed a four-factor model with 21 items known as Strategy (SG), Structure (SR), Support Mechanism (MS) and Innovative Behaviour (TLI). Meanwhile, the Confirmatory Factor Analysis generated 17 items that supported the four factors hypothesis. The model fit index showed a Chi-squared/degree of freedom (Chisq/df) value at 3.940, Tucker-Lewis Index (TLI) at 0.954, Comparative Fit Index (CFI) at 0.962; and Root Mean Square Error of Approximation (RMSEA) at 0.071. The composite reliability (CR) and average variance (AVE) derived from the domains varied between 0.878 to 0.934 (CR) and 0.615 to 0.732 (AVE). The analysis showed that the instrument is accurate and reliable to measure innovation culture in the school context. Validation of this model can significantly use to assess the determinants of innovation culture in educational settings.

Keywords: Innovation Culture, School Culture, Innovative School Culture, School Reform, School Innovativeness

Introduction

Malaysia's dismal performance in the International Assessment of International Mathematics and Science Study (TIMSS) 2011 and the Program for International Student Assessment (PISA) 2009 prompted a large-scale educational restructuring in 2013. As a result, the Malaysian

Educational Development Plan (PPPM) was developed with input from UNESCO education specialists, Bank World, the OECD, institutions of higher learning, school leaders, teachers, parents, students, and the general public for 13 years beginning in 2013 and concluding in 2025. In PPPM, reforms to the education system placed Malaysia's educational quality and productivity first while ensuring each student's costs were kept low. Improved teaching and learning results in students developing high-level thinking skills (HOTS), using information technology to make education more accessible to all students, and implementing ICT programmes at schools. These efforts are aligned with the OECD's (2016) assertion that innovation in education is critical for improving learning performance, educational standards, efficiency, equity, and equality and reducing education expenses. Nowadays, the primary characteristic of innovative development is an innovative education that will shape the future of education reform (Tymenko, 2019).

Although educational innovation is conceivable, it is however not straightforward (Greany, 2018; Joos & Meidjam, 2019). Change and educational innovation are difficult for a highly controlled organisation such as a school since they occur inside a highly regulated, politicised, and hierarchical structure (Carbonell, 2011; Diaz-Gibson et al., 2019; Pedró, 2013; Schön, 1998). Programmes and standards, instructional materials, educational technologies, organisation, and educational environment management all fall within educational innovation. As a result, it places great value on investigating educational innovation as a complex, self-renewing systemic development reliant on shifting social and educational agendas (Demyanenko, 2020). Each school's unique culture and educational background might be used to analyse and contextualise innovation (Dungan, 2018). The school's culture must support the adoption of innovation and acquire acceptability (Joos & Meijdam, 2019; Odumosu et al., 2020).

A supportive atmosphere for creativity and motivation is needed to foster an innovative culture inside an organisation (Tushman & O'reilly, 1997; Danks et al., 2017), which is often referred to as the "heart of innovation" in academic literature (Tushman & O'reilly, 1997). It is critical for the personnel in an organisation to feel empowered and encouraged to make innovative choices and experiment with unique problem-solving techniques (Amabile, 1997). Indirectly, this will eliminate all impediments to innovation success. The degree of creativity in an organisation is related to a corporate culture that fosters learning and involves decision-makers (Hurley & Hult, 1998). Fostering an innovative culture inside the organisation will provide the organisation with a competitive edge and will result in an increased organisational performance (Dobni, 2008). Teachers frequently assert that school administrators often implement projects that negatively influence the school and its surrounding environment (Titrek, 2015). As a result, fostering an innovative school culture is critical to fostering teachers' innovative ideas. Additionally, there is still a scarcity of research on innovation culture in educational settings today. This study will provide insight into the cultures that foster innovation in the educational environment.

Literature Review

Empirical studies have proven that there is a strong connection between an organisational culture and the ability of organization to be innovative (Tushman, 1997; Naranjo-Valencia et al., 2016). Culture will change people's behaviour to make them want to do things (Hofstede, 2011; Schein, 1990). This culture will help the organisation be more innovative (Naranjo-Valencia et al., 2016). By examining the relationship between organisational culture and educational advancements, academicians and policymakers may acquire a deeper

understanding of the fundamental characteristics of organisational culture in innovation (Caliskan et al., 2019). The findings will serve as a roadmap for cultural transformations and educational reforms. The true challenge however is to instill an innovation culture throughout all schools and empower teachers to be leaders in curriculum reform (Ambrose, 2018).

Applying an innovative culture to education is important for educational change (Caliskan et al., 2019). "Innovation culture" refers to the condition when people at a school follow the same rules and traditions. These rules and traditions include things like what people should do and how they should do it and what they should expect from each other (Rashid et al., 2011). In order to make innovation as the norm in schools, people must have positive attitudes and behaviours about change. This attitude is known as "creativity." They must be able to accept new things. In addition, the school leaders and administrators must be able to motivate, reinforce, and train themselves to do their jobs well. Organisational cultures have been shown to affect innovation, but they can also stifle innovation (Caliskan, 2019).

However, when it comes to researching an innovation culture in schools, a variety of approaches and theories was adopted by researchers to conduct their research. The Competing Value Framework (CVF) Model by Cameron and Quinn (1999); Schein's Model (1990); Rao and Weintraub (2013); Hoogan and Coote's (2014); Dobni's (2018) are among the widely used organisational culture theories used to study innovation culture in an educational context (Fuad et al., 2020). As a result, it is difficult to measure innovation culture because of its broad extent and the lack in its operationalisation (Bourdeau et al., 2020). However, research conducted in recent years demonstrated a consistent trend across all of them. The most common theme mentioned are risk-taking (Monsonís Canós, 2019; Ruchiwit et al., 2019; Smith & Smith, 2020; Koroleva & Khavenson, 2017; Poirier, Schwartz & Eddy et al., 2017; Hamburg & Bucksch, 2017; Dungan, 2018; Schwabsky, Erdogan & Tschannen-Moran, 2019), collaboration and teamwork (Baruah & Paulus, 2019; Lašáková et al., 2017; Saleh et al., 2017; Carvalho et al., 2020), communication (Serdyukov, 2017; Kolesnikova, 2020; Diaz-Gibson et al., 2019; Lavonen, 2017), school structure (Tymenko, 2019; Deppeler & Aikens, 2020; Greany, 2016; Whang, 2017), school strategy (Whang, 2017; Diaz-Gibson et al., 2019; Afshari et al., 2019), and innovative behaviour (Sidorkin, 2017; Lašáková et al., 2017; Kremer et al., 2019; Dungan, 2018). These cultural beliefs and norms mostly aligned with (Martins and Terblanche's cultural model, 2003).

When Martins and Terblanche (2004) investigated the relationship between organisational culture and creativity and innovation, they discovered that the dimension described in Martin's model of organisational culture (1989, 1997) directly impacts the creativity and innovation of an organisation's culture. As a result, many researchers prefer to use the cultural model developed by Martins and Terblanche (2003) to study the innovation culture in schools. Five factors, including structure, strategy, support mechanisms, innovative behaviour and communication, have been identified as necessary elements in promoting innovation in this model. This model captures most of the features of innovation cultures in the Malaysian educational system. This conclusion is based on the fact that these structures have a systemic approach, which allows for inquiries into the interdependence, relationships, and connectivity of different subsystems and organisational cultural factors and how they all work together.

Methodology

This quantitative study used descriptive survey design. The Exploratory Factor Analysis (EFA) and Confirmatory factor analysis (CFA) were conducted on the 44 purposed items of the school innovation culture scale. EFA is used to determine the underlying structure among the analysis variables. In contrast, the CFA approach is frequently used to test the construct validity and dimensionality of the development scale or instruments (Hair et al., 2019). Thus, it is appropriate to test the number of factors or the latent constructs that best fit the model examined.

Participants

The respondent for the EFA analysis consisted of 105 respondents randomly selected from three schools in the chosen population. Next, the CFA analysis respondent consisted of 478 teachers who were randomly selected from 32 secondary schools in Sabah, Malaysia. A total of 322 (67.4%) female teachers and 156 (32.6%) male teachers have participated in this study. As the sample is greater than 200, it meets the rule of thumb mentioned by Hair et al (2019) to decrease the likelihood of problems with the model's degree of freedom

Instrumentation

The researcher used a questionnaire containing 44 items (questions) for the EFA analysis in this study. The construct Structure (SR) consisted of ten items, Strategy (SG) with ten items, Supportive Mechanism (MS) with nine items, Communication (KOM) with five items and Innovative behaviours with ten items. All research instruments were adapted from Gomes and Wojahn's (2017); Zdunczyk and Blenkinsopp's (2017) instruments 2007. The content validity index evaluated by the educational leadership experts ranged between 0.92 to 1.00.

Data Analysis

Exploratory Factor Analysis (EFA)

The EFA was carried out on all five sub-constructs, which had 44 elements. An overall number of 105 questionnaire items were sent to teachers in Sabah, Malaysia. The Principal Component Analysis (PCA) approach was used to conduct the EFA analysis. Items with a low value of less than 0.55 were removed from an evaluation (Hair et al., 2019).

Confirmatory Factor Analysis (CFA)

An AMOS programme (version 24) was applied to evaluate the maximum likelihood confirmatory factor analysis of 44 items of the Innovation Culture Instrument following EFA to assess the data's model fit. First, as indicated by Hair et al (2019), data imputation was performed on all missing values situations. The data's normality was then examined to rule out univariate outliers, as confirmatory factor analysis is susceptible to outliers and missing values. Then, a Mahalanobis distance was used to exclude outliers from the data. Following that, Confirmatory Factor Analysis (CFA) was used to estimate the factor loadings of each variable. Each latent variable must have a minimum of three indicators. Hair et al (2019) recommended that a loading factor larger than 0.55 be used when the sample size is 105. If the loading factor is more than or equal to 0.7, it is considered a reliable indicator (Hair et al., 2019).

The CFA analysis determined the model's stability and validity using the Convergence Validity (CR) and Discrimination Validity (AVE) tests. Convergent Validity quantifies how the items reflected the underlying theoretical component being measured. Discriminant Validity

quantifies the degree to which items will differ and examines the significant variance of each variable for the same purpose (Hair et al., 2019). These constructs overlap if their correlation is greater than 0.9 (Hair et al., 2019). Next, the discriminant validity (AVE) was determined by examining the square root of the AVE and the correlation between the components. Discriminant validity is attained when the square root of the AVE is greater than the correlation between the constructs.

Results

Exploratory Factor Analysis

PCA with Promax rotation was performed on 44 items evaluating innovation culture using SPSS version 26. Prior to doing the factor analysis, a preliminary analysis was conducted to assess the data's appropriateness. Kaiser-Meyer-sample Olkin's adequacy value was 0.926, greater than the necessary value of 0.5. (Hair et al., 2019). Additionally, Bartlett's Test of Sphericity revealed a significant value of less than .05 (Hair et al., 2019). Table 1 summaries the outcomes of this test. The test findings indicate that the data is adequate and fits the criteria for performing the factor analysis technique (Hair et al., 2019).

Table 1
KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.926
Bartlett's Test of Sphericity	Approx. Chi-Square	3230.224
	df	528
	Sig.	.000

Following that, Table 2 and Figure 1 provide the number of components retrieved from the eigenvalues and the scree plot result, respectively. The PCA findings in Table 4 reveal that five components with eigenvalues greater than one account for 72.189 per cent of the total variance.

Table 2
The eigenvalues explained

Total Variance Explained							
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	17.637	53.445	53.445	17.323	52.494	52.494	13.124
2	2.239	6.784	60.228	1.926	5.836	58.330	13.194
3	1.615	4.894	65.122	1.293	3.919	62.248	13.661
4	1.242	3.763	68.885	.896	2.716	64.965	12.744
5	1.090	3.303	72.189	.770	2.333	67.298	5.425

Table 4 has eigenvalues ranging from 1.090 to 17.637. Component 1 explains 53.445 per cent of the variation, whereas component 2 explains 6.784 per cent, component 3 is 4.894 per

cent, component 4 is 3.763 per cent, and component 5 is 3.303 per cent. The scree plot, as shown in Figure 1, supports this conclusion. The entire value of the variance described in this section is 67.298 per cent. This value is acceptable since it exceeds the predetermined 60 per cent criterion (Hair et al., 2019).

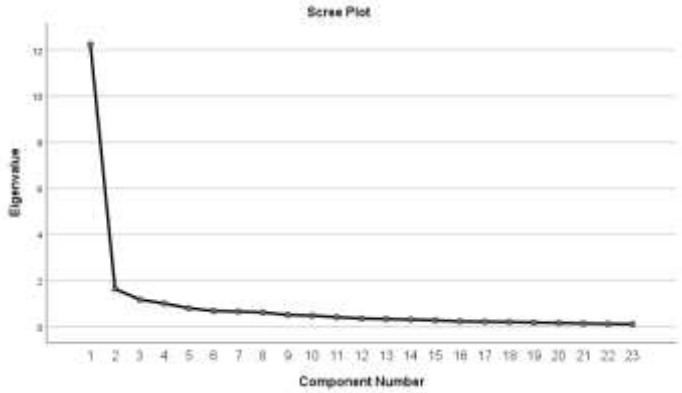

Figure 1. The eigenvalue scree plot

The five components found and the elements represented by them throughout the EFA technique are summarised in Table 3. This result is consistent with the scree plot result in Figure 1. Items that cross-load and those that do not load with any factor were removed. Due to the limited sample size of 105, a cutoff value of 0.55 was used for factor loading (Hair et al., 2019). Items having a value of less than 0.55 were removed from the final questionnaire. Component five has just two elements and hence does not meet the criteria for performing CFA (confirmatory factor analysis). As a result, component number five was dropped.

Table 3
The exploratory Factor Analysis (EFA) components and their respective items.

Pattern Matrix

	Factor				
	1	2	3	4	5
MS26	.832				
TLI35	.711				
MS25	.710				
MS28	.693				
MS27	.687				
SR6		.944			
SR8		.807			
SR5		.735			
SR10		.701			
SR7		.601			
SR4		.581			
SG20			.750		
SG18			.683		
MS23			.657		
SG15			.587		
SG19			.574		
KK34				.883	
TLI37				.769	
TLI42				.730	
TLI40				.657	
TLI36				.579	
SR1					.739
SR2					.690

MS26, MS27, MS28, MS29, and TLI35 comprised the first determinant: the support mechanism. The second component includes the Structure descriptors SR4, SR5, SR6, SR7, SR8, and SR10. The third component is the Strategy determinant and consists of SG15, SG18, SG19, SG20, and MS23. Meanwhile, the fourth component, Innovative Behaviour, constituted KK34, TLI36, TLI37, TLI40, and TLI42. As a result, innovation culture was evaluated using 21 elements across four dimensions. Cronbach Alpha was then calculated to confirm that the latent concept has internal validity. Internal validity refers to the strength of the association between the items produced by the preceding PCA. The internal validity of each component is shown in Table 4.

Table 4
The Internal Reliability of the constructs.

Reliability Statistics		
Component	Number of Items	Cronbach's Alpha
Support Mechanism	5	0.882
Structure	6	0.921
Strategy	5	0.876
Innovative Behavior	5	0.908
Total Items	21	0.898

Cronbach's alpha values greater than 0.7 show the accuracy of the items used to compute the variable (Robinson et al., 1991). As a result, confirmatory Factor Analysis was carried out to approve all 21 items in four components for further analysis.

The Confirmatory Factor Analysis

The exploratory factor analysis in the preceding section led to the innovation culture measurement model (EFA). Following the EFA processes, only four determinants were indicated, as shown in Figure 2. Support Mechanism (MS), Structure (SR), Strategy (SG), and Innovative Behavior are the four factors of innovation culture (TLI). Prior to the CFA processes, each portion of MS and SR had six elements, whereas SG and TLI only had five.

Figure 2 depicts the measurement model used for the initial observation. According to Hair et al (2019), an analysis of factor loading indicated all load levels above 0.5. Using Chi-sq, the 5.198 value is above the needed 5.0 requirement, but the RMSEA value of 0.093 also failed to meet the 0.08 model fit threshold. Three indices are higher than the 0.90 thresholds: CFI (.925), IFI (.925), and TLI (.914). Thus, the initial model of innovation culture must be modified to meet the model fit requirements.

The modification index (MI) is then analysed, representing the covariances' value between products. MI values of 79.978 are greater for TLI41 and KK34. Consequently, TLI41 was removed from the list due to its greater frequency than TLI36. After this component was eliminated, the model fit indices were reevaluated. While the relative value of Chi-Sq (4.865) satisfied the stated requirements, the root means square error (RMSEA) value of 0.081 fell short of the necessary threshold value. Consequently, model modifications were carried out repeatedly until the appropriate matching indices were acquired and the model proved fit.

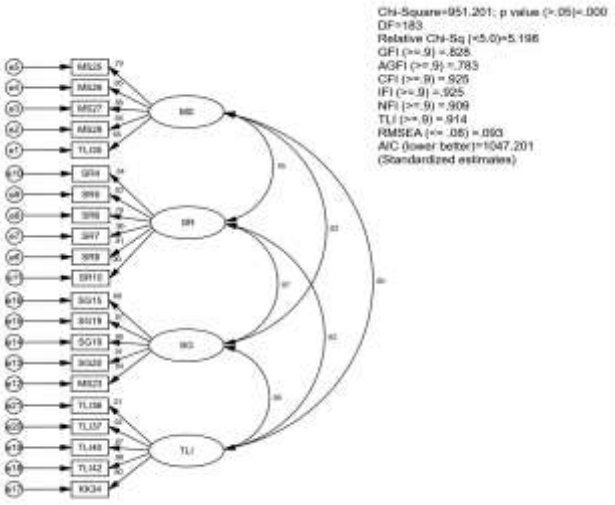

Figure 2. Confirmatory Factor Analysis of Innovation Culture Scale (before modification)

The goodness of fit indices

Figure 3 depicts the final measurement model concerning multiple iterations of the modification procedure. To get the necessary model fit indices, the Support Mechanism component's items TLI35 and TLI41 were withdrawn; the Structure component's item SR10 was removed; the Strategy component's item MS23 was removed, and the Innovative Behavior component's item KK34 was removed. Figure 3 reveals that the Chi-Sq relative index is 3.940, which is less than the necessary value of 5.0. The RMSEA value of 0.071 shows that the value is less than 0.08. Other indices with higher 0.9 values were the CFI (.962), IFI (.962),

NFI (.950), and TLI (.954). As a result, because all indices' values fulfil the given standards, this model is therefore suitable for the assessment of its validity and reliability.

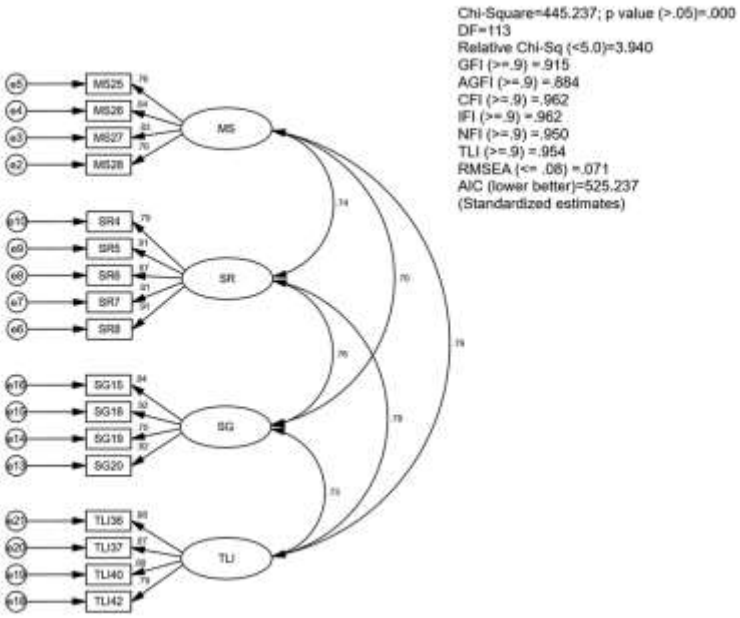

Figure 3. Confirmatory Factor Analysis of Innovation Culture Scale (after modification)

The RMSEA value is 0.071 (meets the criteria of 0.08), the CFI value (.962) fulfils the condition of more than 0.90, and the Chisq / df ratio is 3.940 in the parsimonious fit category (achieves less value out of 5.0). Thus, as seen in Table 5, all latent constructs in this model fulfil the criterion for construct validity (Hair et al., 2019).

Table 5
Table of Model Fit Indices

Category	Cut Off value	Value	Decision
Absolute fit	RMSEA ≤ 0.08	0.071	Accepted
Incremental Fit	CFI ≥ 0.9	0.962	Accepted
	TLI ≥ 0.9	0.954	
Parsimonious Fit	Chisq/df < 5	3.940	Accepted

The Validity and Reliability of the School Innovation Culture Scale

Prior to developing the structured model, it is necessary to establish the validity and dependability of innovation culture components. The measurement model's unidimensionality, convergent, and discriminant validity depicted in Figure 3 were evaluated. Factor loading, Average Variance Extracted (AVE) values, and Construct Reliability contribute to a measurement model's convergent validity (CR). When evaluating unidimensionality, the factor loadings of each item must be more than 0.5 or 0.7. Each construct's average variance extracted (AVE) value must be larger than 0.5, and its construct reliability (CR) value must be 0.7 or above. Nevertheless, CR values between 0.6 and 0.7 are acceptable (Hair et al., 2014).

To begin, observations of factor loading were made to ascertain unidimensionality. As seen in Table 8, the loading of all factors is more than the optimal value of 0.7. Following that, the Support Mechanism component had an AVE value of 0.726, the Structure component had an AVE value of 0.766, the Strategy component had an AVE value of 0.816, and the Innovative Behavior component had an AVE value of 0.784. All AVE values are more than or equal to the

minimum value of 0.5. Meanwhile, the support mechanism component has a CR value of 0.888. 0.942 is the value assigned to the structural component. The strategy component is 0.930, whereas the TLI component is 0.916. All of these numbers are more than the needed minimum of 0.6. As a result, it was concluded that this model satisfies the convergent and construct validity requirements.

Table 6
The AVE and CR values for Innovation Culture constructs.

construct	Items	Factor Loading	CR (Minimum 0.6)	AVE (Minimum 0.5)
Supportive Mechanism (MS)	MS25	0.76	0.878	0.642
	MS26	0.84		
	MS27	0.83		
	MS28	0.78		
Structure (SR)	SR4	0.79	0.934	0.615
	SR5	0.91		
	SR6	0.87		
	SR7	0.81		
	SR8	0.91		
Strategy (SG)	SG15	0.94	0.911	0.722
	SG18	0.92		
	SG19	0.70		
	SG20	0.82		
Innovative Behaviour (IB)	TLI36	0.88	0.916	0.732
	TLI37	0.87		
	TLI40	0.88		
	TLI42	0.79		

Discussion

This study quantified the innovation culture using Martins and Terblanche's (2003) theory. Five determinants were proposed in this theory: Strategy (SG), Structure (SR), Support Mechanism (MS), Innovative Behavior (TLI), and Communication (KOM). However, the investigation validated just four determinants: strategy, structure, support mechanism, and innovative behaviour. Each of these three determinants, namely Strategy, Support Mechanism, and Innovative Behavior, had four components, while the Structure determinant contained five things. With a variance percentage of 67.298, 17 items were validated to assess the four determinants of innovation culture using this theory. This study corroborates Crossan and Apaydin's (2010) assertion that the following aspects are predictors of organisational innovation: purpose and strategy; structure and system; resource allocation; organisational learning and knowledge management; and organisational culture.

The first established determinant is strategy, consisting of four components: i) The requirement to adhere to a defined job description; ii) Prioritising cooperation; iii) Cross-functional teams are habituated to inventing, and iv) Diverse skills on innovation teams. This characteristic demonstrates unequivocally that creativity is a culture fueled by collaborative effort (Owusu-Agyeman, 2019). Teamwork is the main factor that frequently appears in all research regarding the implementation of innovation inside an organisation (Davydova & Dorozhkin, 2016; Banerjee & Srivastava, 2017; Feixas et al., 2018; Zhang et al., 2018; Vick &

Nagano, 2018; Owusu-Agyeman, 2019; Soleas & Bolden, 2020). Team members must trust and respect one another, comprehend one another's viewpoints and styles, manage conflicts successfully, and be receptive to new ideas or inquiries that result in innovative ideas (Banerjee & Srivastava, 2017). Teamwork is more successful when team members possess complementary talents and abilities and share common ideals. A team of innovators must be allowed sufficient time and space to collaborate to develop innovation (Zhang et al., 2018) in schools.

The OECD (2016) said unequivocally that schools require strategies to implement innovative practices since schools are incapable of managing research, networking, restructuring, and developing technical breakthroughs necessary for educational innovation. However, implementing inventions in schools, which change pedagogies, technologies, and management systems, are not straightforward (Findikoglu & Ihan, 2016). Thus, innovation teams of individuals with various abilities and capable of working with other teams, whether from the same school, from different schools, or in multiple districts and states, are critical for nurturing innovative thinking in schools. Persons with a strong innovation culture often possess superior abilities and competence (Bezhanova et al., 2019). Additionally, inventing requires individual skills such as professionalism, constant development, aggressiveness, and resilience (Meissner & Schmatko, 2019). These distinct self-competence characteristics can help develop self-leadership abilities and self-confidence, resulting in more efficient collaboration.

The second confirmed determinant is structure, which consists of five components: i) The school's strategic priority is to develop new products to solve student problems; ii) Discuss the gap between present and past achievements; iii) Provide complete information on how management can realise the strategic goals of innovation; iv) Ensure that innovation goals align with school goals, and v) Emphasise the importance of innovation quality in school goals and objectives. Damanpour (1991) stated that structure would indicate the complexity and intensity of an organisation's management. Historically effective organisational structures may be ineffective when the organisation's primary purpose is to be innovative and creative. Beauracracy will be a significant impediment to members of the organisation's aspirations to be creative and inventive. Organizations that prioritise innovation will have a distinct organisational structure from other organisations. Structural change is critical for innovation implementation; it may provide management with new and different ways than the previous, too bureaucratic structure. However, these improvements will frequently encounter the same opposition that innovation faces in organisations (Lavelle, 2015). Structural changes in educational organisations might expedite the adoption of innovations (Lašáková et al., 2017). Establishing small units dedicated to innovation, such as e-learning units, can accelerate the adoption of innovations. It supports innovation performance and serves as a module development unit and training provider for personnel.

The third determinant confirmed in this model is the Support Mechanism, which includes four items: i) It is relatively easy to obtain resources for implementing high-risk projects; ii) Training received is more focused on functional expertise than on social skills; iii) Have authority to determine which training is required; and iv) Rewards are given in recognition of innovative ideas. Teachers' levels of competence and ability and their motivation to learn and adapt what they learn in the classroom all contribute significantly to innovation. As a result, it is critical to get funding for high-risk ventures (Behrens & Patzelt, 2018; Soleas & Bolden, 2020; Vicente et al., 2020). Additionally, proper resources for

innovation would hasten the impact of radical innovation (Behrens & Patzelt, 2018) and motivate educators to innovate (Soleas & Bolden, 2020).

An innovative culture should prioritise specialised training that teaches employees how to organise their actions to accomplish the goals and objectives set by themselves or the organization (Meissner & Schmatko, 2018). This training involves an examination of the team's or group's aims and objectives and an increase in their understanding of the importance of enhancing organisational performance concerning team performance. Due to the training offered, new organisation members will develop their leadership skills and build confidence in their talents and competencies. These abilities can also help the team function more efficiently and effectively. In addition, training will increase member collaboration and facilitate good communication. On the other hand, Sartori et al (2018) noted a significant gap in implementing staff training and development connected to innovation, although prior research showed that training is critical. Caliskan and Zhu (2019) believe that teachers' participation in educational innovation is constrained by a lack of training, workload, curriculum, academic achievement conflicts, management, and current leadership.

Finally, the fourth determinant confirmed in this model is Innovative Behaviour, which consists of four components: i) Identify a better way to do work, ii) All ideas are given equal consideration, iii) Feel motivated to stay current on knowledge, and iv) Conflict is resolved through constructive discussion. Teachers will constantly seek novel approaches to challenges, particularly those pertaining to students' academic progress (Smith & Smith, 2020). They will search out an appropriate strategy if they notice their student's academic performance is lacking. However, projected innovation will include some risk-taking because it will affect the schools' revenue and image. Fear of failure can lead experimental innovators' ambition to create to trump their fear of failure. As a result, Smith and Smith (2020) emphasise the need for managerial assistance in accepting failures. Knowledge underpins every teacher's inventive behaviour when fixing student challenges. Knowledge translation happens when teachers apply current information to create new goods, processes, or services in organisations.

Significant advancements are frequently prompted by shifts in educational, social, political, or economic aims (Dalin, 1973). These advancements would affect traditions, resulting in increasing social friction. Eventually, conflicting community ideals emerge between school employees, allowing for consensus or progress (Stenhouse, 1975). Conflict arises during team collaboration to develop innovative ideas and ultimately deliver innovations. During the collaboration, the sides to the disagreement may hear one another's perspectives and then agree on a solution. Negotiation between members and leaders and cooperation among team members will increase the number of ideas generated inside the organisation and motivate employees to create. Additionally, all teachers' plans should be treated uniformly, whether they are handled by all teachers, principals, or administrators. As a result, instructors must be more receptive to conflict resolution, comprehend why disagreements arise, identify the persons involved, and evaluate each concept equitably to innovate. This behaviour is critical for ensuring that disagreement has a beneficial effect on school growth.

Four drivers of innovation culture in the school setting were validated in this study: structure, strategy, support mechanism, and innovative behaviours. Only the communication factor presented at the outset of the study had a significant link with innovation culture in the schools analysed, although earlier research had shown its importance in the culture of innovation (Owusu-Agyeman, 2019; Sipe, 2019). Caliskan and Zhu (2019) argued that an

excessively bureaucratic organisational structure would stifle internal communication. This situation exists in Malaysian education system, where the principals remain as administrative authority of the school. Kurt et al (2017) assert that a leader's negligence in listening to or discarding elevated recommendations stifles innovation. As a result, as the innovation culture grows more bureaucratic, change within the organisation will be gradual.

Conclusion

This study delves into the realm of innovation culture within educational environments through the lens of Martins and Terblanche's (2003) theory. The exploration encompasses five critical determinants: strategy, structure, support mechanism, innovative behavior, and communication. However, the empirical evidence distinctly showcases that four factors firmly establish themselves as the driving forces behind the culture of innovation within the observed schools: Strategy, Structure, Support Mechanism, and Innovative Behavior. Remarkably, the influence of communication determinants on the culture of innovation within these schools appears to be rather limited. It is essential to acknowledge that this study bears certain limitations, primarily rooted in its employment of cross-sectional data and its focus on a specific population within the Malaysian state of Sabah. Thus, the implications drawn from these findings could potentially evolve with the generalization of the study to other countries or through the incorporation of qualitative research methods. Table 7 showed the summarized findings of the research.

Table 7
Summarized of the Research Findings

Determinants	Items	Details of the items
Supportive Mechanism (MS)	MS25	Easily obtain resources to implement high-risk projects
	MS26	Training received more focused on functional expertise rather than social skills
	MS27	Authority to determine the type and frequency of training needed
	MS28	Rewards are given in recognition of exceptional creativity, initiative, and innovation.
Structure (SR)	SR4	Strategic priority of the school is to develop new products and services to solve stakeholders' problems.
	SR5	The gap between current and past achievements is discussed.
	SR6	The management provides comprehensive information on how strategic goals can be achieved.
	SR7	Personal goals are aligned with the school's goals.
	SR8	Quality is strongly emphasized in the school's goals.
Strategy (SG)	SG15	Need to adhere to formal job description.
	SG18	Importance is given to teamwork development and support.
	SG19	Cross-functional teams are accustomed to working together.
	SG20	Teamwork involves a variety of expertise, skills, and personalities.
Innovative Behaviour (IB)	TLI36	If there are mistakes, an investigation will be conducted to identify the responsible individual.
	TLI37	Strive to find better methods of performing tasks.
	TLI40	Motivated to ensure that my skills and knowledge are up-to-date.
	TLI42	Conflicts are resolved through constructive discussions.

This study's significance is two-fold, encompassing theoretical contributions and contextual relevance. By operationalizing Martins and Terblanche's (2003) innovation culture theory and validating its determinants—strategy, structure, support mechanism, innovative behavior, and communication—the study refines and substantiates this theoretical framework. However, it's noteworthy that this theory omits potential facets of innovation culture. To gain a more comprehensive understanding, the study also draws upon various cultural models such as Cameron and Quinn's (1999) Competing Values Framework, (Schein's, 1990; Model et al., 2013; Hoogan and Coote's, 2014; Dobni's, 2008). This contextual depth safeguards against overlooking nuanced cultural aspects.

In the educational context, particularly within Malaysia's system, this study carries practical implications. Given the challenge-ridden landscape of school-based innovation, where resistance and bureaucratic barriers prevail, the study's findings offer actionable insights. It spotlights support mechanisms' pivotal role, underscores effective conflict resolution in the intricate school environment, and highlights the influence of organizational structure on innovation culture. While not directly validated, the study's inclusion of communication aligns with the importance of robust communication strategies within educational settings.

However, it's crucial to acknowledge that this research's scope might not encompass all facets of innovation cultures, as alternative models exist. Despite this limitation, the study serves as an initial exploration of Malaysia's educational innovation culture. Consequently, educators, administrators, and leaders can derive valuable insights from the cultures highlighted in this research. As a preliminary investigation, this study serves as a stepping stone to comprehend and prioritize the intricacies of innovation culture within Malaysia's educational system.

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