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Abstract
This study focuses on the components of Technological Pedagogical Content Knowledge (TPACK) and Inventive Skills (IS) among secondary school Malay language teachers in Malaysia. TPACK is eight elements related to teacher knowledge to integrate technology, pedagogy and content components in a subject. Meanwhile, IS is a skill dimension that needs to be mastered by Malay language teachers in Malaysia. IS marks one of the most important parts of 21st century skills. Malay language teachers need to be sensitive to every transformation in the national education system in order to be in line with current needs. Therefore, this study tries to analyze the influence of TPACK components on IS among Malay language teachers. This study uses a survey research design and the study sample consists of 400 Malay language teachers of national secondary schools in Malaysia who were selected using a stratified random sampling technique. This study conducted Partial Least Squares-Structural Equation Modeling (PLS-SEM) analysis through SmartPLS 3.0 software. Overall, these eight components of TPACK can be important predictors of IS among Malay language teachers. In addition, this study also provides a clear picture to all Malay language teachers in Malaysia regarding proactive measures to master TPACK and IS components comprehensively. The knowledge and teaching skills possessed by teachers will develop in line with their experience in the national education system. Therefore, TPACK components, namely technological knowledge, pedagogical knowledge, content knowledge, technological pedagogical knowledge, technological content knowledge, pedagogical content knowledge, technological pedagogical content knowledge and contextual knowledge will be able to further highlight the teacher's IS during the teaching and facilitation process in the classroom especially among Malay language teachers in Malaysia.
Keywords: TPACK, Technological Pedagogical Content Knowledge, Inventive Skills, Malay Language Teacher, National Secondary School

Introduction

The continuous technological evolution in the 21st century has introduced many new technologies, such as online applications and software, that could be integrated into teaching and facilitation practices. Hence, it promotes the vital integration of technological elements

in the teaching and facilitation of the Malay language curriculum. Furthermore, the Malaysian Education Development Plan (PPPM) 2013-2025 has firmly emphasised aspects related to Information and Communication Technology (ICT) to enhance the quality of learning in the Malaysian education system. Koehler and Mishra (2008) maintained that integrating knowledge related to technology, pedagogy, and content in the teaching process would result in vibrant and optimal classroom instruction. Nevertheless, integrating technology into the classroom alone cannot help students learn. It denotes that effective learning also relies on how the knowledge linked to the technology is applied. In this context, Mishra (2019) extended the existing models to form the Technological Pedagogical Content Knowledge (TPACK) model to explain how integrating technology in teaching could enhance teachers' professionalism and Inventive Skills (IS).

The initial TPACK model was introduced by (Mishra and Koehler, 2006). It underscores the effectiveness of technology integration in education. The TPACK model develops the original concept of content pedagogical knowledge (Shulman, 1986) TPACK includes eight key knowledge ingredients; Technology Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Technological Pedagogical Content Knowledge (TPACK) and Contextual Knowledge (XK) (Mishra, 2019).

The TPACK model is conceptually connected to the teachers' knowledge required to integrate technology into the teaching and facilitation process. Knowledge related to the TPACK components can support teachers to convey the subject content through pedagogical methods and technologies that are compatible with the content. Therefore, TPACK furnishes a basis for an effective teaching and facilitation process. Teachers must constructively comprehend efficacious technology and pedagogy integration to deliver content to facilitate the learning process and ensure productive learning.

In addition, teachers must master at least one of the 21st century skills, especially IS, to cultivate students who can adapt to modern living and demonstrate higher-order thinking skills. At the same time, they need to revise their knowledge to stay relevant to the latest and future necessities. NCREL and Metiri Group (2003) presented six elements of IS. These elements are Self-Adjustment and Difficulty Management (SADM), Self-Regulation (SR), Curiosity (C), Dare to Take Risks (DTR), Creativity (CR), and Higher-Level Thinking and Good Reasoning (HOTR). Teachers play a prominent function as students cannot acquire the skills of the 21st century if the teacher does not hold the appropriate knowledge in applying such skills during the teaching and facilitation process in the classroom (Faiza and Zamri, 2017).

Similarly, teachers also need to be experts in pedagogical and content in a subject (Joshua, 2019). They also need to be facilitators in the classroom by mastering these IS elements to benefit the students and the school (Rozaiman and Zamri, 2015). Consequently, the knowledge component related to technology, pedagogy, and content in a subject, when integrated with the IS elements that the teacher needs to master as a skill of educational professionals, can facilitate optimal and high-quality learning effects or outcomes in the country's education system.

Problem Statement

Integrating technology into the classroom can assist teachers' teaching and facilitation process (Joshua, 2019; Jain et al., 2018). The positive impact of technology integration has also been recognised. In line with the need to integrate technology in the teaching and facilitation process, teachers need to know how it can be used optimally to influence the

teaching and facilitation process positively. Teachers' capacity to integrate technology into the teaching and facilitation process will help them apply technology to strengthen a skill or content in a particular subject.

Nonetheless, there are concerns that teachers are still incapable of integrating technology into education, primarily during the teaching and facilitation process in the classroom. Rusdi (2017); Talirkodi (2016) concluded that teachers face challenges applying technology during teaching and facilitation because they do not possess the skills and basic knowledge. Learning technology is time-consuming, especially for long-serving teachers. It substantiates that the knowledge associated with technology use is essential to streamlining teachers' teaching and facilitation process.

Furthermore, teachers' lack of knowledge is considered a second-order barrier concerning teachers' internal factors and is the most typical reason for teachers' hesitation toward technology integration (Aslan and Chang, 2016; Hew and Brush, 2007; Ertmer, 1999). Further, teachers are likely to experience a lack of knowledge in two circumstances, namely a lack of skills and expertise in using technology and a lack of knowledge to employ technology in the teaching and facilitation process in the classroom (Janet and Roslinda, 2020; Wachira and Keengwe, 2010).

IS is a crucial criterion in 21st century skills, as envisioned by the Ministry of Education (MOE), to produce individuals capable of thinking critically and innovatively. Thus, teachers of the Malay language subjects need to be ready and continuously aim to discover solutions with distinctive and fresher methods to apply these IS elements among the students at school. The application of Higher-Order Thinking Skills (HOTS) is a challenge in 21st century education, geared toward a more energetic and conducive learning atmosphere in the classroom.

In the meantime, there are still Malay language teachers who are incompetent to execute the teaching and facilitation process based on the application of information and communication technology to motivate the teaching process to be functional and pertinent to the world's contemporary development. In his analysis, Anwar (2018) confirmed that the Malay language teachers failed to implement the teaching and facilitation process that could stimulate the elements of High Order Thinking Skills (HOTS) in the classroom by operating the latest technological equipment.

When the teachers of the Malay language subjects master the eight components of knowledge based on the TPACK model, they can highlight IS elements further. It is because the mastery of the fundamental aspects related to the technology knowledge (TK), PK (pedagogical knowledge) and CK (content knowledge) components can help teachers become more imaginative, courageous, flexible to the situation, competitive, demonstrate critical thinking and reasoning, and constantly upgrade themselves to perform effective teaching and facilitation process.

Research Objective

This study intended to identify the influence of the TPACK component on IS during the teaching and facilitation process among secondary school Malay language teachers in Malaysia. Hence, this study aimed to address the research objective below:

1. Analyse the structural relationship between the TPACK components and IS among Malay language teachers.

Research Hypothesis

Ha1: There is a significant structural relationship between the Technological Knowledge (TK) component and IS among Malay language teachers.

Ha2: There is a significant structural relationship between the Pedagogical Knowledge (PK) component and IS among Malay language teachers.

Ha3: There is a significant structural relationship between the Content Knowledge (CK) component and IS among Malay language teachers.

Ha4: There is a significant structural relationship between the Pedagogical Content Knowledge (PCK) component and IS among Malay language teachers.

Ha5: There is a significant structural relationship between the Technology Content Knowledge (TCK) component and IS among Malay language teachers.

Ha6: There is a significant structural relationship between the Technological Pedagogical Knowledge (TPK) and the IS of the Malay language teacher.

Ha7: There is a significant structural relationship between the Technological Pedagogical Content Knowledge (TPACK) component and the IS of Malay language teachers.

Ha8: There is a significant structural relationship between the Contextual Knowledge (XK) component and IS among Malay language teachers.

Methodology

This study was quantitative, and the survey research design was employed for data collection. The target respondents were Malay language subject teachers in national secondary schools throughout Malaysia. The sample consisted of 400 teachers selected using the stratified random sampling technique. In terms of gender distribution, the respondents included 307 female teachers. The respondents' locations were clustered into five main zones- namely Borneo Zone, Central Zone, Eastern Zone, Southern Zone, and Northern Zone, as shown in

Table 1

The data in this study were collected employing a questionnaire instrument.

Table 1

Number of Study Samples Based on Zone and Gender

Bill	**Zone**	**Gender**		**Sample Total**
		Male	**Female**	
1.	East	21	56	77
2.	Middle	22	97	119
3.	North	11	43	54
4.	South	19	63	82
5.	Borneo	20	48	68
Total		**93**	**307**	**400**

All data obtained were analysed using the IBM-SPSS version 26.0 software to obtain the study sample's demographic information and conduct multivariate analysis, namely Partial Least Squares-Structural Equation Modeling or better known as PLS-SEM via the SmartPLS 3.0 software. Data analysis using PLS-SEM analysis is a complex yet popular advanced statistical technique, particularly in Social Science (Hair et al., 2017). This analysis technique combines several statistical analyses simultaneously, such as factor analysis, multiple regressions, and path analysis. The path analysis function in the SmartPLS 3.0 software tests the relationship between independent variables and dependent variables to accomplish the research

objectives and test the study's hypotheses. This process involves two kinds of evaluation, namely the measurement model evaluation and structural model evaluation (Ringle et al., 2012).

Findings

Respondent Profile

The study's sample consisted of 68 teachers from the Borneo Zone, 119 teachers from the Central Zone, 77 teachers from the Eastern Zone, 82 teachers from the Southern Zone, and 54 teachers from the Northern Zone. In terms of gender, 93 male teachers and 307 females were involved. Out of the 400 respondents, 300 were Malay, 31 were Chinese, 24 were Indian, 28 were Sabah Bumiputera, 16 were Sarawak Bumiputera, and only one respondent was from other races, as Table 2 reports.

Table 2
Demographic Information of Survey Respondents

Bill	Demographic Information	Item	Frequency	Percentage (%)
1.	Zone	Borneo (Sarawak, Sabah, WP Labuan)	68	17.0
		Central (Selangor, Perak, WP Kuala Lumpur, WP Putrajaya)	119	29.8
		East (Terengganu, Kelantan, Pahang)	77	19.3
		South (Johore, Malacca, Negeri Sembilan)	82	20.5
		North (Perlis, Kedah, Penang)	54	13.5
2.	Gender	Male	93	23.3
		Female	307	76.8
3.	Race/ Ethnic Group	Malay	300	75.0
		Chinese	31	7.8
		India	24	6.0
		Sabah Bumiputera	28	7.0
		Sarawak Bumiputera	16	4.0
		Others	1	0.3

The following phase process of data analysis was conducted through PLS-SEM. The model evaluation was divided into two phases: the evaluation of the measurement model and the structural model evaluation (Hair et al., 2017; Ramayah et al., 2018). The two-stage approach was used to analyse the constructs and subconstructs s involved in the study. There were nine constructs and six subconstructs identified at both stages of the analysis. The nine constructs included the components of TK, PK, CK, PCK TCK, TPK, TPACK, XK, and IS among teachers. At the same time, the other six subconstructs included six elements of IS, namely self-adjustment and difficulty management, self-regulation, curiosity, risk-taking, creativity, higher-level thinking, and good reasoning. These subconstructs were classified as reflective indicators for the second-order of the main construct, which refers to teachers' IS based on the first-order and second-order measurement models for the first and second stages. In the first stage, the model was run by measuring the first-order of the subconstruct and the indicator.

In contrast, the model reflected the second-order construct with the latent variable score evaluation for the first-order subconstructs in the second stage. The resulting model was illustrated in the first-order and the second-order. The model that uses reflective measurements in the first stage - first order and second stage - the second-order is known as the Type-I model (Jarvis et al., 2003). In other words, the measurement model with the second-order structure would be displayed in the form of a summary of the structure of the first stage - the first order. It aimed to avoid the model's structure becoming too complex and overestimating the parameters. Although the model was displayed in the form of first-order, the relationship between each construct and subconstruct was visible in the measurement model constructed at the first and second stages.

In order to assess the validity and reliability, the measurement model was assessed before evaluating the next structural model (Anderson and Gerbing, 1988). After the measurement model analysis, the results proved that the study's instruments had high reliability and validity values. Table 3 and Table 4 present the Cronbach Alpha reliability values and the composite coefficient for each construct with values above 0.70 (Hair et al., 2017; Henseler et al., 2009). Moreover, the loading value for each construct and subconstructs of the survey questionnaire instrument also exceeded the value of 0.70 (Gefen and Straub, 2005) and the average extracted variance (AVE) values for both stages exceeded 0.50 (Fornell and Larcker, 1981). Therefore, the study questionnaire instrument that measured all constructs and subconstructs in the context of this study met the requirements of high validity and reliability as it achieved a predetermined standard of validity and reliability analysis.

Table 3
Cronbach Alpha and Composite Reliability – First Order

Construct/ Subconstructs	**Loadings**	**Cronbach Alpha**	**Composite Reliability**	**AVE**
Dare to Take Risks	0.747	0.869	0.899	0.560
Creativity	0.757	0.851	0.891	0.578
Higher-Level Thinking and Good Reasoning	0.719	0.813	0.866	0.518
Content Knowledge	0.777	0.869	0.902	0.605
Contextual Knowledge	0.787	0.847	0.891	0.622
Pedagogical Knowledge	0.759	0.878	0.906	0.582
Pedagogical Content Knowledge	0.768	0.901	0.920	0.591
Technology Knowledge	0.740	0.796	0.858	0.549
Technology Content Knowledge	0.755	0.874	0.903	0.572
Technology Pedagogical Knowledge	0.762	0.897	0.917	0.581
Technology Pedagogy Content Knowledge	0.748	0.842	0.884	0.560
Self-Adjustment and Difficulty Management	0.724	0.774	0.848	0.528
Self-Regulation	0.716	0.769	0.841	0.515
Curiosity	0.757	0.752	0.843	0.574

Table 4
Cronbach Alpha and Composite Reliability – Second Order

Construct/ Subconstructs s	Loadings	Cronbach Alpha	Composite Reliability	AVE
Teacher Inventive Skills	0.717	0.814	0.865	0.520
Content Knowledge	0.771	0.866	0.898	0.558
Contextual Knowledge	0.787	0.847	0.891	0.622
Pedagogical Knowledge	0.760	0.878	0.906	0.582
Pedagogical Content Knowledge	0.768	0.901	0.920	0.591
Technology Knowledge	0.740	0.796	0.859	0.550
Technology Content Knowledge	0.755	0.874	0.903	0.572
Technology Pedagogical Knowledge	0.757	0.897	0.916	0.550
Technology Pedagogy Content Knowledge	0.748	0.842	0.884	0.560

Further, a variable's discriminant validity can also be seen from the correlation squared and the AVE of the related variable. The variable has a high discriminant validity if the AVE value is greater than the value of the variable's correlation squared with other variables (Hair et al., 2017; Fornell and Larcker, 1981). Table 5 and Table 6 present the square root value of AVE for each variable where the overall values obtained exceeded the value of the correlation squared with other variables for both levels in this study's context.

Table 5
Fornell-Larcker Criteria – First Order

	DTTR	CR	HOTS	CK	XK	PK	PCK	TK	TPK	TCK	TPACK	SDRM	SR	CUR
DTTR	**0.748**													
CR	0.428	**0.760**												
HOTS	0.570	0.493	**0.720**											
CK	0.420	0.457	0.487	**0.778**										
XK	0.253	0.537	0.392	0.327	**0.788**									
PK	0.437	0.479	0.566	0.613	0.355	**0.763**								
PCK	0.442	0.438	0.493	0.423	0.359	0.507	**0.769**							
TK	0.243	0.271	0.325	0.304	0.333	0.310	0.271	**0.741**						
TPK	0.340	0.388	0.461	0.400	0.426	0.509	0.436	0.571	**0.756**					
TCK	0.493	0.442	0.444	0.340	0.353	0.396	0.600	0.217	0.289	**0.763**				
TPACK	0.445	0.441	0.557	0.435	0.308	0.558	0.727	0.250	0.442	0.549	**0.748**			
SDRM	0.381	0.454	0.500	0.383	0.401	0.490	0.612	0.338	0.524	0.515	0.685	**0.727**		
SR	0.387	0.320	0.334	0.272	0.286	0.269	0.278	0.118	0.157	0.404	0.292	0.271	**0.718**	
CUR	0.398	0.399	0.483	0.441	0.300	0.496	0.486	0.338	0.412	0.485	0.518	0.469	0.391	**0.757**

Table 6
Fornell-Larcker Criteria – Second Order

	IS	CK	XK	PK	PCK	TK	TCK	TPK	TPACK
IS	**0.721**								
CK	0.580	**0.747**							
XK	0.518	0.325	**0.788**						
PK	0.645	0.620	0.356	**0.763**					
PCK	0.651	0.431	0.360	0.507	**0.769**				
TK	0.391	0.306	0.334	0.310	0.271	**0.742**			
TCK	0.550	0.412	0.427	0.510	0.436	0.570	**0.756**		
TPC	0.657	0.347	0.376	0.413	0.604	0.234	0.321	**0.742**	
TPACK	0.699	0.439	0.308	0.559	0.727	0.250	0.442	0.555	**0.748**

The composite reliability for all subconstructs at the first stage and constructs at the second stage exceeded 0.70. This result established that all the constructs and subconstructs involved in this study had high internal consistency construct reliability (Nunnally and Bernstein, 1994; Gefen et al., 2005).

This research also conducted the path analysis for the eight research hypotheses- Ha1, Ha2, Ha3, Ha4, Ha5, Ha6, Ha7, and Ha8. Table 7 shows the analysis results of the findings of the value of the coefficient of determination (R^2) obtained. It reported 0.729. It implies that 72.9% of the variance in the teacher's IS has been explained by the components of TK, PK, CK, PCK, TCK, TPACK and TCK. In other words, higher mastery of TK, PK, CK, PCK, TCK, TPACK and TCK entails higher IS among the teachers.

Table 7
Determination of Coefficient Value (R2)

Latent Construct	Variance Explained (R^2)	Value
Teacher Inventive Skills	0.729	High

Accordingly, the hypotheses for Ha2 ($\beta = 0.165$, $t = 3.550$, $p < 0.05$), Ha3 ($\beta = 0.162$, $t = 4.058$, $p < 0.05$), Ha5 ($\beta = 0.093$, $t = 2.046$, $p < 0.05$), Ha6 ($\beta = 0.273$, $t = 6.853$, $p < 0.05$), Ha7 ($\beta = 0.235$, $t = 5.626$, $p < 0.05$) and Ha8 ($\beta = 0.153$, $t = 4.269$, $p < 0.05$) were supported, while for the ha1 hypothesis ($\beta = 0.046$, $t = 1.260$, $p > 0.05$) and Ha4 ($\beta = 0.042$, $t = 0.786$, $p > 0.05$) were not supported. Table 8 presents the results of the analysis of the path coefficients values for all hypotheses.

Table 8
Path Coefficient Values

Relationship	Beta (β)	SE	Value t	P-value	Results
Ha1 : TK IS→	0.046	0.036	1.260	0.208	Not Supported
Ha2 : PK IS→	0.165	0.046	3.550	0.000	Supported
Ha3 : CP IS→	0.162	0.040	4.058	0.000	Supported
Ha4 : PCK IS→	0.042	0.053	0.786	0.432	Not Supported
Ha5 : TCK IS→	0.093	0.045	2.046	0.041	Supported
Ha6 :TPK PTP IS→	0.273	0.040	6.853	0.000	Supported
Ha7 : TPACK IS→	0.235	0.042	5.626	0.000	Supported
Ha8 : XK IS→	0.153	0.036	4.269	0.000	Supported

Discussion

The spread of the COVID-19 pandemic has driven the Ministry of Education Malaysia to execute teaching and learning at home (PdPR). Although online PdPR holds considerable limitations and shortcomings, past studies have shown that the TPACK Model proposed by Mishra and Koehler (2006) has helped teachers apply technology more flexibly to enrich their teaching pedagogy and deliver the subject content more effectively. This study's general findings established that TPACK and IS components mastery among Malay Language Teachers in national secondary schools throughout Malaysia was high, and the relationship between TPACK component and teachers' IS was also very significant. This result verified that IS elements among teachers would be more evident when they could master all the components contained in the TPACK Model. This is evident during the Teaching and Learning from Home (PdPR), as teachers can implement this process successfully and effectively online. Osman (2020) expressed that Malaysia recorded the highest search counts for "Google Classroom". It proves that Malaysian teachers are very devoted and committed to carrying out their duties. This optimistic development is evident when many teachers can produce digital

learning materials for online teaching and facilitation, such as CikgooTube, Google Classroom Malaysia Telegram group, and Library and Media Teachers Facebook group (Hamzah, 2020).
In addition, teachers need to equip themselves with the skills essential to apply elements related to ICT to keep an optimal influence in the teaching and facilitation process based on the integration of technology based on the TPACK Model. The teacher needs to possess knowledge related to technology, pedagogy, and content by organising technological integration so that the process of teaching and facilitation in the classroom will become more significant. Following the education system of the 21st century, the teacher's knowledge must be dynamic, varying according to the present situation. It applies in terms of the change from the students or technology. Thus, teachers need to update themselves and be conscious of contemporary technological developments regularly. The students' knowledge in the technology field occasionally surpasses the teacher's proficiency. Therefore, it is critical for the teacher to proactively learn the latest elements of ICT to apply in teaching and facilitation in the classroom.
Teachers also need to master the components of TPACK and integrate these 21st century skills into the classroom. Innovative Teaching and Learning (ITL 2011) noted that the teacher teaching process strongly relates to 21st century learning outcomes. Nonetheless, only a small number of teachers are familiar with the skills of the 21st century. Noraini (2015) recorded that the teacher's understanding of a concept would deliver an explicit picture of their actions, decisions, and practices in the classroom. Teachers are one of the facets contributing to the students' vulnerability to master skills such as communication, critical thinking, and problem-solving (Saemah and Zamri, 2018).
Furthermore, teachers' high level of mastery and knowledge can help grow their confidence and enthusiasm to execute the skills of the 21st century in the process of teaching and facilitation (Faiza and Zamri, 2017). In line with that, teachers need to be more imaginative and ingenious in the classroom. The 21st century teaching and facilitation by teachers can provide students with the advantage to master the Malay language subjects themselves. Also, the teaching and facilitation process becomes more interesting, and the teacher holds mixed methods and conventions to convey the lesson's content. It will ultimately establish creative and innovative students. The teacher will teach the students activities to boost their creativity and innovation. This analysis aligns with the 10th shift of the Malaysian Education Development Plan 2013 to 2025, aspiring to optimise students' success for every ringgit invested by the MOE in the education system.

Conclusion

Ergo, meaningful teaching and facilitation processes highly depend on the teacher's capacity to deliver effective teaching content by integrating technological and pedagogical elements in the classroom (Pella, 2015; Shulman, 1987). Teachers' effective teaching and facilitation process is paramount so that students can maximise the learning outcomes acquired and thus help them build their capacity to establish a generation that satisfies the attributes of the 21st century generation. Teachers should be more optimistic and always equip themselves with acquaintances linked to technology, pedagogy, and content to deliver maximum impact in integrating TPACK and IS elements during the teaching and facilitation process implemented in the classroom. Consequently, it is crucial for a teacher to equip oneself with components related to TPACK and IS taught to students in the classroom. Preliminary deconstructions have verified that the TPACK component could help teachers apply the elements of IS and are pertinent in supporting teachers to shape the implementation of effective teaching and

facilitation processes (Ball et al., 2008; Shulman, 1987). Without sufficient competency and wisdom, teachers may not be able to deliver cognitively competitive students compared to international students (You and Choon, 2019).

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