

**AN INVESTIGATION OF THE THEORY OF PLANNED BEHAVIOR IN
PREDICTING MALAYSIAN SECONDARY SCHOOL TEACHERS' USE OF ICT
DURING TEACHING AND LEARNING SESSIONS**

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Received: 10.10.2023

Accepted: 20.01.2024

ABSTRACT

Background and Purpose: The Theory of Planned Behaviour (TPB) is a framework utilized to comprehend human behaviour towards the adoption and utilization of technology, particularly in educational settings such as ICT usage during teaching and learning sessions. The study aimed to determine the validity of the TPB model in explaining the use of ICT (UICT) by secondary school teachers in Malaysia during their teaching and learning sessions. Additionally, the research sought to identify the most influential factors affecting UICT and examine the differences in UICT use in relation to demographic variables such as gender and years of teaching experience.

Methodology: A total of 331 secondary school teachers from 30 schools in Selangor, Malaysia participated in the study and a 24-item online questionnaire was used to measure four constructs (BB, NB, CB, and UICT), and the validity of the TPB model in explaining the use of UICT by Malaysian secondary school teachers was confirmed using PLS-SEM analysis.

Findings: The study found that all three constructs, behavioral beliefs (BB), normative beliefs (NB), and control beliefs (CB), had a significant influence on UICT during teaching practices, with CB being the most significant predictor ($\beta = .388$). Although no significant differences were found in relation to gender, the study did reveal significant differences based on years of teaching.

Contributions: The findings of this study provide a valuable framework for future studies to build upon and extend their understanding of the factors that shape ICT use among secondary school teachers. Furthermore, the model could be replicated in other educational contexts, such as early childhood education and primary education, or with pre-service teachers from developing countries, in order to validate the generalizability of the results.

Keywords: Use of ICT, theory of planned behaviour, secondary school teachers, Malaysia.

Cite as: Mat Yusoff, S., Lijie, H., Mohamad Marzaini, A. F., & Basal, M. H. (2024). An investigation of the theory of planned behavior in predicting Malaysian secondary school teachers' use of ICT during teaching and learning Sessions. *Journal of Nusantara Studies*, 9(1), 97-120. <http://dx.doi.org/10.24200/jonus.vol9iss1pp97-120>

1.0 INTRODUCTION

The rapid progressions in technology have revolutionized our means of interacting with the surrounding environment, including how we teach and learn. As such, the integration of technology in education has become a top priority for educational institutions and governments worldwide (Rana et al., 2020). However, while there have been significant investments made in technology infrastructure, the successful incorporation and acceptance of technology in teaching and learning sessions remain a challenge. This is due to various factors, such as a lack of training and support for teachers, inadequate access to technology, and resistance to change (Yusop et al., 2021). Therefore, it is critical to understand the obstacles and challenges hindering the adoption of technology in educational settings, particularly in developing countries where the digital divide is more pronounced. By gaining a deeper understanding of these barriers, educational policymakers and stakeholders can develop effective strategies that can enhance the adoption and integration of technology in education, leading to better teaching and learning outcomes.

The theory of planned behavior (TPB) proposed by Ajzen (1991) has been extensively used as a validated model for predicting technology acceptance in various settings. Despite its effectiveness, the TPB has been underutilized in developing countries (Yusop et al., 2021).

Therefore, this study addresses this research gap by investigating the TPB's reliability and validity in explaining the utilization of ICT by Malaysian secondary school teachers. The study's importance lies in its potential to inform educational policymakers and stakeholders in developing countries on the most effective ways to promote technology adoption and integration. Additionally, the study's exploration of gender and years of teaching experience in ICT use during teaching and learning sessions can provide valuable insights for developing targeted technology integration strategies. As such, this study's findings can have far-reaching implications for enhancing teaching and learning outcomes in developing countries through effective ICT integration.

In addition to assessing the TPB's validity and reliability in Malaysia, this study seeks to enhance the prevailing literature on technology acceptance by presenting empirical evidence on the factors that impact the UICT in the teaching and learning in a developing nation. This study's findings could have practical implications for policymakers, school administrators, and educators in Malaysia and other developing countries in designing effective strategies and interventions to promote the adoption and integration of ICT in education. The results of this study can act as a springboard for additional research into technology acceptance and usage in various educational contexts, particularly in developing countries. Therefore, understanding the variables that affect technology adoption and use, as well as developing effective strategies to promote technology integration in education, can lead to better teaching and learning outcomes and prepare students for success in a technology-driven world.

2.0 LITERATURE REVIEW

2.1 Ajzen's Theory of Planned Behavior

According to Thomasseti et al. (2018), TPB develops from the theory of reasoned action (TRA), which suggests that individuals may face external or internal barriers that limit their volitional control. These barriers can shape individuals' attitudes and intentions, and which can influence their behavior towards a particular action. Due to the influence of barriers, an individual's perceived behavior may be different from their expected behavior. Ajzen (1991) proposed that a person's attitude towards a behavior, coupled with external barriers in the form of subjective norms and perceived behavioral control, can predict their behavioral outcome based on their intentions. Perceived behavioral control refers to an individual's ability to adopt an expected behavior, while subjective norm refers to societal pressure to adopt a particular behavior (Laviolle et al., 2015). The addition of perceived behavioral control adds fluidity to the theory and helps to explain the complex relationship between attitudes and behavior, which

previous theories such as the theory of reasoned action failed to do due to inconsistencies between attitudes and behavior.

The current study utilizes the TPB as a framework to investigate the factors that affect Malaysian secondary school teachers' attitudes towards using information and communication technology (ICT) during teaching and learning sessions. TPB is an extension of the TRA, which includes an additional component known as perceived behavioral control, referring to an individual's perception of their ability to perform the behavior in question. The TPB has been extensively used and validated in a variety of contexts, including understanding technology adoption and use. By using TPB in this study, it will provide a comprehensive understanding of the beliefs that influence teachers' use of ICT during teaching and learning sessions. Moreover, previous research has demonstrated the effectiveness of TPB in understanding technology adoption and use (Teo & Tan, 2012; Parikh et al., 2021). However, despite the extensive use of TPB in previous research, criticisms have emerged. One of the most significant critiques of TPB is its lack of attention to social and environmental factors that may influence behavior, thus limiting its explanatory power in some contexts. Additionally, there are concerns about the subjective nature of perceived behavioral control and its potential for response bias. Despite these limitations, the current study's utilization of TPB as a framework is a promising approach to understanding technology adoption and use among Malaysian secondary school teachers.

The TRA suggests that when it comes to adopting instructional technology, teachers make a rational decision based on a combination of individual and social factors. The personal factor is influenced by the teacher's orientation towards technology use, which can be characterized as either positive or negative. The social factor, on the other hand, is based on the subjective norms of the teacher, reflecting their perception of how significant other people's opinions are in shaping their technology use in the teaching process. Furthermore, TRA asserts that behavioral intention to use technology can be improved when teachers feel that they have control over its adoption. This perceived control can be influenced by internal and external factors, such as the teacher's perceived level of expertise and their ability to use ICT tools without difficulty. The aim of this study was to explore how beliefs related to behavior, social norms, and perceived control are associated with attitudes, subjective norms, and perceived behavioral control, as explained in Ajzen's (1991) TPB. The objective was to gain insights into the factors that shape the beliefs of Malaysian secondary school teachers on the utilization of ICT in their teaching and learning sessions.

Although the TRA is helpful in understanding the factors that influence a teacher's decision to adopt instructional technology, it has some drawbacks. One of these is that it doesn't consider external factors beyond subjective norms that influence technology adoption, as noted by Yang et al. (2020). For instance, teachers' access to technology infrastructure, technical support, and training opportunities can significantly influence their ability to make use of technology in their teaching and learning sessions. Additionally, TRA fails to consider the potential influence of contextual elements such as cultural and societal values on the beliefs and attitudes of teachers regarding the utilization of technology (Bordalba & Bochaca, 2019). It is therefore vital to consider the broader social and cultural context in which technology adoption takes place to fully understand its determinants. Despite these limitations, the TRA remains a valuable framework for investigating the underlying beliefs and behaviors of teachers on the technology adoption, and it can provide valuable insights into the development of effective strategies to promote technology adoption in education.

2.2 Technology Integration Through TPB

Throughout the last twenty years, researchers have utilized the TPB framework to explore teachers' intentions towards integrating ICT into their teaching, as demonstrated in studies such as those conducted by Sadaf et al. (2012), Teo and Van Schaik (2012), and Valtonen et al. (2015). Previous research using quantitative methods and the TPB framework has revealed that behavioral beliefs (BB), or attitudes, are the strongest predictors of ICT behavioral intentions or actual use, while normative beliefs (NB) and control beliefs (CB) are less influential factors (Teo & Van Schaik, 2012). However, Valtonen et al. (2015) found that NB was the most influential factor in predicting the intention to use ICT, while Sadaf et al. (2012) conducted a qualitative study and found positive attitudes towards the use of Web 2.0 technologies for teaching, using the TPB as their framework. The study found that teachers perceive their future students as an essential factor in influencing their use of Web 2.0 tools for instructional purposes. More research is needed to gain a better understanding of the factors that influence teachers' intentions and actual use of ICT in their teaching and learning sessions.

In this study, the researchers focused on the TPB model to explore its direct impact on the use of ICT in teaching and learning sessions. Previous research has mainly used quantitative methods to assess the actual usage of ICT in education and has also examined demographic information such as gender and years of teaching experience to understand variances in technology utilization (Yusop et al., 2021; Alzahrani et al., 2017; Aslan & Zhu, 2017; Fatima et al., 2019; Kreijns et al., 2013). By adopting the TPB framework, the researchers made a

valuable contribution to the field by gaining a better understanding of the factors that affect teachers' intentions and behaviors regarding ICT utilization in teaching. Furthermore, including demographic variables helped uncover potential disparities in the adoption of ICT based on individual characteristics, which could inform targeted interventions to improve teacher training and support (Yusop et al., 2021). This study's approach could provide insights into designing more effective ICT implementation strategies that are tailored to teachers' specific needs, experiences, and perceptions.

However, measuring the actual use of ICT in education can be challenging, as it may vary widely depending on the context and the specific tools employed. Also, self-reported measures have been utilized in some studies, which could be vulnerable to measurement errors or social desirability bias. Furthermore, although the TPB framework has been successful in forecasting behavioral intentions and actual behavior, it is not a flawless model, and there may be additional factors beyond the three primary constructs (attitudes, subjective norms, and perceived behavioral control) that can impact teachers' utilization of ICT in the classroom. Hence, it is vital to interpret the findings of this study and previous research with caution, acknowledging the limitations and complexities involved in studying technology integration in education. Nonetheless, the insights gained from this work can provide useful guidance for policymakers, educators, and researchers seeking to promote effective and equitable UICT in teaching and learning sessions.

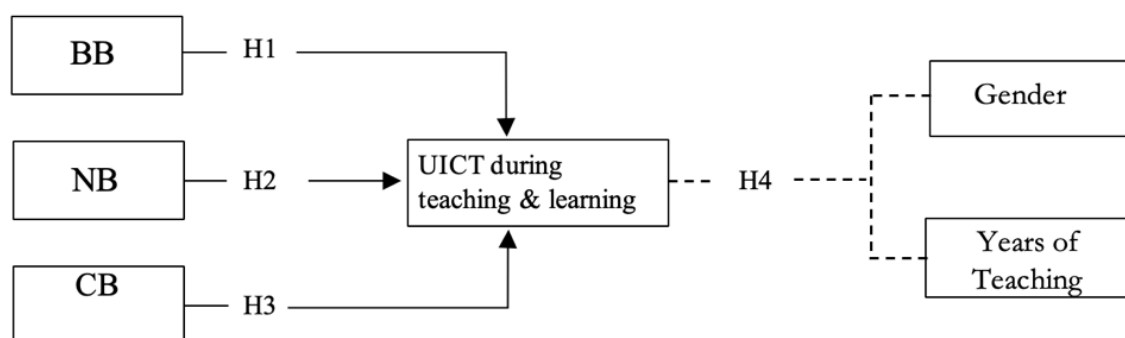


Figure 1: Model of study

Note - BB = behavioral beliefs; NB = normative beliefs; CB = control beliefs; UICT = use of information and communication technology.

2.3 Hypotheses

The utilization of the TPB framework in this study facilitated the validation and thorough investigation of the underlying beliefs that influence teachers' utilization of ICT during teaching and learning sessions, as evidenced by the five hypotheses presented in Figure 1:

Hypothesis (H1): BB has a significant and positive influence on UICT during teaching and learning sessions.

Hypothesis (H2): NB has a significant and positive influence on UICT during teaching and learning sessions.

Hypothesis (H3): CB has a significant and positive influence on UICT during teaching and learning sessions.

Hypothesis (H4): There is a significant difference in terms of genders regarding UICT during teaching and learning sessions.

Hypothesis (H5): There is a significant difference in terms of years of teaching regarding teachers' UICT during teaching and learning sessions.

3.0 RESEARCH DESIGN

To achieve the research objectives, a survey research design was used, which is a non-experimental research method. The research process included several stages, namely, instrumentation, data collection, data preparation, and data analysis, to ensure the validity and reliability of the study's hypotheses. During the instrumentation stage, the researchers adapted and adopted a validated questionnaire to measure the constructs of the TPB framework. The researchers then collected data through the questionnaire from a sample of teachers who are teaching in secondary schools in Selangor, Malaysia. The collected data was cleaned, coded, and analyzed using statistical software. Finally, the researchers analyzed the data to test the research hypotheses. The survey research design and the utilization of a validated questionnaire strengthened the study's internal validity and increased the generalizability of the findings.

While survey research is commonly used in educational research, it is important to consider its limitations. One potential issue with survey data is response bias, where participants might provide responses that are deemed socially acceptable instead of their genuine beliefs or behaviors. In addition, the non-experimental research design limits the ability to establish causality between variables. However, despite these limitations, survey research remains a valuable tool in educational research for exploring attitudes, beliefs, and behaviors among teachers and students (Hamilton & Corbett-Whittier, 2012).

3.1 Instrument

The researchers utilized a questionnaire adapted from Habibi et al.'s (2020) dataset to investigate the validity and reliability of the TPB in explaining the use of ICT by Malaysian secondary school teachers during teaching practices, identifying the most significant factor influencing ICT use, and exploring differences based on two demographic variables. The questionnaire was constructed based on previous studies, including the TPB (Sadaf et al., 2012; Valtonen et al., 2015; Yusop, 2015) and the use of ICT during teaching and learning sessions (Aslan & Zhu, 2017). This approach allowed the researchers to draw on the strengths of previous research and tailor the questionnaire to the Malaysian context. As per Habibi et al. (2020), while the questionnaire was initially developed for the Indonesian context, it can be extrapolated to other developing countries, such as Malaysia.

The use of established instruments and survey is a common practice in research to guarantee the reliability and validity of the data collected (Fowler, 2013). In this study, the adoption of a previously validated questionnaire by Habibi et al. (2020) provided a basis for comparison, which increased the credibility and generalizability of the findings. Additionally, the adaptation and construction of questions from previous studies allowed for a comprehensive investigation of the factors influencing secondary school teachers' UICT during teaching and learning sessions, providing a more nuanced understanding of the topic.

Table 2: The instrument used in the study

No.	Construct	Indicators	No. of items
1.	BB	BB2, BB3, BB4, BB5, BB6, BB7, BB8	7
2.	NB	NB1, NB2, NB3, NB4, NB5	5
3.	CB	CB1, CB2, CB3, CB4, CB5	5
4.	Preservice teachers' integration of ICT (UICT)	UICT1, UICT2, UICT3, UICT4, UICT5, UICT6, UICT7, UICT8, UICT9, UICT10, UICT11, UICT12	12

Note - BB = behavioural beliefs; NB = normative beliefs; CB = control beliefs; UICT = use of information and communication technology.

3.2 Data Collection and Preparation

The researchers conducted the study by distributing the instrument to participants from 30 secondary schools in Selangor, Malaysia, between the months of December 2022 and February 2023. The researchers in this study made sure that ethical standards were followed by obtaining

permission letters for distributing the instrument and obtaining approval from the Educational Policy Planning and Research Division of the Ministry of Education Malaysia. The collection of data process was conducted online, and responses were compiled using Microsoft Excel and SPSS for statistical analysis. Using online questionnaires for data collection has become increasingly popular in recent years due to the convenience it offers both researchers and participants. Additionally, this approach allows for easy data management and analysis.

The study population for this research comprised approximately 20,000 individuals from 279 secondary schools in Selangor, Malaysia, as reported by the Ministry of Education in 2023. To ensure a representative sample, simple random sampling was utilized to select 379 secondary school teachers from which participants were recruited via an online questionnaire. Following a rigorous screening process, a total of 331 sample data were deemed measurable and included in the analysis (as detailed in Table 2). Data collection for this study was conducted between November 2022 and March 2023. Although the sample size may appear relatively small, it is still considered representative and valid for conducting statistical analysis (Sekaran & Bougie, 2016). Moreover, the researchers' use of a rigorous screening process ensures that only high-quality data was included in the final analysis, thereby enhancing the reliability and validity of the findings.

Table 3: Participant characteristics based on demographic information

N = 331	Characteristics	Frequency	Percentage
Gender	Male	77	23.3
	Female	254	76.7
Years of Teaching	1 – 5 years	143	43.2
	6 – 10 years	93	27.8
	11 – 16 years	35	10.6
	16 – 20 years	27	8.2
	More than 20 years	34	10.3

3.3 Data Analysis

Prior to conducting the measurement model process, the researchers ensured the completeness and accuracy of the data by conducting a thorough data preparation process. This process aimed to eliminate any outliers, missing values, non-normal distributions, and data input errors (Hair et al., 2010). Besides, the researchers utilized various techniques, including Skewness, Kurtosis, Q-Q plot, and histogram, to examine whether the data was normally distributed. After

conducting these procedures, they concluded that the data was normally distributed. This ensured the data was suitable for conducting the measurement model process. Ensuring the completeness and accuracy of data is crucial in any research study to maintain the validity and reliability of the results. The assessment of normality of data is a critical step in the preparation process as it assures that the data fits the standard statistical assumptions, leading to more robust and accurate results. By employing several procedures, the researchers in this study were able to ensure the data met the normality assumption, which is essential for the validity of the measurement model.

The study employed a rigorous approach to test the reliability and validity of the construct through reflective measurement models with four indicators. The researchers used multiple techniques to evaluate the accuracy and consistency of the construct, including reflective indicator loadings, internal consistency reliability, convergent validity, and discriminant validity. The use of PLS-SEM to assess the reflective indicator loadings ensured that the measurement model was reliable. Moreover, the use of Cronbach's alpha and composite reliability (CR) measures ensured that the internal consistency reliability of the construct was adequate, which is important for establishing the construct's validity. Additionally, the study used several methods to assess the discriminant validity of the construct, including the Fornell-Larcker criterion, loading and cross-loading criterion, and Heterotrait-Monotrait (HTMT), which further ensured that the construct was valid. The use of such rigorous methods in testing the validity and reliability of the construct enhances the credibility of the findings, indicating the study's rigor and increasing its potential for generalization (Hair et al., 2019).

To assess the structural model's predictive power, this study utilized recommended techniques by Hair et al. (2019). The evaluation process involved checking for collinearity, assessing the path coefficients (β), the coefficient of determination (R^2), the effect size of f^2 , and Q^2 , along with its effect size, as outlined by Hair et al. (2019). Moreover, to comprehend differences in the UICT during teaching and learning sessions based on gender and years of teaching experience, t-tests and one-way ANOVA tests were conducted (Pallant, 2016). Moreover, ensuring the reliability and validity of the findings relies heavily on the use of appropriate statistical methods. The systematic approaches outlined by Hair et al. (2019) are widely recognized as effective tools for evaluating the predictive capabilities of structural models. Similarly, the use of t-tests and ANOVA tests is a standard practice in analyzing differences between groups. Hence, the use of these rigorous methods strengthens the credibility of the research findings.

4.0 RESULTS AND DISCUSSION

4.1 PLS-SEM Measurement Models Used in The Study

Despite some of the loading values being below the recommended threshold value of $>.708$, as suggested by Hair et al. (2019), based on the results of the reflective indicator, the study proceeded with the analysis, the researchers decided to set the cutoff point for loading values to $>.600$, taking into account the average variance extracted (AVE) values and ensuring that no more than 15% of the items were dropped. This decision was made in order to strike a balance between maintaining the reliability and validity of the construct and retaining a sufficient number of items for analysis. Besides, the choice of cutoff value for loading values can impact the results of the analysis and may vary depending on the specific context and research question. Table 3 shows that certain indicators, namely UICT9, UICT4, and UICT1, had loading values below $.600$, which is below the recommended threshold. As a result, these indicators were removed from the analysis. Besides, the measures of internal consistency reliability, namely Cronbach's alpha and CR, exhibited satisfactory levels of reliability, as they were above the minimum threshold of $.600$ and below the maximum threshold of $.950$. These findings suggest that the questionnaire used in this study is a reliable instrument for measuring the constructs under investigation.

Table 4: Measurement model of TPB and UICT

Construct	Item	VIF	Loading	AVE	CR	α
BB	BB2	1.705	0.732	0.559	0.898	0.867
	BB3	2.236	0.787			
	BB4	1.917	0.782			
	BB5	2.214	0.803			
	BB6	1.754	0.729			
	BB7	1.759	0.672			
	BB8	1.808	0.718			
	CB	CB1	1.581			
CB2		1.574	0.751			
CB3		1.686	0.766			
CB4		2.027	0.817			
CB5		1.541	0.722			
NB	NB1	1.729	0.745	0.589	0.877	0.825
	NB2	1.714	0.747			
	NB3	1.737	0.784			
	NB4	1.526	0.746			
	NB5	1.849	0.813			
UICT	UICT10	2.510	0.811	0.523	0.907	0.883
	UICT11	1.959	0.737			
	UICT12	1.798	0.677			
	UICT2	1.480	0.610			
	UICT3	1.581	0.651			
	UICT5	2.404	0.737			
	UICT6	2.879	0.793			
	UICT7	2.103	0.713			
	UICT8	2.477	0.753			

The Fornell-Larcker criterion and cross-loading criterion were employed to assess the discriminant validity values of the constructs, and the results are presented in Tables 4 and 5, indicating that the values meet the criteria. The values on the off-diagonal of the matrix indicate the correlations between the different constructs, while the values on the diagonal represent the variance extracted for each construct. Table 4 shows the AVE values for each construct are greater than the corresponding off-diagonal values, which demonstrates good discriminant validity. Good discriminant validity is essential in ensuring that each construct is measuring a

unique and distinct construct, rather than being redundant or overlapping with other constructs. This is a crucial aspect of construct validity in any research study.

Table 5: Fornell-Larcker Criterion

Construct	BB	CB	NB	UICT
BB	0.747			
CB	0.466	0.758		
NB	0.638	0.524	0.768	
UICT	0.509	0.599	0.565	0.723

The findings of the cross-loading analysis are showcased in Table 5, which signifies that the loading value of an indicator on its own construct is notably greater than its loading value on other constructs. This finding supports the construct validity of the research model and suggests that the indicators used in this study are able to effectively measure their intended constructs without significant interference from other constructs. This is a crucial aspect of construct validity as it assists to confirm that the measures used in the research are accurately capturing the construct of interest and not confounded by other factors. The findings of the study reveals that the research model's construct validity is supported, which suggests that the TPB is a suitable framework for explaining the utilization of ICT by Malaysian secondary school teachers during teaching and learning sessions. Table 6 presents the results of the Heterotrait-Monotrait ratio (HTMT) which is used to test the discriminant validity of the proposed model. The study found that the HTMT values of all constructs were below .850, which is the recommended threshold for good discriminant validity. These results suggest that the research model with the instruments used in the study is reliable and valid.

Table 6: Outer loading

Item	BB	CB	NB	UICT
BB2	0.732			
BB3	0.787			
BB4	0.782			
BB5	0.803			
BB6	0.729			
BB7	0.672			
BB8	0.718			
CB1		0.729		
CB2		0.751		
CB3		0.766		
CB4		0.817		
CB5		0.722		
NB1			0.745	
NB2			0.747	
NB3			0.784	
NB4			0.746	
NB5			0.813	
UICT10				0.811
UICT11				0.737
UICT12				0.677
UICT2				0.610
UICT3				0.651
UICT5				0.737
UICT6				0.793
UICT7				0.713
UICT8				0.753

Table 7: HTMT

Construct	BB	CB	NB	UICT
BB				
CB	0.548			
NB	0.746	0.638		
UICT	0.579	0.699	0.653	

4.2 Assessment Model

The study assessed the potential issue of collinearity among the predictors BB, CB, and NB that impact UICT. The results indicate that the VIF values for all three sets of predictors were below the threshold of 3, with BB → UICT having a VIF value of 1.578, CB → UICT having a VIF value of 1.436, and NB → UICT having a VIF value of 1.896. This suggests that there was no significant collinearity among the predictors, meaning that they were not highly correlated with each other. Moreover, all relationships reported in the structural model (Table 7) and (Figure 2) were significant at a 5% level of significance. These findings underscore the robustness and reliability of the proposed model in explaining the factors influencing the use of ICT during teaching practices among Malaysian secondary school teachers. Regarding the prediction of UICT, the results reveal that CB is the most significant construct, with a path coefficient (β) of .388, followed by NB with a β of .257. Additionally, BB also showed a significant relationship with UICT, with a β of .164. These findings are supported by the corresponding t and p values, as presented in Table 7. The results of the study imply that among Malaysian secondary school teachers, normative beliefs, control beliefs, and behavioural beliefs play a significant role in predicting the use of ICT during teaching and learning sessions.

Table 8: Path coefficient, t value, and p values

Hypotheses	Path	Path coefficient (β)	t	p	Significance (p < .005)
H1	BB → UICT	.164	3.076	.002	Yes
H2	CB → UICT	.388	7.874	.000	Yes
H3	NB → UICT	.257	4.682	.000	Yes

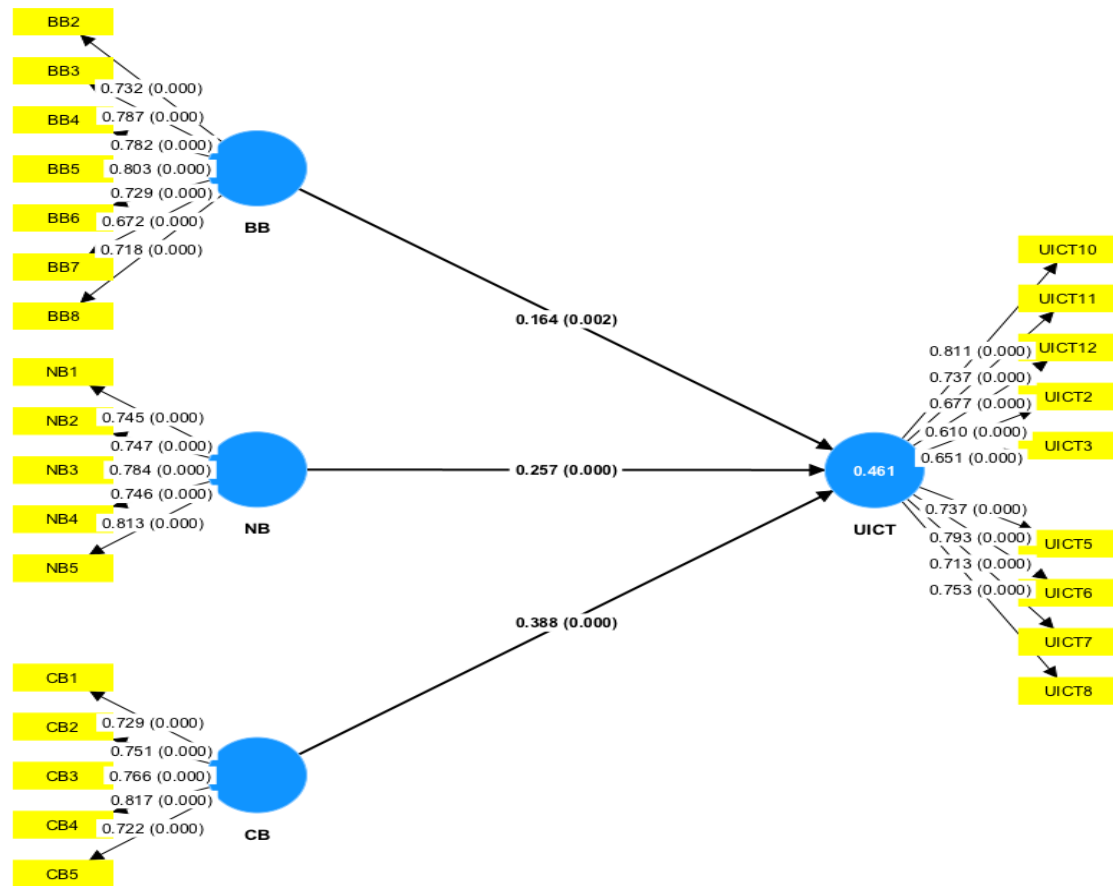


Figure 2: The structural equation model that was estimated

To measure the predictive power of the model to make accurate predictions, the coefficient determination (R^2) was calculated. The result indicates that the model explains 46.1% of the variance in U ICT, which is considered moderate. This suggests that the model has good predictive accuracy. Furthermore, all of the exogenous constructs, namely BB, CB, and NB, were found to have significant effect sizes on the endogenous construct, U ICT. The effect sizes for the relationships between the exogenous constructs (BB, CB, and NB) and endogenous construct (U ICT) were determined through the calculation of f^2 values. The results indicated small effect sizes for $BB \rightarrow U ICT$ (.028), $CB \rightarrow U ICT$ (.195), and $NB \rightarrow U ICT$ (.065). Additionally, the predictive relevance of the model for the endogenous construct was evaluated using the Q^2 value, which indicated a value of .446, indicating good predictive relevance.

4.3 Significance Differences Regarding U ICT

In addition to examining the relationship between three constructs and U ICT, the study also analyzed whether there were any differences in U ICT based on teachers' demographic information, such as gender and years of teaching experience. Table 8 contains the results of

the analysis. To test the assumption of equality of variance, we conducted the test of homogeneity of variances, with a result of $p=0.94>0.05$, indicating that the assumption of homogeneity of variance was not violated. To investigate whether there were any differences in the variance of UICT during teaching and learning sessions based on gender, a one-way between-groups analysis of variance (ANOVA) was performed. Participants were divided into two groups, consisting of 77 males and 254 females. The mean score for males was 44.71, while females had a mean score of 45.51. According to the main table of ANOVA, there was no significant difference in UICT between male and female participants in the study, as the p-value $F(1, 331) = 1.023, p = .312$ was higher than the significance level of .05. Therefore, the study concludes that there is no significant gender difference in UICT variance during teaching and learning sessions.

Table 9: ANOVA result; gender

Hypotheses	Demographic	M	N	F	p	Significance ($p < .005$)
H4	Male	44.71	77	1.023	.312	No
	Female	45.51	254			

The researchers also examined the impact of teaching experience on the levels of UICT using a statistical analysis called one-way between-groups analysis of variance. The participants were grouped into five categories based on their teaching experience, ranging from 1-5 years to over 20 years. The results showed that there was a statistically significant difference in UICT levels across the five groups ($F(4, 331) = 2.50, p = .042 < .05$), but the difference was only slight. The effect size was calculated to be small, based on Cohen's criteria. Further analysis using the Tukey HSD test did not find any significant differences among the groups. In conclusion, although there was a statistically significant difference in UICT levels based on teaching experience, the difference was minor and the effect size was small. The Tukey HSD test results indicate that there are no significant differences between any of the groups.

Table 10: ANOVA Result; Years of teaching

Hypotheses	Demographic	M	N	F	p	Significance (p < .005)
H5	1 – 5 years	44.97	143	2.500	.042	Yes
	6 – 10 years	44.57	92			
	11 – 15 years	47.11	35			
	16 – 20 years	44.62	27			
	> 20 years	45.33	34			

5.0 DISCUSSION

Model development; Malaysian context

Despite numerous studies on the factors influencing technology adoption and use, which utilize diverse theoretical frameworks like the technology acceptance model, technological pedagogical and content knowledge, and unified theory of acceptance and use of technology, the theory of planned behavior (TPB) is still widely employed and supported by robust empirical evidence for its ability to predict technology adoption and use across different technologies and contexts, as highlighted by Sadaf et al. (2012). However, there is a limited application of the TPB framework in the context of developing countries. Add positive critical discussion to this paragraph. Despite the limited application of the TPB in developing countries, its potential impact is significant. Understanding the factors that influence technology adoption and use in developing countries is crucial for promoting inclusive technological advancements and closing the digital divide. The TPB framework provides a foundation for exploring these issues and can inform the development of interventions and policies that facilitate technology adoption and use in these contexts.

To address this research gap, this study utilized a statistical analysis technique called Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the proposed model's validity and whether the TPB constructs positively influenced the use of ICT among Malaysian secondary school teachers during teaching and learning sessions. During the validation process, some items were eliminated from the UICT construct due to their low reflective loading values, which is a recommended elimination process as stated by Hair et al. (2019). The results showed that the remaining items were valid and reliable measures of Malaysian secondary school teachers' use of ICT during teaching and learning sessions, indicating the potential of the TPB framework in informing technology adoption and use research in developing country contexts. This study's findings have important implications for the development and implementation of effective technology integration strategies in

education. The use of PLS-SEM in validating the proposed model is a significant contribution of this study. PLS-SEM is a useful statistical analysis technique in situations where the sample size is relatively small, as is often the case in educational research. The elimination of low reflective loading values of some items in the UICT construct is also a rigorous process that improves the construct's validity and reliability (Hair et al., 2019).

Key predicting variables

This study successfully confirmed the three hypotheses that aimed to investigate the influence of behavioral beliefs, normative beliefs, and control beliefs on the use of ICT during teaching and learning sessions among Malaysian secondary school teachers. The results indicated that all three predictors have a positive effect on the use of ICT in teaching and learning sessions. Specifically, the construct of perceived behavioral control, which is reflected by control beliefs, was found to be the most potent predictor of technology adoption, with normative beliefs and behavioral beliefs following as subsequent predictors. This finding confirmed with previous research that reported control beliefs as the strongest predictor of technology acceptance and use in the educational context (Fatima et al., 2019). This suggests that teachers' beliefs about their skills to use technology, such as their perceived control over its use, play a critical role in shaping their behaviour towards technology use in the classroom. Therefore, it is essential to address teacher perceived behavioural control when developing interventions aimed at promoting the use of technology in teaching and learning sessions.

The study also found that behavioural beliefs, which reflect attitudes toward technology, significantly influenced Malaysian secondary school teachers' use of ICT during teaching and learning sessions. These results correspond to prior research that has found that positive attitudes are a strong predictor of technology use in the classroom. For example, Van Braak et al. (2004) found that positive attitudes were strongly related to computer use in teaching. Kreijns et al. (2013) also reported a strong correlation between attitudes and behavioural intention to adopt digital teaching materials. Similarly, the study conducted by Sang et al. (2010) discovered a positive correlation between primary school teachers' favourable attitudes toward ICT in education and their inclination to incorporate ICT into their teaching methods. These findings suggest that developing positive attitudes toward technology is essential for promoting its use in educational settings, and educational policymakers should focus on improving teachers' attitudes towards technology to encourage its adoption in teaching and learning.

In addition to the significant effect of behavioural beliefs on Malaysian secondary school teachers' use of ICT during teaching and learning sessions, this study also found that normative beliefs, which reflect subjective norms, were a significant predictor. These results align with prior research that has demonstrated the significance of subjective norms in shaping people's intentions and behaviours when it comes to technology adaptation (Valtonen et al., 2018; Yusop et al., 2021). Subjective norms are determined by individuals' perceptions of what others (such as colleagues, administrators, and students) believe about a particular behaviour, as well as the extent to which they feel compelled to conform to these perceived beliefs. The social and cultural context within which teachers operate can significantly influence their perceptions of what is expected of them in terms of ICT use in the classroom. Thus, teachers' beliefs about what their colleagues and students expect from them, and their perceptions of the support they receive from their school administration and peers, can play a crucial role in shaping their intentions and behaviours regarding ICT use. Therefore, by highlighting the significance of normative beliefs in predicting ICT use among Malaysian secondary school teachers, this study underscores the need for interventions that target social and cultural factors that influence teachers' beliefs about ICT use in the classroom. Such interventions can focus on creating a supportive and collaborative environment that encourages the integration of ICT in teaching and learning.

The significance of demographic information in relation to the use of ICT during teaching and learning sessions

The aim of this study was to examine potential gender differences in the use of ICT during teaching and learning sessions. The results revealed that there were no significant differences in the level of UICT between male and female teachers, which is consistent with Lahti et al.'s (2014) findings. However, previous research has produced mixed results regarding gender differences in technology use, with some studies suggesting that female teachers use technology more frequently than their male counterparts, while others report the opposite. These inconsistencies may be due to differences in sample size, participant characteristics, and cultural contexts. The large and diverse sample used in this study is a strength, as it allowed for a comprehensive examination of the issue across multiple demographics. The lack of significant gender effects in UICT use could be attributed to the changing cultural norms and gender roles in education, as well as the increasing availability of ICT tools and resources. Nonetheless, the results suggest that more research is needed to explore the relationship between gender and technology adoption, and to identify the factors that influence the gender

gap in UICT. Furthermore, it may be beneficial to tailor interventions to specific contexts to better promote gender diversity in technology use among teachers.

This study also aimed at investigating the impact of teaching years on the level of UICT during teaching and learning sessions among secondary school teachers in Malaysia. The results showed only slight significant differences in the use of ICT based on teaching years, which is in line with the findings of a previous study conducted by Martin et al. (2019). The findings suggest that factors such as personality, teacher training, age, professional competency, and attitudes towards ICT may play a crucial role in influencing teachers' use of ICT, regardless of their teaching experience. However, the correlation between teaching years and UICT may not be straightforward, as teachers with longer teaching experience may have different personal characteristics that indirectly affect their use of ICT. For instance, they may be less likely to adopt new technologies due to a perceived lack of relevance or difficulty in integrating them into their teaching practices. Additionally, there may be contextual factors such as school policies, available resources, and support from school administrators that affect the level of ICT use among teachers. Given the limited number of studies that have examined the influence of teaching years on UICT, it is crucial to conduct further research to fully understand this correlation. Future studies may need to adopt a mixed-methods approach that combines quantitative measures with qualitative data to gain a more comprehensive understanding of the factors that influence teachers' use of ICT in different teaching contexts.

6.0 CONCLUSION

The research findings in this study provide valuable insights into the TPB factors that influence the use of ICT during teaching practices among Malaysian secondary school teachers. The study highlights the important role of normative beliefs, control beliefs, and behavioral beliefs as significant predictors of teachers' ICT use during teaching and learning sessions, with control beliefs being the strongest predictor. The results are particularly relevant for educational policymakers and practitioners seeking to enhance the integration of ICT in teaching and learning practices. Moreover, this research adds to the current body of knowledge on the use of the Theory of Planned Behavior to clarify how teachers in Malaysia adopt technology. Further research is warranted to explore how other individual and contextual factors may interact with TPB constructs to shape teachers' ICT adoption and use behaviour.

The research model proposed in this study has significant implications for future research investigating the factors that affect the integration of ICT into teaching and learning sessions, particularly in the context of developing nations like Malaysia. The findings of this study

provide a valuable framework for future studies to build upon and extend their understanding of the factors that shape ICT use among secondary school teachers. Furthermore, the model could be replicated in other educational contexts, such as early childhood education and primary education, or with pre-service teachers from developing countries, in order to validate the generalizability of the results. Overall, this research model holds promise for informing policy and practice related to ICT integration in teaching and learning contexts in Malaysia and beyond.

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