Investigating Factors Influencing Students' Intentions to Learn Mathematics Using the Theory of Planned Behavior: A Case Study at ACLEDA Institute of Business

Sokha Norng [1], Chanrey Phang [2], Mady Sen [3] & Phorn Ngam [4]

Corresponding Author. Email: norng.sokha@acleda-aib.edu.kh
1, 2, 3 & 4. ACLEDA Institute of Business

ABSTRACT

Mathematics, one element of Science, Technology, Engineering, and Mathematics (STEM) education, has been prioritized by the Royal Government of Cambodia. The mathematics course is offered from K12 to post-secondary education. To make sure that it has been applied successfully and effectively necessitates the study on students' attitudes and intentions towards learning the course. This study, therefore, attempts to investigate factors impacting students' attitude and intention to learn Mathematics by structuring teachers' knowledge and skills in the Theory of Planned Behavior (TPB). The study used correlational design by conducting a survey with 128 year-one students at ACLEDA Institute of Business and employed a structural equation modeling (SEM) to run path analysis. The study found that four hypotheses were supported and one hypothesis was not supported. In other words, teachers' knowledge had a positive significant impact upon students' attitudes towards learning mathematics at (β=0.418), but teachers' skills do not impact attitude towards learning mathematics. Attitude and perceived behavioral control had a positive significant impact upon the intention to learn mathematics at (β=0.429) and (β=0.654), respectively. Behavioral intention had a positive significant impact on the actual learning mathematics at (β=0.683).

Keywords: Mathematics, Teachers' Knowledge, Teacher's Skills, Theory of Planned Behavior (TPB), confirmatory factor analysis (CFA), Structural Equation Modelling (SEM)

1. Introduction

1.1 Background of the study

The Rectangular Strategy—Phase 4 of the sixth legislature focuses four priority areas, but "gives the top priority to people." In order to achieve Rectangle One, emphasizing human resource development, the Royal Government aims at completing four tasks: "improving the quality of education, science and technology; improving vocational training; improving public healthcare and nutrition; and strengthening gender equality and social protection" (The Royal Government of Cambodia [RGC], 2018, p.10). In addition, the Cambodia Industrial Development Policy 2015-2025 aims at developing human resources and skills by "strengthening basic knowledge for children and youth in mathematics, sciences, literature and technology"; and promoting "the study on sciences, technology, engineering, and mathematics (STEM) from primary education to post-secondary education level" (RGC, 2015, pp. 26-27). Moreover, the Cambodia National Qualification Framework (CQF) aims at promoting numerical skills through learning outcome-based curriculum (CQF, 2012); and the guidelines and rubrics for National Standards for Accreditation of Higher Education Institution requires each higher education institution to integrate Mathematics into the Foundation Year Curriculum (Accreditation Committee of Cambodia [ACC], 2019).

To meet ACC's requirement, the Mathematics course has been integrated into the curriculum of Foundation Year at ACLEDA Institute of Business. The course falls into three categories: Mathematics for Finance and Banking in semester one to students majoring in Finance and Banking; Mathematics for Business and Economics in semester one to students majoring in Business IT, Fintech, and International Business; and Mathematics for Computing in semester two to students majoring in Business IT and Fintech.

1.2 Problem statement

To be able to implement the Mathematics course effectively, an understanding of students' attitudes is really needed. For instance, Huda et al., (2021) illustrates a positive students' perception of online mathematics learning using You Tube. Bringula et al. (2021) reveals that learners have mixed notions about their mathematics capabilities and interest in learning mathematics in an online environment. Bong and Skaalvik (2003) identify individuals' ability related to mathematics as compared to others and they seek immediate learning interventions from teachers or their classmates.

As part of the mathematical modeling, the Theory of Planned Behavior (TPB), developed by Ajzen, (1991), "offers a theoretically meaningful framework for examining students' beliefs and attitudes toward mathematics at school" (Niepel et al., 2018). However, In Cambodia, little is known about the adoption of Theory of Planned Behavior (TPB) on the investigation of students' intention to study Mathematics class, especially the students' perception towards their teachers' knowledge and skills.

1.3 Research objective

Therefore, this study attempts to investigate factors influencing students' intention to learn Mathematics by using Theory of Planned Behavior (TPB) with additional variables of teachers' knowledge and skills.

1.4 Research questions

- Which factors influence students' intention to learn Mathematics?
- Does students' intention influence the actual learning of mathematics?

1.5 Hypotheses

- H1: Teachers' knowledge has a positive significant effect on students' attitudes to learn Mathematics.
- H2: Teachers' skills have a positive significant effect on students' attitudes to learn Mathematics.
- H3: Attitude has a positive significant effect on students' Intention to learn Mathematics.
- H4: Perceived Behavioral Control has a positive significant effect on students' Intention to learn Mathematics.
- H5: Students' Intention has a positive significant effect on the actual learning of Mathematics.

1.6 Significance of the study

The findings of this study contributed significantly to the existing Theory of Planned Behavior (TPB) and teachers of mathematics classes. The structuring of teachers' knowledge and skills into TPB has made the conceptual model even more helpful in predicting students attitudes and intention to learning mathematics; and mathematics teachers can improve their techniques and strategies in improving or strengthening the students' learning outcomes of their classes.

2. Literature Review

2.1 Definition of mathematics

According to Harel (2008), mathematics is defined as a union of two categories of knowledge, namely ways of understanding and ways of thinking. Later, the definition has been generalized as the notions of proof and proof scheme, respectively (Harel, 2008). In the Encyclopedia Britannica, mathematics is defines as "the science of structure, order, and relation that has evolved from elemental practices of counting, measuring, and describing the shapes of objects… it deals with logical reasoning and quantitative calculation, and its development has involved an increasing degree of idealization and abstraction of its subject matter" (Folkerts et al., 2020, para. 1).

At ACLEDA Institute of Business, Mathematics for Finance and Banking covers topics such as Simple Interest and Simple Discount, Compound Interest and Compound Discount, Simple Annuities, General Annuities, Amortization, Bonds, and Business Investment Decisions. Mathematics for Business and Economics covers topics such as Linear Equation, Non-Linear

Equation, and Mathematics for Finance, Differential, Partial Differential, and Linear Programming. Mathematics for Computing covers topics such as Introduction to Algorithms, Base and Number Representation, Computer Representation and Arithmetic, Functions, Introduction and Recursion, Introduction to graph theory, and Algorithms and Computational Complexity.

2.2 The adoption of Theory of Planned Behavior on intention to learn mathematics

Influenced from Theory of Reasoned Action (TRA), firstly developed by (Fishbein & Ajzen, 1975), an extended variable of Perceived Behavioral Control (PBC) has been structured in order to connect intention and behavior (Ajzen, 1991). The structuring of PBC into TRA has developed a new theoretical background, namely the Theory of Planned Behavior. Niepel et al. (2018) cited that "a person's intention to carry out a certain behavior is the best predictor of his or her actual performance of that behavior" (p.25). Ajzen (1991) also asserts that the individual's intention is influenced by his or her attitude, subjective norms, and perceived behavioral control.

TPB has been used in predicting entrepreneurial intentions and actions (Kautonen et al., 2015); in predicting attendance of peer-assisted study sessions for statistics (White et al., 2008); in predicting college students' intention to graduate (Sutter & Paulson, 2017); and in analyzing students' beliefs and attitudes toward mathematics across time (Niepel et al., 2018).

2.3 Conceptual framework of Theory of Planned Behavior (TPB) in the study of intention to learn mathematics

Since teachers' knowledge and skills influence students' learning, this study has structured them into TPB in order to determine the factors influencing students to learn Mathematics.

2.3.1 Knowledge and attitudes

According to Bolisani & Bratianu (2018), Knowledge is an abstract concept without any reference to the tangible world. Chong & Cheah (2009) cited, "Teachers must know the subject they will teach and understand how to organize curriculum in light of both students' needs and the schools' learning objective" (p.7); and three interconnected areas between teachers, learners and content are knowledge of learners and their development in social contexts, knowledge of subject matter and curriculum goals, and knowledge of teaching (Hammond & Snowden, 2007). Thus, the study proposed the following hypothesis.

H1: Teachers' knowledge has a positive significant effect on students' attitudes to learn Mathematics.

2.3.2 Skills and attitudes

Irvine (1997) as cited in (Chong & Cheah, 2009, p.5) defines skills as "achievements and/or behavior to be acquired through practice or training to facilitate the student learning and classroom management". As part of the teaching profession, teachers need the teaching skills,

which required as a set of procedures in order that they can apply during their teaching experiences (Grossman, 1990). These skills include pedagogical skills, interpersonal skills, reflective skills, personal skills, and administrative and management skills (Chong & Cheah, 2009). Therefore, the study proposed the following hypothesis.

H2: Teachers' skills have a positive significant effect on students' attitudes to learn Mathematics.

2.3.3 Attitude and behavioral intention

Attitude toward behavior is defined as an individual's belief of a certain behavior or act which makes a positive or negative contribution to that person's life (Alexander, 2015). Actually, individual's attitude answers the question of what individuals think about the behavior as to whether or not it is enjoyable. If one expects to gain from the action, the attitude toward the action is logically positive (EPM, 2020). For instance, if the students enjoy the mathematics formulas, are likely to discover the various solutions, or believe that Mathematics makes them get good grade, or benefit their future work, they intentionally contribute to the class. Attitude is the main predictor of behavioral intention (Ajzen, 1991). It influences the intention to adopt a specific system (Davis et al., 1989) and to adopt technology learning (Bagozzi et al., 1992). Thus, the study proposed the following hypothesis.

H3: Attitude has a positive significant effect on students' intention to learn Mathematics.

2.3.4 Subjective norm (Controlled Variable)

According to Ajzen (1991), subjective norm is defined as the perceived social pressure to engage or not to engage in a behavior. This variable normally answers the individuals' question of what others think about the behavior (EPM, 2020). The group that influences the individuals' behaviors can be family, friends, social networks, or significant others (Ajzen, 1991). However, this variable is controlled in this study since mathematics course is the required by the Foundation Year Department of ACLEDA Institute of Business.

2.3.5 Perceived behavioral control and behavioral intention

Perceived Behavioral Control (PBC) expresses a person's belief on how easy or hard it is to display a certain behavior or act in a certain way (Alexander, 2015). In psychology, control, an important variable within the TPB of which a person feels capable and confident in their ability to execute the desired behavior, plays a central role in their intentions and actual behavior outcomes (Smith, 2013). PBC is also the predictor of behavioral intention (Ajzen, 1991); intention to adopt online distance learning (Osman, 2020); and intention to adopt Computing Resource Center (Taylor & Todd, 1995). Therefore, the study proposed the following hypothesis.

H4: Perceived Behavioral Control has a positive significant effect on students' intention to learn Mathematics.

2.3.6 Behavioral intention and usage behavior

Ajzen (1991) defines behavioral intention as willingness to perform a certain task. The actual system use (usage behavior) is the end-point where people use technology and it is influenced by behavioral intention on technology acceptance and usage (Davis et al., 1989), on technological learning and usage (Bagozzi et al., 1992), at Computer Resource Center (Taylor & Todd, 1995), and online distance learning (Osman, 2020).

H5: Behavioral Intention has a positive significant effect on the actual learning of Mathematics.

2.4 Conceptual model in the adoption of TPB on learning mathematics

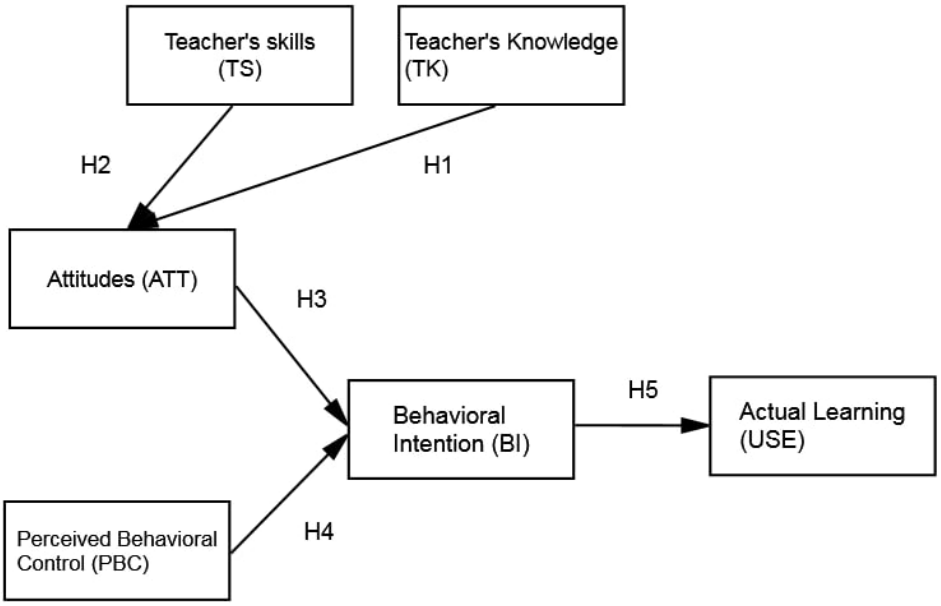

Figure 1: Conceptual model of Structured TPB on Learning Mathematics

3. Methods

3.1 Research design

This study employed quantitative research approach, using a correlational design (Cresswell, 2012). To test the hypotheses, the study developed a logistics plan by aligning the research question. Moreover, the study used a survey questionnaire as a research tool to collect primary data. The questionnaire was designed in Microsoft Form with two main categories: the first category involving personal data of the respondents and the second one measuring six constructs. Then, the survey questionnaire was distributed to students through such media platforms as Microsoft Team and Telegram. The obtained data were later coded for both descriptive and inferential statistical analysis.

3.2 Sampling and sample frame

The study selected students from three different shifts of Mathematics classes at ACLEDA Institute of Business. The students were grouped in terms of gender, age, year of study, and major. Multiple stage random sampling was employed. The study selected 128 students as a sample size. This sample size was appropriate because Green (1991) determined N > 50 + 8 m is appropriate for the best practice of regression analysis; and "m" represents the number of independent variables.

3.3 Research tools & measurements of constructs

The questionnaire was comprised of two main categories: the first involving identifies personal data of the respondents and the second measuring six constructs namely Teachers' Knowledge (TK), Teachers' Skills (TS), Attitude (ATT), Perceived Behavioral Control (PBC), Behavioral Intention (BI), and Actual Learning (USE). Moreover, 7-likert scale was employed in order to minimize the errors.

Table 1: Construct Measurements of all Variables

Variables	Items	Sources
Teachers' Skill (TS)	TS1: My Math lecturer is skillful in delivery instruction. TS2: My Math lecturer is approachable whenever I need his/her assistant. TS3: My Math lecturer is reflective in responding to my questions. TS4: My Math lecturer is well prepared and good at time management. TS5: My Math lecturer is good at assigning tasks and giving feedback.	(Chong & Cheah, 2009)
Teachers' Knowledge (TK)	TK1: My Math lecturer is very knowledgeable about his/her subject teaching. TK2: My Math lecturer understand my learning styles. TK3: My Math lecturer prepare the content of the subject, fulfills my needs and understanding. TK4: My Math lecturer know the speed (not too fast or not too slow) of his teaching. TK5: Overall, the knowledge of my Math lecturer is very good.	(Chong & Cheah, 2009)
Attitudes (ATT)	ATT1: It is a good idea to learn Mathematics online. ATT2: It is wise to learn Mathematics online. ATT3: It is pleasant and interesting to learn Mathematics and online. ATT4: Overall, I have a positive opinion towards learning Mathematics online.	(Ajzen, 2013) (Yang et al., 2021) (Keo et al., 2021) (Em et al., 2021) (York et al., 2021)

(continued)

Table 1: Construct Measurements of all Variables(continued)

Variables	Items	Sources
Perceived Behavioral Control (PBC)	PBC1: I would feel comfortable to learn Mathematics online PBC2: I have enough knowledge to learn Mathematics online. PBC3: I could do self-learning in online class of Mathematics. PBC4: I have the ability to learn Mathematics online. PBC5: I believe I can control over online Mathematics class.	(Taylor & Todd, 1995) (Ajzen, 2013) (York et al., 2021)
Behavioral Intention (BI)	BI1: I plan to do online Mathematics class in the future. BI2: I intend to learn Mathematics online. BI3: I will strongly recommend online Mathematics class to someone that I know. BI4: Whenever I want to develop my knowledge, I will do online Mathematics.	(Ajzen, 2013) (Yang et al., 2021) (Keo et al., 2021) (Em et al., 2021) (York et al., 2021)
Actual Learning (USE)	USE1: I have learned Mathematics online during Covid-19 pandemic. USE2: I have learned Mathematics online every week during Covid-19 pandemic. USE3: I become familiar with learning Mathematics online.	(Venkatesh & Davis, 2000) (Taylor & Todd, 1995) (Ajzen, 2013)

3.4 Data collection

The questionnaires were administered to 300 students who had learned the three courses of mathematics, namely Mathematics for Finance and Banking, Mathematics for Business and Economics, and Mathematics for Computing. The data were collected between from September to October 2021.

3.5 Data analysis

The study transformed data from Microsoft Form to SPSS and then did demographic analysis (analysis in terms of frequency and percentile), descriptive analysis (analysis measurement of constructs in terms of Minimum, Maximum, Mean, Standard deviation and level of agreement), and measurement model analysis (reliability and validity). Moreover, the study analyzed the bivariate of each construct to test their association before running Confirmatory Factor Analysis (CFA). Finally, the study ran path analysis as part of hypothesis testing in AMOS.

3.6 Ethical consideration

To avoid plagiarism, the study offered credit to all works, done by others; especially, the study used in-text citation and end-text citation. Moreover, the study had to keep confidential of the respondents' response. Last but not least, the study had to maintain integrity in interpreting and reporting all the data.

3.7 Reliability test (Cronbach's alpha)

According to the Table 2, the Cronbach's Alpha of all constructs scored above 0.7 in both pilot test (n=30) and the actual result (n=128), which was that the constructed variables and factors are reliable to be implemented in this research (Nunnally, 1994). Therefore, the constructs are good to be used to acquire the students' intention to learn Mathematics.

Table 2: Reliability Test of Cronbach's Alpha on Each Variable

No	Item	n= 30	n=128
1	Attitude	0.807	0.823
2	Perceived Behavioral Control	0.756	0.843
3	Behavioral Intention	0.742	0.816
4	Actual Use	0.754	0.800
5	Teachers' Skill	0.787	0.872
6	Teachers' Knowledge	0.853	0.910
	All Variables	0.893	0.930

4. Results and Discussions

4.1 Results of the study

4.1.1 Demographic factors

Table 3: Demographic Respondents

Item	Categories(N=128)	Frequency	Percentage
Gender	Female	110	85.9%
	Male	18	14.1%
Age	Equal or under 17 years old	3	2.3%
	18-19 years old	84	65.6%
	20-21 years old	31	24.2%
	22-23 years old	4	3.1%
	24-25 years old	2	1.6%
	Over 25 years old	4	3.1%
Education	Bachelor	117	91.4%
	Associate	10	7.8%
	Master	1	0.8%
Major	Finance and Banking	104	81.3%
	Business IT	1	0.78%
	Fintech	11	8.59%
	International Business	12	9.38%
	Logistic and Supply Chain Management	0	0.0%

(continued)

Table 3: Demographic Respondents (continued)

Item	Categories(N=128)	Frequency	Percentage
Occupation	Currently Unemployed	85	66.4%
	Company Employee	25	19.5%
	Government Officer	3	2.3%
	Business Owner	10	7.8%
	Self-employed	5	3.9%

4.1.2 Level of agreement

Based on the research stated of evaluation criteria, (Armstrong, 1987), the variable becomes essential when score is higher. They questionnaires of variables were conducted in 7-likert scale points ranging from following:

- Strongly Disagree ranges from 1.00 to 1.85
- Disagree ranges from 1.86 to 2.71
- Somewhat Disagree ranges from 2.72 to 3.57
- Neutral ranges from 3.58 to 4.42
- Somewhat Agree ranges from 4.43 to 5.28
- Agree ranges from 5.29 to 6.14
- Strongly Agree ranges from 6.15 to 7.00

Table 3: Level of Agreement

Variable	Minimum	Maximum	Mean	Std. Deviation	Level of Agreement
Attitude (ATT)	3.75	7.00	5.7793	0.69064	Agree
Perceived Behavioral Control (PBC)	3.20	7.00	5.5484	0.77936	Agree
Behavioral Intention (BI)	2.75	7.00	5.4121	0.88935	Agree
Actual Learning (USE)	3.00	7.00	5.6849	0.72971	Agree
Teacher's Skill (TS)	3.40	7.00	5.8250	0.65255	Agree
Teacher's Knowledge (TK)	2.40	7.00	5.8016	0.79467	Agree

*Note: Somewhat Agree: 4.43 – 5.28, Agree: 5.29 – 6.14, Strongly Agree: 6.15 – 7.00

4.1.3 Correlation analysis

Correlation Analysis was used to test correlation level and validity between all constructs which in this research brought six constructs into testing. The correlation's values ranging between –1 to +1, meaning that the closer of number in each variable reaching nearly +1, the stronger of correlations (Pearson, 1926).

Table 4 shows that all variables are significantly correlated at the significant level of 0.01 (2-tailed). The results also showed the favorable and positive correlations between variables

with the lowest of 0.589 of teacher skill towards behavioral intention and highest of 0.791 of teacher skill towards teacher knowledge.

Table 4: Pearson Correlation Matrix

	1	2	3	4	5	6
1-Attitude	1					
2-Perceived Behavioral Control	0.715**	1				
3-Behavioral Intention	0.664**	0.760**	1			
4-Actual Use	0.646**	0.618**	0.596**	1		
5-Teacher Skill	0.715**	0.676**	0.589**	0.676**	1	
6-Teacher Knowledge	0.657**	0.658**	0.679**	0.675**	0.791**	1

**. Correlation is significant at the 0.01 level (2-tailed).

4.1.4 Confirmatory Factor Analysis (CFA)

After running Confirmatory Factor Analysis (CFA), the study dropped three, three, two, three, two, and one indicators of the following factors such as Teachers' Knowledge (TK), Teachers' Skill (TS), Attitude (ATT), Perceived Behavioral Control (PBC), Behavioral Intention (BI), and Actual Learning (USE), respectively.

4.1.5 Factor loadings

Figure 2 shows that the factor loadings of all items were highly adequate. The standardized regression weights ranged from 0.641 to 0.903, above 0.50 as suggested by (Hair et al., 2006). Thus, most of the constructs confirm the convergent validity test, and those factor loadings can be used to estimate construct reliabilities (CR) and average variance extracted (AVE).

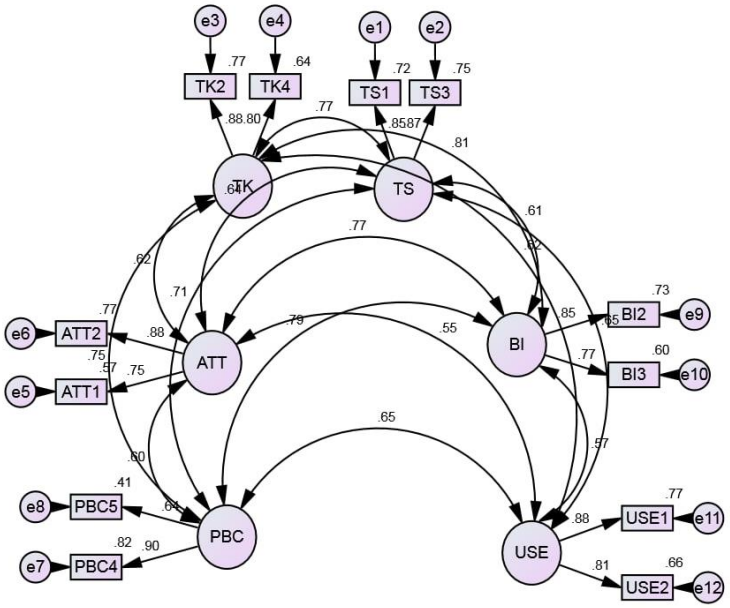

Figure 2: Factor loading analysis

4.1.6 Cronbach alpha and construct reliabilities

Table 5 shows that each construct consists of composite reliability reaching an acceptable value of 0.60 (Karatu et al., 2014). The teacher skill has the highest Cronbach's alpha of 0.843, but perceived behavioral control has the lowest Cronbach's alpha of 0.724; moreover, the teacher skill also has the highest construct reliability (CR) of 0.849, while perceived behavioral control has the lowest reliability (CR) of 0.755.

Table 5: Cronbach's Alpha and Construct Reliabilities

Variable Types	Variable Names	Items Name	Items	Cronbach's alpha	CR
Exo1	Teacher knowledge (TK)	TK2 TK4	2	0.824	0.828
Exo2	Teacher Skill (TS)	TS1 TS3	2	0.843	0.849
Exo3	Perceived behavioral control (PBC)	PBC4 PBC5	2	0.724	0.755
Mediating Variable	Attitude (ATT)	ATT1 ATT2	2	0.795	0.800
Mediating Variable	Behavioral Intention (BI)	BI2 BI3	2	0.789	0.797
Endo	Actual Adoption (USE)	USE1 USE2	2	0.824	0.834

4.1.7 Discriminant validity of constructs

Table 6 illustrates the result of variance extracted (VE), which is calculated into average variance extracted (AVE). The VE for teacher knowledge, teacher skill, attitude, perceived behavioral control, behavioral intention, and actual adoption is 0.706, 0.737, 0.668, 0.613, 0.663, and 0.716, respectively.

Table 6: Final CFA of the Six Variables

Variable	Code	Factor Loading	SFL	Error	Variance Extracted
TK	TK2	0.879	0.773	0.227	0.706
	TK4	0.800	0.640	0.360	
TS	TS1	0.849	0.721	0.279	0.737
	TS3	0.868	0.753	0.247	
ATT	ATT2	0.878	0.771	0.229	0.668
	ATT1	0.752	0.566	0.434	

(continued)

Table 6: Final CFA of the Six Variables(continued)

Variable	Code	Factor Loading	SFL	Error	Variance Extracted
PBC	PBC5	0.641	0.411	0.589	0.613
	PBC4	0.903	0.815	0.185	
BI	BI2	0.855	0.731	0.269	0.663
	BI3	0.771	0.594	0.406	
USE	USE2	0.814	0.663	0.337	0.716
	USE1	0.877	0.769	0.231	

Table 7 illustrates the average variance extracted (AVE) and squared inter-construct correlation (SIC) for two variables. As cited in Phang (2016), the AVE should be more than the squared inter-construct correlation (SIC) of the two constructs to support discriminant validity. If AVE is less than CS, the problem of multicollinearity would exist (Fornell & Larcker, 1981). The table also shows that the highest AVE is between Teacher Skill and Actual Use, equal to 0.726, and the lowest AVE is between Perceived Behavioral Control and Behavioral Intention, equal to 0.638. The highest SIC was between Teachers' Knowledge (TK) and Behavioral Intention (BI), equal to 0.656, and the lowest SIC was between Attitude (ATT) and Actual Learning (USE), equal to 0.298.

Table 7: Average Variance Extracted (AVE) and Squared Inter-Construct Correlation Estimates (SIC)

Variable Name	TK	TS	ATT	PBC	BI	USE
TK	1					
TS	0.722	1				
	(0.594)					
ATT	0.687	0.703	1			
	(0.384)	(0.413)				
PBC	0.660	0.675	0.641	1		
	(0.567)	(0.503)	(0.360)			
BI	0.685	0.700	0.665	0.638	1	
	(0.656)	(0.372)	(0.594)	(0.627)		
USE	0.711	0.726	0.692	0.665	0.689	1
	(0.382)	(0.428)	(0.298)	(0.419)	(0.327)	

**Note: SIC in parenthesis*

Table 7 also reveals that each AVE value was more than the squared inter-construct correlation (SIC). The highest difference was between Attitude (ATT) and Actual Learning (USE) at 0.3939, and the lowest difference was between Perceived Behavioral Control (PBC) and Behavioral Intention (BI) at 0.0107. Thus, discriminant validity theory is accepted, or multicollinearity is absent. In other words, each construct could be considered distinctively from one to another (Phang, 2016).

4.1.8 Model fit indices

CFA confirms that the TPB model is really fit in the study of student intention as the fit indices are:

Table 8: Model Fit

Fit Measures	Value	Results
CMIN/DF(χ2 /df)	1.857<2	good fit
RMSEA	0.082	acceptable fit
NFI	0.922>0.90	acceptable fit
CFI	0.961>0.97	good fit
GFI	0.921>0.90	acceptable fit
AGFI	0.843> 0.85	not great but tolerable

Adopted from (Schermelleh-Engel et al., 2003)

Note: CMIN/DF= Chi square divided by degrees of freedom, RMSEA=Root Mean Square Error of Approximation, NFI=Normed Fit Index, CFI=Comparative Fit Index, GFI=Goodness-of-Fit Index, AGFI=Adjusted Good-of-Fit Index

4.1.9 Path analysis

Figure 3 shows the standardized regression weight of path analysis. For Path 1, factors such as Teachers' Skill (TS) and Teachers' Knowledge (TK) are the predictors of the Attitude. For Path 2, factors such as Attitude (ATT) and Perceived Behavioral Control (PBC) are the predictors of the Behavioral Intention (BI). For Path 3, Behavioral Intention (BI) is the predictor of the Actual Learning (USE).

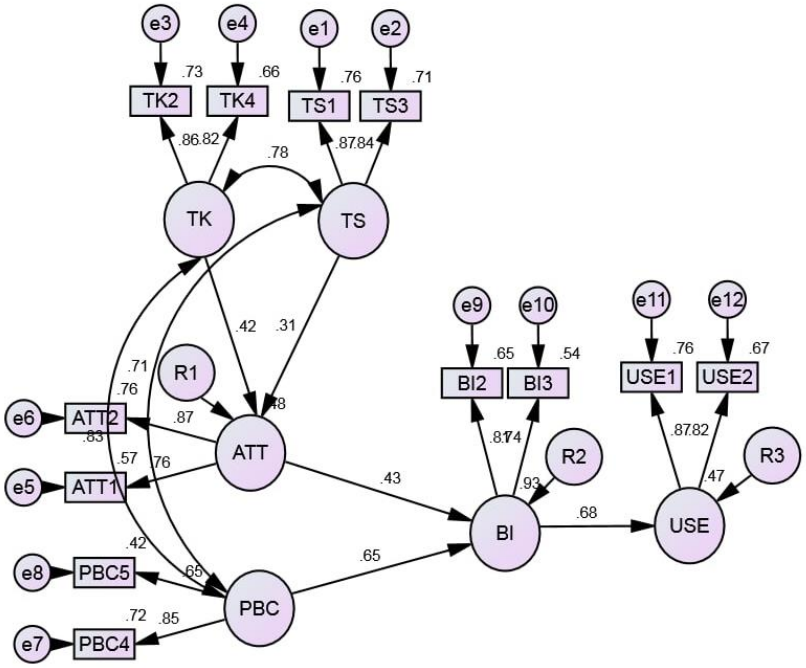

Figure 3: Results Path Analysis

Table 9 shows a regression analysis of path analysis 1 with Attitude as the dependent variable. The result suggests that the model is statistically significant in explaining that at least one predictor impacts the Behavioral Intention to adopt blended learning. It also shows that there is a positive impact of Teacher Knowledge (β=0.418) at a significance level (0.017), but Teachers' Skills do not impact Attitude as the p-value is 0.068 > 0.05.

Table 9: Path Analysis 1 (Attitude as Dependent Variable)

IV	DV	Unstandardized Estimates		Standardized Estimates		Sig.
		B	S.E	Beta	C.R.	(P-value)
TK	ATT	0.324	0.136	0.418	2.389	0.017*
TS	ATT	0.281	0.154	0.314	1.828	0.068

*. Correlation is significant at the 0.05 level (2-tailed)

Note: IV= Independent Variable, DV=Dependent Variable, B=direct effect, S.E.=standard Error, C.R.=Critical Ratio, Sig.=Significance,ATT=Attitude,TK=Teachers' Knowledge, TS= Teachers' Skills

The following table (Table 10) is the result of regression analysis in path 2 for the relationship between Attitude and Perceived Behavioral Control as the independent variable and Behavioral Intention as the dependent variable. It showed a positive impact of the Attitude (β=0.429) at level significance (0.000) and positive impact of Perceived Behavioral Control (β=0.654) at a significance level (0.000) on Behavioral Intention.

Table 10: Path Analysis 2 (Behavioral Intention as Dependent Variable)

IV	DV	Unstandardized Estimates		Standardized Estimates		Sig.
		B	S.E.	Beta	C.R.	(P-value)
ATT	BI	0.458	0.110	0.429	4.165	0.000**
PBC	BI	0.632	0.109	0.654	5.790	0.000**

**. Correlation is significant at the 0.01 level (2-tailed)

Note: IV= Independent Variable, DV=Dependent Variable, B=direct effect, S.E.=standard Error, C.R.=Critical Ratio, Sig.=Significance, BI=Behavioral Intention, Att= Attitude, PBC= Perceived Behavioral Control

The following table (Table 11) is the result of regression analysis in path 3 for the relationship between Behavioral Intention as the independent variable and Actual Adoption as the dependent variable. It shows a positive impact of the Behavioral Intention (β=0.683) at a significant level (0.000) on the Actual Adoption of student intention to learn Mathematics.

Table 11: Path Analysis 3 (Actual Adoption as Dependent Variable)

IV	DV	Unstandardized Estimates		Standardized Estimates		Sig.
		B	S.E.	Beta	C.R.	(P-value)
BI	USE	0.664	0.097	0.683	6.844	0.000**

**. Correlation is significant at the 0.01 level (2-tailed)

Note: IV= Independent Variable, DV=Dependent Variable, B=direct effect, S.E.=standard Error, C.R.=Critical Ratio, Sig.=Significance, BI=Behavioral Intention, USE=Actual Adoption

4.1.10 Results of hypothesis testing

The following table shows that H1, H3, H4, and H5 were supported at the significance level of (0.017), (0.000), (0.000), and (0.000), respectively; whereas H2 was not supported at the significance level of (0.068).

Table 12: Hypothesis Testing

Hypotheses		Significance Value	Statistical Significance
H1:	Teachers' knowledge has a positive significant effect on students' attitudes to learn Mathematics	0.017	Supported
H2:	Teachers' skills have a positive significant effect on students' attitudes to learn Mathematics.	0.068	Not Supported
H3:	Attitude has a positive significant effect on students' Intention to learn Mathematics.	0.000	Supported
H4:	Perceived Behavioral Control has a positive significant effect on students' Intention to learn Mathematics.	0.000	Supported
H5:	Students' Intention has a positive significant effect on the actual learning of Mathematics.	0.000	Supported

4.2 Discussion

The structuring of Teachers' Knowledge and Teachers' skills in the current TPB model is statistically significant when controlling Subjective Norm variable. The conceptual model on the study of students' intention to learn mathematics met the Goodness of Fit Indices. This was in line with the adoption of TPB in health care campaigns (Javadi et al., 2013), Decomposed Theory of Planned Behavior (Taylor & Todd, 1995), the adoption of online distance learning (Osman, 2020).

The mean score of Teacher's Knowledge was 5.801, which was in line with (Chong & Cheah, 2009); and Teacher's Knowledge had a positive impact on students' attitude towards learning mathematics. In this sense, the students had a positive opinion on their teachers' knowledge, whereby their learning styles and teaching are understood at an acceptable speed.

The mean score of Teacher's Skills was 5.825, which was consistent with (Chong & Cheah, 2009); however, Teacher's skills do not impact students' attitude toward learning mathematics. In other words, the teachers' skills do not influence the students' behavior to learn mathematics.

The mean score of Attitude was 5.779; and Attitude had a positive significant impact on students' intention to learn mathematics, which means that the students were willing to learning mathematics because they formed a positive opinion about the course itself and teachers' knowledge and skills. Furthermore, the mean score of Perceived Behavioral Control was 5.548; and Perceived behavioral control had a positive significant impact on students' intention to learn mathematics. In other words, the students were willing to learn mathematics because they had the ability to learn the course, especially their ability to control over online mathematics class. This finding was in line with the study of White et al.

(2008) on Predicting attendance at peer-assisted study sessions for statistics; of Lipnevich et al. (2011) on Mathematics attitudes and mathematics outcomes of the United States; and Belarusian middle school students; of Hagger et al. (2015) on Perceived autonomy support and autonomous motivation toward mathematics activities; and of Niepel et al. (2018) on Students' beliefs and attitudes toward mathematics across time.

5. Conclusion

The results show that regarding a demographic factor, most of the students are female, accounted for 85.94%, whose age ranges between 18 to 19 years, equal to 65.63%. Moreover, a large majority of them are currently doing bachelor degree, accounting for 91.41%, majoring in Finance and Banking, equaling to 81.25%; and 66.41% of them are currently unemployed since they are now in their first year.

The study has found that the four hypotheses were supported but one hypothesis was partially supported; in other words, Teachers' Knowledge had a positive significant impact attitude towards learning mathematics at (β=0.418); Attitude and Perceived Behavioral Control had a positive significant impact the intention learning mathematics at (β=0.429) and (β=0.654), respectively; and Behavioral Intention had a positive significant impact the actual learning mathematics at (β=0.683); However, Teachers' Skills do not impact attitude towards learning mathematics at (β=0.314).

The study found that TPB is very useful in the analysis of attitudes and behavior to learn mathematics. The study removes Subjective Norm from the proposed conceptual model because Mathematics course is the compulsory; in other words, students do not have choice in the Foundation Year Programs. More importantly, the structuring of teachers' knowledge and skills is the pure finding in this study, which can be a value added to the adoption of SEM in the quantitative research in the educational setting.

Implications and **further study**

The finding of this study shows that students are willing to learn mathematics because they form a positive opinion towards the course, and they have enough ability and knowledge to learn the course as well. In this sense, the study suggests that the Math lecturers pay close attention to attitudes toward this course since the understanding of students' attitudes and intention can be useful inputs for conducting the Math course effectively. Furthermore, teachers' knowledge plays a significant role in motivating students to learn the Math course; however, teachers' skills are still concern in this study as they do not influence students' attitudes to learn mathematics. Therefore, the study suggests Math lecturers upgrade their teaching skills continuously.

Since the study mainly focuses on Mathematics course at ACLEDA Institute of Business; the results can be generalized to other higher education institutions. In this regard, the study suggests that future researchers adapt this proposed conceptual model in order to analyze students' attitudes and intention in other courses or at other higher education institutions in Cambodia

References

ACC. (2019). *Guidelines and Rubrics for National Standards for Accrditation of Higher Education Institutions. Phnom Penh: Accreditation Committee of Cambodia*.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Ajzen, I. (2013). Theory of Planned Behaviour Questionnaire. Measurement Instrument. In *Database for the Social Science.*

Alexander, D. (2015). *Theory of Planned Behaviour. In the Video Presentation, designed by Alexander Dreiling, Geremy Farr-Wharton and Jack Robin. Copyright by Queensland University of Technology*.

Armstrong, R. L. (1987). The Midpoint on a Five-Point Likert-Type Scale. *Perceptual and Motor Skills*, *64*(2), 359–362. https://doi.org/10.2466/pms.1987.64.2.359

Bagozzi, R. P., Davis, F. D., & Warshaw, P. R. (1992). Development and test of a theory of technological learning and usage. *Human Relations*, *45*(7), 659–686.

Bolisani, E., & Bratianu, C. (2018). The elusive definition of knowledge. In *Emergent knowledge strategies* (pp. 1–22). Springer.

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review*, *15*(1), 1–40.

Bringula, R., Reguyal, J. J., Tan, D. D., & Ulfa, S. (2021). Mathematics self-concept and challenges of learners in an online learning environment during COVID-19 pandemic. *Smart Learning Environments*, *8*(1), 1–23.

Chong, S., & Cheah, H. M. (2009). A values, skills and knowledge framework for initial teacher preparation programmes. *Australian Journal of Teacher Education (Online)*, *34*(3), 1–17.

CQF. (2012). *Cambodia Qualifications Framework. Retrieved from http://cambodiancouncilofnurse.com/wp-content/uploads/2018/07/Cambodia-qualification-framework_Eng.pdf.*

Cresswell, J. W. (2012). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Approaches to Research* (4th ed.). Pearson Education, Inc.

Darling-Hammond, L., & Baratz-Snowden, J. (2007). A good teacher in every classroom: Preparing the highly qualified teachers our children deserve. *Educational Horizons*, *85*(2), 111–132.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, *35*(8), 982–1003. https://doi.org/10.1287/mnsc.35.8.982

Em, S., Norng, S., & Thab, C. (2021). The Analysis of Technology Acceptance Model on the Study of Consumer Attitudes toward the Intention to Adopt Mobile Banking App in Cambodia. *AIB Research Series, Volume 1,* 74–86. http://acleda-

aib.edu.kh/tc/eng/business-news-20210302.pdf

EPM. (2020). *Theory of Planned Behavior. In the Video Presentation. Retrieved from https://www.youtube.com/watch?v=hhlxxJrWLUE*.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introdluction to Theorv and Research.* Addison-Wesley.

Folkerts, M., Berggren, . John L., Knorr, . Wilbur R., Fraser, . Craig G., & Gray, . Jeremy John. (2020). Mathematics. Encyclopedia Britannica. https://www.britannica.com/science/mathematics. In *Encyclopedia Britannica.*

Green S B. (1991). How Many Subjects Does It Take To Do A Regression Analysis. *Multivariate Behavioral Research*, *26*(3), 499–510. https://doi.org/10.1207/s15327906mbr2603

Grossman, P. L. (1990). *The making of a teacher: Teacher knowledge and teacher education*. Teachers College Press, Teachers College, Columbia University.

Hagger, M. S., Sultan, S., Hardcastle, S. J., & Chatzisarantis, N. L. D. (2015). Perceived autonomy support and autonomous motivation toward mathematics activities in educational and out-of-school contexts is related to mathematics homework behavior and attainment. *Contemporary Educational Psychology*, *41*, 111–123.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate Data Analysis (6th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.*

Harel, G. (2008). DNR perspective on mathematics curriculum and instruction, Part I: focus on proving. *ZDM*, *40*(3), 487–500.

Huda, N., Wahyuni, T. S., & Fauziyah, F. D. (2021). Students' Perceptions of Online Mathematics Learning and Its Relationship Towards Their Achievement. *International Conference on Engineering, Technology and Social Science (ICONETOS 2020)*, 522–529.

Irvine, J. J. (1997). *Critical Knowledge for Diverse Teachers and Learners.* ERIC.

Javadi, M., Kadkhodaee, M., Yaghoubi, M., Maroufi, M., & Shams, A. (2013). Applying theory of planned behavior in predicting of patient safety behaviors of nurses. *Materia Socio-Medica*, *25*(1), 52.

Kautonen, T., Van Gelderen, M., & Fink, M. (2015). Robustness of the theory of planned behavior in predicting entrepreneurial intentions and actions. *Entrepreneurship Theory and Practice*, *39*(3), 655–674.

Keo, S., Norng, S., & Seng, S. (2021). Consumers' Attitudes toward Intention to Adopt Mobile Banking: The Adoption of Diffusion of Innovation Theory on the Study of ABA Mobile Bank. *AIB Research Series, Volume 1*, 33–48. http://acleda-aib.edu.kh/tc/eng/business-news-20210302.pdf

Lipnevich, A. A., MacCann, C., Krumm, S., Burrus, J., & Roberts, R. D. (2011). Mathematics attitudes and mathematics outcomes of US and Belarusian middle school students. *Journal of Educational Psychology*, *103*(1), 105.

Niepel, C., Burrus, J., Greiff, S., Lipnevich, A. A., Brenneman, M. W., & Roberts, R. D. (2018). Students' beliefs and attitudes toward mathematics across time: A longitudinal examination of the theory of planned behavior. *Learning and Individual Differences*, *63*, 24–33.

Nunnally, J. C. (1994). *Psychometric theory 3E*. Tata McGraw-hill education.

Osman, Z. (2020). Determinants of Social Entrepreneur Intention and Behavior among Online Distance Learning Students in Malaysia. *Social Sciences*, *10*(11), 1496–1506.

Pearson, K. (1926). On the coefficient of racial likeness. *Biometrika*, 105–117.

RGC. (2015). *Cambodia Industrial Development Policy 2015 – 2025: "Market Orientation and Enabling Environment for Industrial Development". Phnom Penh: Council of Ministers*.

RGC. (2018). *Rectangular Strategy_Phase 4. Retrieved from http://cnv.org.kh/wp-content/uploads/2012/10/Rectangular-Strategy-Phase-IV-of-the-Royal-Government-of-Cambodia-of-the-Sixth-Legislature-of-the-National-Assembly-2018-2023.pdf*.

Smith, N. (2013). *Introduction to Theory of Planned Behaviour. In the Video Presentation, produced by Nathan Smith. Copyright by the University of Birmingham*.

Sutter, N., & Paulson, S. (2017). Predicting college students' intention to graduate: a test of the theory of planned behavior. *College Student Journal*, *50*(3), 409–421.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage.pdf.crdownload.pdf. In *Information Systems Research* (Vol. 6, Issue 2, pp. 144–176). https://doi.org/10.1287/isre.6.2.144

Venkatesh, V., & Davis, F. D. (2000). Theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

White, K. M., Thomas, I., Johnston, K. L., & Hyde, M. K. (2008). Predicting attendance at peer-assisted study sessions for statistics: Role identity and the theory of planned behavior. *The Journal of Social Psychology*, *148*(4), 473–492.

Yang, S., Norng, S., & Thab, C. (2021). Consumer's Attitudes toward the Intention to Adopt Mobile Payment System: A Study on Mobile Application of ABA Bankin Cambodia. *AIB Research Series*, *1*, 1–19. http://acleda-aib.edu.kh/tc/eng/business-news-20210302.pdf

York, T., Norng, S., & Sem, L. (2021). Factors Inspiring Customers to Use Mobile Banking App: The Adoption of Decomposed Theory of Planned Behavior (DTPB) Model on the Study of ACLEDA Unity ToanChet App. *AIB Research Series*, *1*, 117–131. http://acleda-aib.edu.kh/tc/eng/business-news-20210302.pdf