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Determinants of Willingness to Study Mathematics and Actual Performance: Application of Theory of Planned Behavior

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Abstract
This study examined attitude toward Mathematics on willingness to study Mathematics and actual performance. Based on theory of planned behavior, student willingness to study Mathematics was conceptualized as important role to predict actual performance in previous studies. A framework illustrated the relationship between student confidence, student anxiety, student ability, and student self-control, and willingness to study Mathematics and actual performance. Data was collected from private university students (n = 554) using questionnaires. Factor analysis was conducted to generate unidimensional constructs with construct validity and reliability. Multiple regression was used to test the research framework. The results showed that student confidence, student anxiety, student ability, and student self-control influence student willingness to study Mathematics which leaded to actual performance of students in Mathematics. The implication of the results could be utilized to reinforce student performance, to create the interesting Mathematics class experience, and applicable to similar courses with high student anxiety.

Keywords: Theory of Planned Behavior, Actual Performance, Willingness to Study Mathematics, Student Attitude, Perceived Behavioral Control

1. Introduction
Studying student performance is crucial, as student performance is a key indicator generating the high quality graduates who will be a talented leader and capable employee in the company (Chionh & Fraser, 2009). Previous studies on student performance focused on different factors as follows: gender difference (Marks, 2008); teacher's education and teaching style (Wentzel, 2002); class environment (Chionh & Fraser, 2009); socio economic factor and family education background, class schedules, class size (Heinesen, 2010); Mathematics text books, homework (Törnroos, 2005); exams systems, extracurricular activities (Bishop, 1998); and technology used in the class (Freeman, et al., 2014). The findings of these studies varied from context to context. Since not all variables are applicable to a particular situation, it is important that formal

studies be performed to establish context-specific determinants for sound decision-making. Thus, this study attempts to bridge the gap found in previous studies in relation to the theory of planned behavior (TPB) and actual performance in education. This study has taken the perspective of TPB (Niepel, et al., 2018; Mazana, Montero, & Casmir, 2019) to understand student learning in Mathematics. The TPB argues that an individual's specific behavior is determined by the intention to perform (willingness) that behavior, and the intention can be predicted by the attitude toward that behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). The initial interest of this study was about the willingness to study Mathematics since the basic mathematics subject, the context of this study, was the non-credit subject, the students may not be willing to study and it leads to poor performance. The purpose of this study is to examine the relationship between the determinants of willingness to study Mathematics and actual performance so that student performance can be enhanced. To achieve the purpose, this study developed a conceptual framework by applying theory of planned behavior and evaluated the framework by using a survey method. Although it is important to study student willingness to study Mathematics and actual performance, there are not many studies examining the suitability of the application of theory of planned behavior in education field, especially in studying Mathematics as well as in the Thailand context. Therefore, this study is interested in answering the following research questions: (1) What are the factors affecting student willingness to study Mathematics and their relationship?; (2) How does student willingness to study Mathematics affecting student actual performance?

2. Literature Review

Theory of Planned Behavior

Theory of planned behavior is a prominent theory for encouraging changing human behavior. The focus of the theory is an engagement in the behavior although there are some variables that can influence whether an action toward the behavior will be undertaken. The theory is described as a function of three independent determinants which are attitudes toward behaviors, subjective norms, and perceived behavioral control (Fishbein & Ajzen, 2010). In our study, the theory of planned behavior was used to explain student willingness to study mathematics that will lead to their actual performance. We exclude subjective norms in the sense that students are required to study mathematics regardless of anyone concern. Moreover, Magnusson et al. (2001) also excluded subjective norm from their study. Although Sparks and Shepherd (1992) had subjective norms in their model, its explanatory power was surprisingly small regardless of its important. Thus, TPB is appropriately explained our initial interest which was the effect of the willingness to study on actual performance. Moreover, our study intends to strengthen TPB for generalization purpose with different context. Conceptual framework of this study is shown in Figure 1.

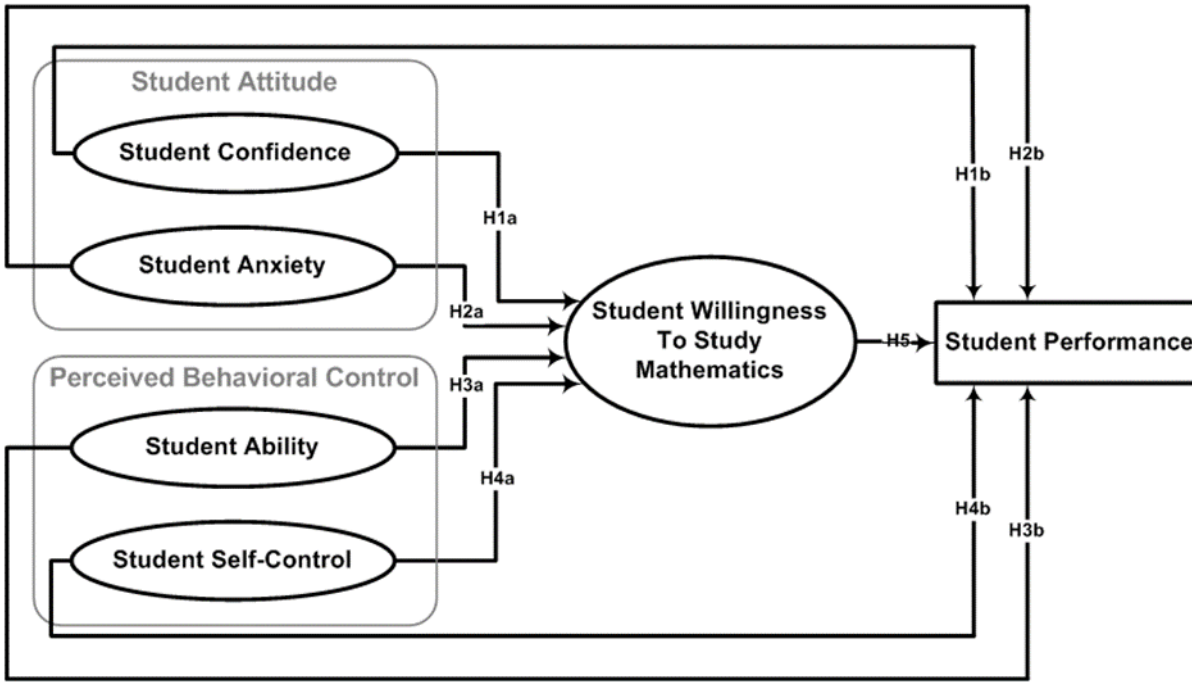

Figure 1: Conceptual Framework

In the context of this study, the theory of planned behavior will postulate that attitude towards mathematics, representing by student confidence and student anxiety, and perceived behavioral control, representing by student ability and student self-control will influence student willingness to study and theoretically will influence students' actual performance in Mathematics. The theory of planned behavior is well suited to identify factors that could help students to increase their willingness to study mathematics. Although the theory of planned behavior has been generously implemented in the health domain, Ajzen and Manstead (2007) speculated that the theoretical conclusion of the theory of planned behavior hold equally well for behavior in other domain e.g. information systems, advertising, education, etc. (Liao, Chen, & Yen, 2007; Ranjbarian, Gharibpoor, & Lari, 2012) and the purpose of the theory has been well supported. A clear explanation of the construct of the theory of planned behavior and their relationship with student willingness to study mathematics and student actual performance will provide clarification about the theory of planned behavior antecedents.

Attitudes towards Mathematics

The definition of attitudes toward mathematics is not accepted in a straightforward and perfect manner. Fishbein and Ajzen (2010) interpreted that attitude as a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given objects. Aiken (1970) defined attitude towards behaviors as an individual tendency to respond positively or negatively to an attitude object (i.e., situation, concept, or person). The variable attitude is one of the most potent factors that relates to achievement (Borasi, 1990). In this research, the theory of planned behavior determined that student confidence and student anxiety will be the indicators of student attitude towards mathematics. Once students become anxious, bored, fearful, or simply believe that mathematics is unimportant, they will not develop confidence and their anxiety will develop avoidance to their willingness to study mathematics (Furner & Berman, 2005). A student's attitude and confidence could be difficult to change. This could be good if a student had a good attitude but could be very problematic

when student's attitude and confidence are negative (Piper, 2008). Kloosterman, Raymond, and Emenaker (1996) found that 66% of student attitudes and confidence remained constant from year to year. Students who were reported a change in their level of confidence changed only from one level to the next, students with low confidence never proceed to high confidence and vice versa. The nature of mathematics cause panic and anxiety. As a result, students ignore to study mathematics and would prefer to partake in other activities that they contemplate the possibility of getting reward and that they feel believable (Zimmerman, 2000).

Student Confidence

Student confidence (in mathematics) refers to students' motivation to learn mathematics, their confidence in their ability to succeed in mathematics and their feelings about mathematics (McMullen, 2005). Student confidence is one of the most influential factors which is unrecognized regarding students' mathematics achievement (Burton, 2004). Reyes (1984) states that confidence consists of an individual perception of self with respect to achievement in school. McElmeel (2002) states that confidence is a faith or belief in oneself and ones' own abilities to succeed. It is the belief that one will act in a right, proper or effective manner. Based on Mohd, Mahmood, and Ismail (2011), student confidence towards problem solving was believed to play a significant role in mathematic achievement and was one of the factors that influenced students in mathematics achievement. Based on the study conducted by Mazana, et al. (2019), students lacked confidence in themselves as mathematics learners. They believed that they were not good in mathematics. This illustrates the importance of confidence and the lack of confidence has positive or negative influence on the student's attitude towards mathematics. Students who are lack of confidence perceived mathematics as difficult which lead to a poor grade and students dislike mathematics. This is also compatible with Simmers (2011) who found that students' dislike of mathematics is connected to the mathematics application in real-life situations. Van der Bergh (2013) asserted that when a student possesses high confidence and he or she believes in their abilities of becoming affluent in mathematics, they are likely to defeat the fear of failing.

Student Anxiety

Many facets of daily life require some knowledge of mathematics and the ability to use this knowledge is unfavorable to the pursuit of many existing and newly emerging occupational fields. Students are required to take some level of mathematics. If the students experience hardship from mathematics anxiety, their willingness to study and to be successful in mathematics courses diminished (Stubblefield, 2006). Miller and Mitchell (1994, p.354) defined mathematics anxiety as "the meaningless state of students in which they feel afraid while focusing on mathematics that affects their performance negatively and prevent them from learning". Tooke and Lindstrom (1998) defined that mathematics anxiety is a negative factor which makes learning harder and reduces positive relationship of students with mathematics. Tobias and Weissbrod (1980) described anxiety towards mathematics as the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematics problem. Sheffield and Hunt (2007) commented that mathematics anxiety is the feeling of anxiety that some individuals experience when facing mathematics problems. They further proclaimed that, like other form of anxiety, students feel their hearts beat more quickly or strongly and they believe that they are not capable of completing mathematical problem and avoid attempting mathematics courses. Mathematics anxiety is regarded to be a widespread problem especially in tertiary education. Ashcraft and Moore (2009) estimated that 17% of the US-American population suffer from high level of mathematics anxiety. Mathematics anxiety does not only have direct effects on task performance but also influences learning and academic progress in the long range. According

to Akinsola, Tella, and Tella (2007), mathematics-anxious students tend to avoid mathematics-related situation and courses and always exhibit procrastination behavior.

Perceived Behavioral Control

Ajzen (1991) introduced the perceived behavioral control that has been considered as a key component of theory of planned behavior. The concept of perceived behavioral control is to serve in theory of planned behavior for understanding the no volitional elements. A high level of perceived behavioral control should strengthen an individual intention to act upon the behavior and the low level of perceived behavioral control leads to less motivation to act upon the behavior. Perceived behavioral control is useful in assessing an individual actual control for specific situation (Ajzen, 2002). In this research, perceived behavioral control governed that student ability and student self-control will be the two indicators. Since learning has been defined as an act of acquiring modification of knowledge and behavioral skills, the main part of student performance and academic achievement is how to captivate the knowledge from which it is acquired learning (Orrell, 2006). In this view, the student will have a chance to acquire knowledge with a unique and different ability to achieve. Students are more passionate in learning (Kutnowski, 2005), their learning preference and learning skills enable them to acquire and modify the existing knowledge to transform behavior and values (Boud, Keogh, & Walker, 2013) and student self-control is developed. Students with high level of self-control are found to have higher grades, can avoid dealing with alcohol and drugs, have better interpersonal relationship, reflect university citizen behavior and exhibit more emotional stability (Tangney, Baumeister, & Boone, 2004). Dalton and Crosby (2011) denoted that student with high self-control helped promoting student learning development in a broader sense more than simply improving study skills and their willingness to study and finally to achieve better performance. Student with low self-control tend to cheat the examination (Williams & Williams, 2012), play gamble (Williams, 2010), drink and drug abuse (Ford & Blumenstein, 2013) and as well as be unhappy that ruin student willingness to study and their performance.

Student Ability

Student ability to learn mathematics is their capability to understand, handle, and work with numbers effectively. The studies carried out by Nizoloman (2013), students were seen to demonstrate a procedural knowledge of the ability to reason through the given mathematical situations, the ability to connect, employ and communicate an algorithmic process within the given problem. That is, to say, the higher the mathematical ability of a student is, the higher his/her achievement in mathematics and the lower the mathematical ability of a student is, the lower his/her achievement in mathematics. The students' ability to learn and willingness to study mathematics will measure student success in solving problems. Bandura (1977) stated that s confidence in his ability (could be considered as student self-efficacy) influences student's mathematical problem-solving ability. Students' mathematical self-efficacy is the students' belief in their level of generality and strength in engaging in various activities and in learning mathematics (Bandura, 1986). Cai and Hwang (2002) expressed that students think about the solutions when they generate mathematical problems. This shows that problem posing can increase students' ability in solving mathematical problems. Based on Zakaria and Ngah (2011), their study showed that student's ability to solve mathematical problems is still at a low level. The results of their study showed no correlation between students' ability to solve mathematical problems and the attitude towards problem-solving.

Student Self – Control

Self-control is explained as the person ability in restraining or hindering behavior or responses intentionally and consciously. It has two domains of control: mental and emotion (Baumeister & Vohs, 2004). It is also used to overcome affective, cognitive, and behavioral tendencies that would otherwise prevent people from achieving their goals (Baumeister, Vohs, & Tice 2007). Based on the study of Tangney et al. (2004), their study specified that self-control not only predict GPA, but also better adjustment, better interpersonal, secure attachment, and more optimal emotional responses. Self-control is not only importance to one's desire and persistence but also need to take action in pursuing one's ambition. When students successfully reach all academic demands such as assignments, examinations, and other requirements, they can pay attention to any distraction such as hanging out with friends or classmates, attempting to pleasure by prevailing school chores. Any students who possess high self-control would get more benefits and advantage than those who have low self-control (Ent, Baumeister, & Tice, 2015)

Student Willingness to Study Mathematics

Student willingness to study is one of the inner strengths and weaknesses that influence student learning performance. Willingness to study is defined as a desire, wish or readiness to acquire new knowledge (Yashima, 2002). It means that a person does not want to stand in one place but wishes to be more qualified and keeps up with the modern trends. Willingness to learn refers to both professional competence and general education (Noplag Blog, 2017). Willingness to study is always related to individual desire and essential requirements, so it is necessary to set conditions that he/she gets certain outcome, especially on the part of the students who want to study. In relation to mathematics learning, willingness to study is likely to have a profound effect on success. Students with high willingness to study are highly motivated, have good behavior and positive attitude towards studying mathematics, and have high level of success in their performance (Tooke & Lindstrom, 1998). They tend to give more attention to their learning process, mathematics materials, assignments and mathematic examinations and tend to become more inquisitive of the content of the subject and be more actively engage in the process of learning mathematics, mathematical task and examinations (Azmidar, Darhim, & Dahlan 2017). Saleh (2004) concluded that high achievers students have high level of willingness to solve mathematical problems compared to average and underachiever students.

Student Actual Performance in Mathematics

Performance is a result of activity that have been done, created both individually and is never devised without an effort either in the form of knowledge or form of skills. Performance is obtained through doing something despite difficulty or delaying in achieving success (Maulida & Kariyam, 2017). Student performance is one of the notable and significant predictors in the lives of the students. It is the outcome of education and it predicts the extent to which the students, teachers, and institution have attained their educational goals and objectives. Student performance is important because it promotes success in their lives (Areepattamannil & Freeman, 2008). Factors affecting student performance e.g. willingness to study, student's academic and learning behavior are equally important in discovering students' academic performance. It includes students outlook, persistence, and effort in learning and how they will relate to the people that make up the school community (Amirtha & Jebaseelan, 2014). Darling, Caldwell, and Smith (2005) used GPA to measure student performance because their main focus was on the student performance for the particular semester. Some other researchers used test results or previous year result since they are studying performance for the specific subject (Hijazi and Naqvi, 2006).

Hypothesis Development

Several studies have examined that attitude influences behavioral intention applying TPB (Chen & Wu, 2020; Lin & Williams, 2016; Burrus & Moore, 2016), thus, the followings are hypotheses for this study.

Student confidence and student willingness to study Mathematics and actual performance

Confidence is important in almost every aspects of student's life. Students who do not show any confidence can find it difficult to be successful in their career. Students with more confidence are able to inspire other students to become confident, motivated and creative. According to Skinner and Belmont (1993), students who are confident and motivated to do school activities select a piece of work to do at the boundary of their competencies, initiate action when given the chance to do something, become passionate in the application of the work, and perceive positive emotion during ongoing action including keenness, enjoyment, hopefulness, peculiarity and willingness. Many previous studies showed that there is a positive relationship between students' confidence and their willingness to study (Nazarova & Umurova, 2016; Sheldrake, Mujtaba, & Reiss, 2015). MacIntyre and Gardner (1994) also found that self-confidence significantly play a part to learner's willingness to communicate in a foreign language. In their study, affective factors such as motivation, personality, intergroup climate, and self-confidence underline willingness to communicate and factors of self-confidence in foreign language and situational self-confidence play an important role in determining the learner's willingness to communicate. The present study, therefore, hypothesizes that:

H1a: There is a relationship between student confidence and student willingness to study Mathematics.

H1b: There is a relationship between student confidence and student actual performance in Mathematics.

Student anxiety and student willingness to study Mathematics and actual performance

In the field of education, anxiety is one of the factors that have a harmful effect on the learning of the students. One type of anxiety is mathematics anxiety. Student anxiety in mathematics is their negative emotional reaction to mathematics. A feeling of emotional strain impedes students from solving mathematical problems both in their ordinary life and academic situations (Ashcraft, 2002). Students who are math anxious always experience increased levels of anxiety in math-related situations. Math anxiety exhibits itself on emotional, cognitive, and psychological level that contributes to the outcomes such as decreases in student's willingness to study and their performance. On an emotional level, students always experience the feeling of emotional strain and worry (Spielberger, 1985). On a cognitive level, math anxiety comprises the functional of working memory. It impairs the mathematical cognitive process of the students (Cassady & Johnson, 2002). According to Hopko, McNeil, Zvolensky, and Eifert, (2001) in the study of undergraduate psychology students, students with medium or high math anxiety were impaired in their reading processes when the text was related to math. On psychological level, students may feel their heartbeat faster when confronted with mathematical problems. They also showed greater increase in cardiovascular reactivity when solving mathematical tasks than students with low levels of math anxiety (Faust, 1992). Thus, the present study hypothesizes that:

H2a: There is a relationship between student anxiety and student willingness to study Mathematics.

H2b: There is a relationship between student anxiety and student actual performance in Mathematics.

Student ability and student willingness to study Mathematics and actual performance

Student ability in Mathematics plays an important role in understanding mathematical problems. Many students perceive that mathematics is the most difficult subject regardless of its importance in their lives. The difficulty of dealing with mathematical problem depends on how student belief in their own ability to succeed. One of the most important parts of students ' comprehension of mathematical problems is self-efficacy. According to Bandura (2010), self-efficacy affects human action through cognitive, motivational, and affective processes. Students with high self-efficacy can plan effectively and successfully in completion of task. In contrast, students who avoid complicated task are students with low self-efficacy. Saez, et al. (2018), conducting a study about willingness to study, self-efficacy and causal attributions in Chilean University using a sample of 695 students, found strong correlation between self-efficacy and self-regulation with the willingness to study. It was concluded that students with high levels of willingness to study show positive beliefs about their own ability to self-regulate their processes of willingness to study. From the study of Carr and Sequeira (2007) using 308 samples from a large Southwest U.S. city, the results showed that self-efficacy was positively related to entrepreneurial intention. Therefore, this study hypothesizes that:

H3a: There is a relationship between student ability and student willingness to study Mathematics.

H3b: There is a relationship between student ability and student actual performance in Mathematics.

Student self-control and student willingness to study Mathematics and actual performance

According to Goleman (2001), self-control in a cautious attitude and clever in managing life balance. The aim is to maintain emotion, not to display emotional weakness in the sense that every feeling has value and meaning. Based on the research of Hafilah and Usman (2019), collecting data from Accounting students of State University of Jakarta, their study found that the higher level of students' ability to control or manage their emotion, the better the level of understanding of accounting knowledge. Students who can control themselves will be able to develop their skills in facing problems than those students who are unable to control themselves well. In conclusion, the higher the self-control, motivation, and learning is, the higher the level of understanding of students ' accounting ability will be, which will also lead to their willingness to study. Moreover, from the study of Kaiser, Hübner, and Bogner (2005), they found that perceived behavioral control which consists of student ability and student self-control have an effect on students intention (willingness) to study. This was coincided with the finding of Lipnevich, MacCann, Krumm, Burrus, and Roberts (2011) on mathematics attitudes and mathematics outcomes of U.S. and Belarusian middle school students composed of 339 U.S. middle school students that perceived behavioral control influenced the intention or willingness of the students to study. Consequently, the present study hypothesizes that:

H4a: There is a relationship between student self-control and student willingness to study Mathematics.

H4b: There is a relationship between student self-control and student actual performance in Mathematics.

Student willingness to study Mathematics and student actual performance in Mathematics

In the theory of planned behavior, Fishbein and Ajzen (2010) identified the essence of the relationship between attitude and intention, stating that attitudes influence intention, which in turn affects actual behavior. That is, the actual behavior is specifically driven by person's behavioral intention, and intention mediates the relationship between psychological influences and action (Bandura, 1986). Woolfolk and Margetts (2007) observed that one of the most significant factors in education is the willingness of students to study, appreciate, and be

excited about what they are studying. When the willingness of students to study is high, they are more likely to find a significant learning challenge. Tooke and Lindstrom (1998) found that the willingness to solve problems played an important role in the achievement of mathematics. Papanastasiou (2000) found that, compared to average and poor learners, outstanding students have a high degree of willingness to solve mathematics problems. In consumer behaviors studies, Brown, Pope, and Voges (2003) shows that customers with desire to buy appear to have greater actual purchase than people who do not wish to buy a specific product. Therefore, the following hypothesis is proposed:

Hypothesis 5: There is a relationship between student willingness to study Mathematics and student actual performance in Mathematics.

3. Research Methodology

Target Population and Data Collection

The data was collected from target population which was the students who took basic mathematics subject in 1/2019 semester (August-October 2019) from one private university. Basic mathematics subject is an introductory course for first year students in business administration faculty. This subject has been selected because it is a non-credit subject which most students may not be willing to study, therefore, it is quite interesting to examine this issue. In addition, as it is important for private university to be able to retain the students under competitive academic environment, this study was conducted in private university with the purpose that the results of this study will be able to enhance student performance which could lead to high retention rate (Hasan, Ilias, Rahman, & Razak, 2008). The data was collected using online questionnaires from all 554 students who took basic mathematics subject. This study used census sample, thus, there is no sampling method used. Table 1 presented student profiles of 554 respondents. The majority of respondents in this study were Thai female students who aged below 19 with GPA 3.00 or above.

Table 1: Student Profiles (n = 554)

		Frequency	Percent
Gender	Male	193	34.8
	Female	361	65.2
Nationality	Thai	442	79.8
	Non-Thai	112	20.2
Age	Below 19 or equal	374	67.5
	20-21	108	19.5
	22 or above	72	13.0
GPA	Less than 2.00	22	4.0
	2.00-2.49	81	14.6
	2.50-2.99	76	13.7
	3.00 or above	153	27.6
	N/A	222	40.1

Note: N/A in GPA refers to students who are in first year, first semester, therefore, they do not have GPA.

Instrument

All item measures were developed from previous studies using a 6-point Likert scale (e.g. strongly agree to strongly disagree) and revised to focus on Math subject. A 6-point Likert scale has been used as a forced choice which will classify respondents into groups that are easy to understand and interpret (Chang, 1994). Cronbach alpha was used to test for reliable measures. Average variance extracted and composite reliability were used to assess convergent validity and discriminant validity applied Fornell and Larcker (1981). Moreover, this study ran exploratory factor analysis to assess unidimensional construct and also test for construct validity both convergent and discriminant (see table 2 & 3). Student confidence was measured by eight items adapted from Mokhtar, Md Yusof, and Misiran (2012). Student anxiety was measured by seven items adapted from Grootenboer and Hemmings (2007). Student ability was measured by six items adapted from Meece, Wigfield, and Eccles (1990). Student self-control was measured by six items adapted from Tangney et al. (2004). Student willingness to study was measured by five items adapted from Pajares and Graham (1999). Student actual performance was measured by single item which was the total 100 scores of quizzes, assignments, midterm, and final exam.

In this study, table 2 illustrates the reliability and validity results for all measures. For reliability measurement, the Cronbach's alpha was used to test the reliability. Hair, Black, Babin, and Anderson (2010) suggested the value of Cronbach's alpha for measurement scale should be 0.70 or greater than to indicate acceptable reliability measures. The results showed that the Cronbach's alpha ranged from 0.716 to 0.919 which represented good reliability of the measures. For validity measurement, exploratory factor analysis was used to group item measures into a few concepts that closely mapped the literatures so that the hypothesis testing was possible while preserving most variation with simplicity (Jolliffe, 2010). Principal components analysis with varimax rotation and Kaiser normalization was considered appropriate as the number of 554 samples was more than five times the number of item measures which were 32 item measures (Tabachnik & Fidell, 1996). The factor analysis has reduced thirty-two item measures to five factors with eigenvalue more than one and factors loading value more than 0.500, ranging from .635 to .897 (Stevens, 1992). The Kaiser-Meyer Olkin (KMO) measure of sampling adequacy was 0.900 (Kaiser, 1974), indicating adequate sample size, and along with the Bartlett Test of Sphericity (7037.344, $p < 0.0005$), indicating a significant correlation between item measures which is valid to run a meaningful EFA, altogether confirming the validity of the measures (Norusis, 2005). Table 2 also illustrates a clear factor structure in which convergent and discriminant validity are evident by the high loadings within factors, and no major cross-loadings between factors.

In the social sciences, where information is often less precise than pure science, it is common to consider a solution that accounts for 60 percent of the total variance as satisfactory to provide practical significance for the derived factors by ensuring that they explain at least a specified amount of variance (Hair et al., 2010). In this study, these five factors account for 74.84% of the variance in the data, ensuring at least a specified amount of variance explained. Moreover, factor loading, composite reliability (CR), and average variance extracted (AVE) were used to establish convergent validity. The value ranges from 0 to 1, especially AVE should exceed 0.50 to present convergent validity which in this study all value mention was exceed the threshold value, indicating convergent validity (Hair et al., 2010; Bagozzi and Yi, 1988) (see table 2).

Table 2: Descriptive of Measurement

Constructs	Factor Loadings	Means	SD
Student Confidence in Math (α = .854, AVE=.705, CR=.749)	.635-.747 (var=11.5%)	3.31-3.43	1.51-1.56
Student Anxiety in Math (α = .906, AVE=.787, CR=.908)	.653-.861 (var=22.55%)	3.27-4.14	1.49-1.83
Student Ability in Math (α = .862, AVE=.754, CR=.799)	.692-.807 (var=12.0%)	3.30-4.07	1.41-1.44
Student Self-Control (α = .716, AVE=.789, CR=.832)	.753-.814 (var=10.35%)	3.49-3.94	1.49-1.56
Student willingness in studying Math (α = .919, AVE=.865, CR=.922)	.813-.897 (var=18.44%)	4.29-4.61	1.16-1.33

Note: KMO (0.900); Variance extracted (74.84%); Barlett's Test of Sphericity are all significant at p value < 0 .0005

Discriminant validity refers to the extent to which factors are distinct and uncorrelated. The rule is that variables should relate more strongly to their own factor than to another factor. In this study, discriminant validity was analyzed using Fornell and Larcker (1981) by comparing the square root of each AVE in the diagonal (correlation to their own factor) with the correlation coefficients (off-diagonal) for each construct in the relevant rows and columns. Based on the rule mention above, the correlation figure on off-diagonal should be lower than figures on diagonal to reflect the discriminant validity (see table 3). Overall, discriminant validity can be accepted for these measures and supports the discriminant validity between the constructs.

Table 3: Discriminant Analysis

	Confidence	Anxiety	Ability	Self-Control	Willingness
Confidence	**.840**				
Anxiety	-.524**	**.890**			
Ability	.683**	-.554**	**.868**		
Self-Control	.002	.213**	-.043	**.888**	
Willingness	.553**	-.233**	.442**	-.108*	**.930**

Note: **correlation is significant at the 0.01 level (2-tailed). *correlation is significant at the 0.05 level (2-tailed).
The value on the diagonal is square root AVE.

4. Results

A multiple regression analysis was applied using the composite score of each factor. Table 4 revealed that the regression equation for each independent variable on willingness to study mathematics was valid where F value = 70.680. Moreover, the Durbin-Watson value was 1.719 which was close to 2.0, indicating that there was no autocorrelation detected in the data set and the variance inflation factor (VIF) value of each independent variable was range between 1.000-2.057 which were less than 4, indicating that there was no multicollinearity in a set of regression variables (Hair et al., 2010). Therefore, these independent variables were appropriate to include in the regression analysis. For adjusted R square value 33.5 percent indicated that 33.5% of the variances in the dependent variable was explained by the independent variables, that is, an explanatory power of up to 33.5 percent, indicating that they can be used to effectively predict student willingness to study Mathematics. In sum, multiple regression analysis was reliable and valid since all assumptions have been met.

The result of regression analysis showed that the student confidence was a highly significantly related to student willingness to study Mathematics (β = 0.524). H1a was supported. The student anxiety in Math was significantly related to the student willingness to study Mathematics (β = 0.160). H2a was supported. The student ability in Math was significantly related to the student willingness to study Mathematics (β = 0.165). H3a was supported. Lastly, student self-control was significantly related to the student willingness to study Mathematics (β = 0.136). H4a was supported. Furthermore, the result of simple regression analysis showed that the student willingness was a highly significant predictor of student performance in Mathematics (β = 0.243). H5 was supported. In sum, based on the results of the above mentioned, the greatest effects on willingness were influenced by student confidence in Mathematics, followed by student ability in Mathematics, student anxiety in Mathematics, and student self-control. Therefore, students who have high confidence in Math, have high ability in Math, experience high levels of anxiety in Math, and are high in self-control, are more likely to develop the willingness to study Mathematics. Specifically, student willingness to study Mathematics certainly influenced student performance in Mathematics.

Table 4: Hypotheses Testing Results (Indirect Effect)

Hypotheses	Standardized Coefficient	t value	p value	VIF	Results
H1a: Confidence ➔ Willingness	.524	10.639	.000	2.019	Support hypothesis
H2a: Anxiety ➔ Willingness	.160	3.638	.000	1.610	Support hypothesis
H3a: Ability ➔ Willingness	.165	3.316	.001	2.057	Support hypothesis
H4a: Self-Control ➔ Willingness	.136	3.800	.000	1.068	Support hypothesis
H5: Willingness ➔ Actual Behaviors (willingness as mediator)	.243	5.852	.000	1.000	Support hypothesis

Note: Adjusted R square = 33.50%; F value = 70.680 at p value < .0005 for H1-H4; Durbin-Watson value = 1.719
R square = 5.7%; F value = 34.250 at p value < .0005 for H 5; Durbin-Watson value = 1.443

Table 5 revealed that the regression equation for each independent variable on student performance in mathematics was valid (F value = 33.686). Moreover, the Durbin-Watson value was 1.383 and the variance inflation factor value of each independent variable was less than 4; these results indicated the absence of collinearity and the autocorrelation of residuals among the investigated independent variables. Therefore, these independent variables were appropriate to include in the regression analysis, and had an explanatory power of up to 23.0 percent, indicating that they can be used to effectively predict student performance in Mathematics (actual behaviors). The result of regression analysis showed that only student ability and student anxiety were significantly related to student performance in Mathematics (β = 0.232 and β = -0.261) respectively. H2b and H3b were supported. However, student confidence in Math and student self-control were not significantly related to the student performance in Mathematics (β = 0.036 and β = -0.016) respectively. H1b and H4b were not supported. Lastly, student willingness to study Mathematics was not significantly related to the student performance in Mathematics (β = 0.060). H5 was not supported.

In sum, based on the results of the above mentioned, the greatest effects on student performance were influenced by student ability in Mathematics, and followed by student anxiety in Mathematics. Nonetheless, student confidence, student self-control and student willingness did not influence student performance in Mathematics. Therefore, students who have high ability in Math are more likely to perform well in Math and students who experience high level of anxiety in Math are less likely to perform well in Math. However, student who

have high confidence in Math, student with high self-control or student willingness to study Math have no effect on student performance in Math. Notice that student willingness to study Math was a good predictor when it is a mediator, not an independent variable.

Table 5: Hypotheses Testing Results (Direct Effect)

Hypotheses	Standardized Coefficient	t value	p value	VIF	Results
H1b: Confidence ➔ Actual Behaviors	.039	.663	.508	2.424	**NS**
H2b: Anxiety ➔ Actual Behaviors	-.261	-5.379	.000	1.670	Support hypothesis
H3b: Ability ➔ Actual Behaviors	.232	4.269	.000	2.098	Support hypothesis
H4b: Self-Control ➔ Actual Behaviors	-.016	-.400	.689	2.424	**NS**
H5: Willingness ➔ Actual Behaviors (willingness as IV)	.060	1.309	.191	1.505	**NS**

Note: Adjusted R square = 23.0%; F value = 33.686 at p value < .0005 for H1-H4; Durbin-Watson value = 1.383

5. Discussion

Prior research and this study proved that theory of planned behavior is an effective theory in predicting student behavior, including in studying Mathematics. The findings where student willingness to study Mathematics as dependent variable are as follows. The first finding (H1a) was that there was the relationship between student confidence and student willingness to study which was consistent with the study of Parsons, Croft, and Harrison (2009), examining the first year engineer students learning mathematics at the university during 2005-2007. The second finding (H2a) was that there was the relationship between student anxiety and student willingness to study which was consistent with the study of Meece et al. (1990), studying 250 sample of 7th- through 9th-grade students enrolled in math subject. The third finding (H3a) was that there was the relationship between student ability and student willingness to study which was consistent with the study of Niepel et al. (2018), conducting two waves study on June and November 2012, collecting data from various US middle schools. The fourth finding (H4a) was that there was the relationship between student self-control and student willingness to study which was consistent with the study of Fauzi and Widjajanti (2018), conducting desk research by browsing the journal on the internet using the MENDELEY program. In addition, the fifth finding (H5), where student willingness to study as single independent variable, was that there was the relationship between student willingness to study and actual performance which was consistent with the study of Aungatichart, Fukushige, and Aryupong, (2020), examining 400 Thai consumers of organic foods. These findings were corresponding to what is found in the literature and can be interpreted on the basis of theory of planned behavior (Lipnevich et al., 2011; Niepel et al., 2018; Oh, 2003).

The findings where student actual performance as dependent variable are as follows. The sixth finding (H2b) was that there was the negative relationship between student anxiety and student actual performance which was consistent with the study of Vitasari, Wahab, Othman, Herawan, and Sinnadurai, (2010), examining 205 second year engineering students from Universiti Malaysia Pahang (UMP). The seventh finding (H3b) was that there was the relationship between student ability and actual performance which was consistent with the study of Caspi et al. (2006), conducting web-based study to examine the competence of the fourth-year medical students in the US. Surprisingly, this study did not find the relationship between student confidence (H1b), student self-control (H4b), and student willingness to study (H5 as one of the five independent variable) with student actual performance.

The interesting results were that student anxiety was positively related to student willingness to study in Mathematics but negatively related to actual performance, which was consistent with the study of Cassady, (2004), investigating 124 undergraduate students in educational psychology subject at a Midwestern United States university. The possible explanation for positive relationship could be that the more they are afraid of math, the more they are willing to study as they might think that more knowledge could help reduce their anxiety. Another possible explanation for the negative relationship could be that their anxiety could be very high especially during the exam period, thus could cause negative in their performance. Keeley, Zayac, and Correia, (2008) studied 83 students enrolled in a single introductory statistics subject during the spring of 2005 at a large university in the southeastern US and found that the relationship between student anxiety and performance was a curvilinear relationship. Another interesting finding was that the relationship between student ability with willingness to study and actual performance and the possible explanation could be that student ability is determined as their skills, thus when the student believe in their own skills, it could affect their willingness and their action. Moreover, the possible explanation of student confidence that was not related to actual performance could be that students may have over confidence on this non-credit subject, thus they may not put enough effort in doing the exam and so do student self-control who are not likely to put effort in their study, thus they cannot do well in the exam. In sum, the most important of the finding of this study was that student willingness to study Mathematics fully mediate the relationship between student confidence, student anxiety, student ability, and student self-control with their actual performance in Mathematics which can enhance and strengthen theory of planned behavior.

Implication

This study aims to explore the relationship between the determinants of student willingness to study Mathematics and the effect on their actual performance. Although some research studied the determinants affecting actual performance (Mazana, et al., 2019; Mohd, et al., 2011), student willingness to study Mathematics has been neglected. The important of student willingness to study Mathematics is verified by theory of planned behavior (Ajzen, 2002). Student willingness to study has manifested as a major influence in the student academic success. This can be used to introduce programs for students in higher education who want to develop their mathematics learning skills. The findings of this study will help decision makers in higher education institutions to gain a better understanding of the factors that determine student willingness to study Mathematics in classrooms. This would contribute to improved implementation, expenditure, and benefits in the field of education. Student willingness to study should be promoted by teachers in the classroom to facilitate the development of learning competences (Tuckman & Kennedy, 2011). In addition, the student performance should be improved if the students have appropriate attitude like confidence and less anxiety toward their willingness to study and have effective behavioral control like ability and self-control toward their actions. For this the administration should take steps to arrange the curriculum, courses, and proper learning facilities to assist the student to develop those attitude, willingness, and ability in studying Mathematics. The student should perform well if they are properly guided by the parents and also by their teacher.

Limitation

There are certain limitations of this study. Firstly, the study conducted on only one private university from one subject in one semester. Suggested future study should consider include more university, more courses for generalizable purpose. Secondly, although R square value is equaled to 38% which is quite acceptable, there are some other determinants of academic performance that are not discussed and could improve the R square value e.g. self-motivation,

family income, and parents' level of education. The square of the correlation (R square) is measuring the proportion of variation in the dependent variable that can be attributed to the independent variable. Thirdly, the research framework tested is a new combination of theoretical related variables in developing country context like Thailand, thus, it would be more generalizable if there is a chance to study in other developing countries. Finally, this study is a cross sectional research, it is not feasible to assess causality findings between the variables that were examined. It will be interesting in the future to consider the longitudinal study that makes it possible to examine causality.

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