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Kinta Utara Pre-University Students' Attitude and its Correlation with Mathematics T Achievement

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Abstract
Students' progress in their learning is heavily influenced by their attitude. A favourable attitude toward mathematics might boost pupils' metacognition and help them obtain good performance in arithmetic. The purpose of this quantitative survey is to investigate the relationship between pre-university students' attitudes toward mathematics in terms of interest, confidence, anxiety, and students' impression of mathematics usefulness and their accomplishment in Mathematics T in Kinta Utara, Perak. The convenience sample method was used to recruit 211 pre-university students from ten schools in Kinta Utara, including Form 6 College. Data is gathered online using a translated questionnaire from Fennema and Sherman's (1976) Attitude Measure Instrument. The data was analysed with SPSS 26 using the independent t-test and Pearson correlation. The data analysis revealed that there is no statistically significant difference in attitude between male and female pre-university pupils. These four attitude components have a strong relationship with students' progress in Mathematics T. Interest (r=.266), confidence (r=.342), and students' sense of Mathematics usefulness (r=.631) all have a positive significant link with students' achievement, however anxiety (r=-.173) has a negative correlation. Overall, in Kinta Utara, students' attitudes (r=.562) correspond somewhat with students' achievement in Mathematics T. This study shows that attitude constructs, i.e., interest, confidence, anxiety, and students' perception of mathematic usefulness, have an influence on the achievement of pre-university students in Mathematics T in Kinta Utara, Perak.
Keywords: Attitude, Pre-University, Mathematic T, Achievement, Correlation

Introduction

In 2012, a new Malaysian Higher School Certificate (standard abbreviation as STPM) modular system was introduced to replace the terminal system and was monitored by representatives from Cambridge Assessments to maintain the quality and standards of the STPM examination system (MOE, 2012). From that year onwards, changes to the previous STPM curriculum syllabus were made where one of the subjects offered in the science stream, Pure Mathematics, was converted to Technology Mathematics (Mathematics T). The areas covered in the syllabus of this subject are algebra, calculus, geometry, and statistics (MOE, 2012). The areas covered in this syllabus will reflect the level of mastery of mathematics in their respective disciplines at the university level in the future (Nopiah et al., 2015). To ensure

the quality of pre-university students' mastery of mathematics is high, the Cambridge Assessment needs to conduct quality monitoring so that the level of mastery of pre-university students reaches the minimum requirement of mathematics in university level (MOE, 2012). The ability of pre-university students to achieve good results in Mathematics T is highly dependent on the attitudes of the students themselves. Attitude in the context of learning is a person's learning tendency to react positively or negatively to objects, situations, concepts or other people (Sarmah & Puri, 2014). Attitudes in mathematics are an individual's emotional response to mathematics, students' beliefs about mathematics and how students behave towards mathematics (Hart, 1989).

Students' attitude changes over time (Syyeda, 2016) and plays an important role in determining student success. A positive attitude towards learning mathematics among students can improve mathematical achievement while a negative attitude will hinder effective learning, affect learning outcomes and subsequently student performance in examinations (Ayob & Yasin, 2017). Students' positive attitude towards mathematics can also affect students' willingness and readiness to learn mathematics compared to students who are respond negatively to it. By the time students feel that mathematics are important, students will strive to improve their mathematics achievement (Ajisuksmo & Saputri, 2017; Mahmud et al., 2020). The students' attitude is one of the main factors that cannot be ignored. These positive or negative attitudes are influenced by students' perceptions towards mathematics learning. Students who study mathematics think it is difficult to learn because the calculations involved in a problem are complex and difficult to relate to other mathematical knowledge (Hagan et al., 2020). The mastery of a mathematical concept at the beginning of learning depends on the interest and confidence of students to follow the learning at the beginning of the phase (Mirza, 2018). Students' anxiety is reduced if they feel that the initial phase of learning is going well as a result of the teacher's teaching (Okyere et al., 2013).

Students' perception of mathematic usefulness in the future is also very important to determine students' willingness to learn. This perception is influenced by students planning to engage in mathematics related fields of work in the future (Flegg et al., 2012). Various definitions were given to define attitudes in previous studies. Attitude is a person's positive or negative affective, cognitive and behavioural tendencies towards events, people, objects, systems of thought and institutions in one's perception (Yasar, 2016). Research on attitude is important because it explains a person's behaviour, the consistency of that behaviour, the individual's perception of things in this world which includes clues to the determinants of that behaviour and the basis of social behaviour. (Kibrislioglu, 2015). Attitudes toward mathematics are tendencies of positive or negative emotion toward mathematics (Tahar et al., 2010). Students' attitudes towards mathematics were defined as the level of students' interest in the subject of mathematics, the students' tendency to engage in mathematics learning activities and the level of students' belief in the use of mathematics (Othman & Zakaria, 2013)

Therefore, previous studies focused on 3 main domains namely affective (emotions and beliefs), cognitive and behavioural (Ayob & Yasin, 2017). Few studies have been conducted to examine the relationship between students' attitudes towards their mathematical achievement. Past studies have shown that student achievement in mathematics is a major factor in the development of students' attitudes towards mathematics (Mirza, 2018). Study by Hargreaves et al. (2008) found there is no significant differences in Mathematics achievement among male and female students. Students' attitudes towards

mathematics learning and student achievement in mathematics are interrelated (Hasmuddin & Maat, 2020; Ma & Kishor, 2012). According to Nur (2010), there was a significant positive relationship between students' attitudes and mathematical achievement. Okyere et al (2013) in their research stated that there is significant positive relationship between students' attitudes in Ghana with mathematics achievement. In the study conducted by Joseph (2013) in a school in Tanzania, researchers found that 55% of students have a negative attitude towards mathematics and there was a significant positive relationship between students' attitudes with students' achievement in mathematics where $r = 0.33$.

Problem Statement

It is important for the pre-university students to have a good attitude towards Mathematics learning to improve their achievement in Mathematics T. Previous studies showing samples have negative attitude towards their Mathematics learning (Zhang et al., 2019; Bandalos et al., 1995). Students who show negative stimuli to their Mathematics learning can be seen from the interest shown, confidence in it, anxiety, and students' perception towards Mathematics usefulness in future (Mirza, 2018; Syyeda, 2016; Azmidar et al., 2017; Ayob & Yasin, 2017). These four components of attitudes are interrelated and influence each other to form student's attitude towards Mathematics learning. Interest is a feeling of liking that arises towards mathematics, or a feeling of dislike for mathematics (Okyere et al., 2013).

Dislike of Mathematics will affect students' perceptions of Mathematics usefulness for their future. Students find it difficult to acquire useful mathematical skills and processes to apply in their daily lives (Hagan et al., 2020). The difficulties faced by students during the process of learning Mathematics affect students' confidence towards Mathematics. Low self-confidence will defeat the purpose of students learning Mathematics (Inkeeree et al., 2017). This leads to students' anxiety towards their Mathematics learning. Anxiety experienced by students are due to the loss of students' confidence in Mathematics and this resulted in a decline in students' performance for this subject (Namkung et al., 2019; Rosli et al., 2013). Therefore, a survey needs to be conducted to study the correlation between attitudes of pre-university students in Kinta Utara, Perak towards their achievement in Mathematics T.

Theoretical Frame

The ABC model (Affective, Behaviour, Cognitive) is a model that is often referred to by researchers to conduct studies related to attitudes (Jain, 2014). This model prioritizes 3 main components in attitude namely affective, behavioural, and cognitive. In this study, the constructs identified to be involved were interest (behaviour), confidence and anxiety (both affective) and students' perception of mathematic usefulness (cognitive).

Affective Component

Confidence

Confidence is defined as an individual's belief in overcoming a problem and providing the best solution (Cramer et al., 2009). Confidence is also a person's ability to achieve or demonstrate a behaviour or series of behaviours in an impressive manner in certain situations (Bandura et al., 2006). Confidence is the positive thinking of an individual who puts himself or herself able to evaluate about themselves and feel comfortable to perform activities in pursuit of a planned goal (Kunhertanti & Santosa, 2018). In the affective component, student's confidence in learning mathematics plays an important role where successfully built

confidence gives a confidence to students themselves in learning mathematics constructively (Maijala et al., 2004). Students with high self-confidence believe they can succeed in learning mathematics and at the same time do not worry about failure (Kunhertanti & Santosa, 2018). Students with high self-confidence are prepared to face the challenges during mathematics learning process and further improve their academic achievement while students who lack of self-confidence will choose not to face such challenges. (Adelson & McCoach, 2011).

Anxiety

Anxiety is defined as an emotion of fear, worry and restlessness of an individual about something (Saadé, 2017). Anxiety is also a subjective feeling in which tension, fear and worry arise as a result of reactions in the body nervous system (Vitasari et al., 2010). Anxious students show a passive attitude in their studies and because of this, it results in reduced student interest in learning, decreased exam performance and poor quality assignments (Vitasari et al., 2010). Anxiety in mathematics is defined as a matter of concern in education for a long period of time and refers to a state of tension and fear when individuals are involved with mathematics learning (Ashcraft & Krause, 2007). In the empirical studies that have been conducted, it has been found that negative mathematics anxiety is a major factor in poor performance when students facing mathematical reasoning or mathematical problem solving (Bandalos et al., 1995). Mathematical anxiety is negatively correlated with meta-cognitive knowledge. This means that the more students are concerned about the level of learning, the less meta-cognitive knowledge students have in the long run and this prevents students from improving their own performance (Hoorfar & Taleb, 2015).

Behavioural Components

Interest

Interest is an intrinsic motivation that stimulates students' desire to learn mathematics (Guy et al., 2015). It is a psychological state to attract individuals to have a tendency to re-engage in a situation (Hidi & Renninger, 2006). Interest is also the will or desire of an individual to determine the priority of something that brings happy emotions to the individual (Azmidar et al., 2017). Interest in learning mathematics is important and it is one of the contributing factors to the success of students mastering it (Murayama et al., 2013). Students who have a strong interest in solving mathematic problems are more focused when working out the solutions and use more in-depth processing strategies. Students have longer mathematical endurance in solving a problem than other students who are not interested (Ainley et al., 2002). The higher the level of interest in learning mathematics, the higher the level of learning ability. In the studies conducted by Heinze et al (2005), researchers found that there was a correlation between students' interest and achievement in mathematics. Interest in mathematics learning should be taken into account as a predictor for students' mathematical achievement. Gilbert (2016) states that students with high interest in mathematics have high motivation and are more willing to solve high or low cognitive mathematic problems.

Cognitive Component

Students' Perception of Mathematic Usefulness

Students' perception of mathematics usefulness refer to students' perceptions of the importance of mathematics in daily life and the future (Adelson & McCoach, 2011). According to Fennema & Sherman (2020), students' perception of mathematic usefulness refers to

student beliefs about the practical application and application of mathematics in the present and its relation to the future. Students who are interested in mathematics and find it useful are more likely to learn it using self-learning approach (Pintrich & Zusho, 2002). Tartre & Fennema (1995) found that students' perceptions of the use of mathematics, both present and in their future, were a variable related to mathematical achievement.

Objective

This study was conducted to

i. Identify the differences in attitudes between male and female pre-university students in Kinta Utara.
ii. Identify the correlation between attitude (interest, confidence, anxiety, and students' perception of mathematic usefulness) and students' achievement in Mathematics T.

Research Question

i. Are there any differences in attitudes between male and female pre-university students at Kinta Utara?
ii. What is the correlation between attitudes (interest, confidence, anxiety, and students' perception of mathematic usefulness) and students' achievement in Mathematics T?

Survey Hypothesis

H_0: There are no differences in attitudes between male and female pre-university students in Kinta Utara.

H_0: There is no correlation between attitudes (interest, confidence, anxiety, and students perceive of mathematic usefulness) and students' achievement in Mathematics T.

Methodology

This survey study uses a quantitative approach involving 211 Form 6 students in Kinta Utara. These samples were randomly selected using a simple random sampling method. A total of 10 schools including Form 6 College offering Mathematics T subjects in Kinta Utara were involved in this study. Questionnaire instruments were used to collect data from these 10 schools. Attitude Measurement Instrument by Fennema and Sherman (1976) adapted by Dlamini (1998) in her research was used in this study. The instrument produced by Fennema and Sherman contains 9 sub-components that can assess student attitudes. However, only 4 components will be studied in this study, namely students' interest, confidence, anxiety, and students' perception of mathematic usefulness. The questionnaire contains 5 sections namely Section A (Demography), Section B (Interest), Section C (Confidence), Section D (Anxiety) and Section E (Students' perception of mathematic usefulness). There were 49 items in this questionnaire instrument: interest (12 items), confidence (13 items), anxiety (12 items) and students' perception of mathematic usefulness (11 items).

A 5-point Likert scale was used in this instrument, i.e., strongly disagree, disagree, neutral, agree and strongly agree. The original instrument used a 4-point Likert but in this study, a 5-point Likert was used. This is because there is a possibility that respondents may not answer all the questions due to uncertainty (Dawes, 2008). In many cases, it is better to know that the respondent is neutral than letting the respondent not answer the question at all. Data for the achievement of Mathematics T students was obtained from the latest STPM Trial Examination results. This instrument was prepared in the form of a Google Form survey

and the link was provided to the sample through their respective Mathematics T teachers. Before the link was given, permission to conduct the study from the school or college administrators was obtained. Data obtained from Google Forms was extracted using Microsoft Excel and then transferred to IBM SPSS Statistics version 26 for analysis purposes. Independent t-test and Pearson correlation were used to analyse the data.

Pilot Test

A pilot study was conducted to determine the validity and reliability of the instruments used. 30 respondents were randomly selected for this pilot test and this number of respondents was sufficient for the purpose of the pilot study (Johanson & Brooks, 2010). Before this instrument is sent to the respondent, face validation is conducted where 2 experienced English teachers were referred to ensure the sentence structures were understandable and correct. Items whose meaning is different from the meaning of the original instrument were improved on, in terms of its structure and use of vocabulary in the first face validation. After improvement, the instrument is referred to another English teacher to verify the final edition of the instrument. This face validation needs to be done so that the instrument used needs to be valid in terms of its appearance (Ghazali, 2016).

After face validation was performed, to conduct the pilot study, the instrument was sent to 30 respondents who were not involved in the actual study. Data from respondents were extracted using Microsoft Excel and transferred to IBM SPSS Statistics version 26 for analysis purposes. Analysis Alpha Cronbach value was performed to test the reliability of this instrument. The following is an interpretation table of acceptable Alpha Cronbach values (Bond & Fox, 2007);

Table 1 Cronbach Alpha value interpretation

Alpha Cronbach value	Reliability interpretation
0.9 – 1.0	Very good and high consistency effective level
0.7 – 0.8	Good and acceptable
0.6 – 0.7	Acceptable
< 0.6	Items need to be repaired
< 0.5	Items need to be dropped

Table 2 Cronbach Alpha value

Construct	Alpha Cronbach value
Interest	.813
Confidence	.924
Anxiety	.627
Students perceive of mathematic usefulness	.838
Overall	.937

Table 2 shows the results of the analysis of Alpha Cronbach values obtained from the pilot study. The results show a range of values in between 0.627 hingga 0.924. The overall Alpha Cronbach value for the instrument used in this study was 0.937. This Alpha Cronbach value indicates the reliability of the instrument used in this study was very good and have high consistency effective level. The instrument used in this study is suitable for collecting data.

Results

A total of 109 male students (51.7%) and 102 female students (48.3%) were involved in this study. The results of the descriptive analysis showed that the mean was in the range between 2.562 - 3.692 as shown in Table 3.

Table 3 Mean and standard deviation

Construct	Mean	Standard deviation
Interest	3.692	.468
Confidence	3.599	.473
Anxiety	2.562	.294
Students' perception of mathematic usefulness	3.537	.385
Overall	3.344	.207

The overall mean was 3.344 with a standard deviation of .207. This mean indicates that the level of attitude of Form 6 students in Kinta Utara towards achievement is high. Among the four analysed constructs, interest (3.692) showed the highest mean while anxiety (2.562) showed the lowest mean. The lower the mean value of anxiety, the lower students' level of anxiety would be towards mathematics. The mean for confidence (3.599) was the second highest followed by the mean of students' perception of mathematic usefulness (3.537).

Before the analysis was performed to examine the differences in attitudes between male and female pre-university students, and the correlation between each construct with pre-university student achievement in Mathematics T, a normality test was performed. The number of samples used was 211 students and therefore, the Kolmogorov-Smirnov test was used to determine the normality of the data.

Table 4 Normality test

Construct	*Kolmogorov-Smirnov*[a]		
	Statistic	Degree of freedom	Significance level
Interest	.052	211	.200
Confidence	.050	211	.200
Anxiety	.059	211	.072
Students' perception of mathematic usefulness	.056	211	.200

Results of the normality test showing that all the constructs measured in this study were normally distributed. Significance value of *Kolmogorov-Smirnov* test for interest ($p = .200 > .05$), confidence ($p = .200 > .05$), anxiety ($p = .072 > .05$) and students' perception of mathematic usefulness ($p = .200 > .05$). Interest, confidence, anxiety, and students' perception of mathematic usefulness are normally distributed.

Inferential statistical analysis for independent t-test was conducted to test the mean difference for attitudes between male and female pre-university students in Kinta Utara, Perak. Table 5 below shows the results of independent t-test analysis between male and female students.

Table 5 Attitude differences based on gender using independent t-test

Gender	N	Mean	Standard deviation	t-value	Significance level
Male	109	3.347	.208	$.236$	.813
Female	101	3.341	.207		

The mean difference between male and female students is .006 and the results of the independent t-test analysis showed that there was no significant difference between the attitudes of male and female pre-university students at Kinta Utara. Hence, the null hypothesis was failed to be rejected. Value $t(208) = .236$ and this value is not significant ($p = .813 > .05$) [$95\%\ CI = -.050$ hingga $.063$]. Results of analysis show that there is insufficient evidence to conclude that there are differences in attitudes between male and female pre-university students at Kinta Utara.

Inferential statistical analysis for Pearson correlation was conducted to identify the relationship of attitudes (interest, confidence, anxiety, and students' perceptions of the use of mathematics) with students' achievement in the subject of Mathematics T. Table 6 below shows the results of Pearson correlation analysis between attitude constructs of interest, confidence, anxiety, and students' perception of mathematic usefulness, with students' achievement.

Table 6 Correlation between interest, confidence, anxiety, and students' perception of mathematic usefulness with students' achievement

Components		Interest	Confidence	Anxiety	Perception of mathematic usefulness	Attitude
Achievement	*r*	.266	.342	–.173	.631	.562
	p	.000	.000	.012	.000	.000

Results of analysis show that there is a positive significant correlation between interest ($r = .266, p = .000 < .05$), confidence ($r = .342, p = .000 < .05$) and students' perception of mathematic usefulness ($r = .631, p = .000 < .05$). However, results of analysis show that there is a significant negative correlation for anxiety ($r = -.173, p = .012 < .05$) with students' achievement in Mathematics T. Results of the analysis showed that there was a significant positive correlation between the overall components of attitudes with students' achievement in Mathematics T ($r = .562, p = .000 < .05$). Therefore, the null hypothesis is successfully rejected. Analysis shows there is sufficient evidence to conclude that there is a relationship between the attitudes of pre-university students in Kinta Utara with student achievement in Mathematics T. Based on the Pearson correlation coefficient, r, the correlation between students' attitudes and achievement in Mathematics T is moderately and positively correlated (Schober & Schwarte, 2018).

Discussion

Descriptive analysis of interest showed that students have high interest in this subject. The high interest shown by students has a strong influence on a student's cognitive and affective ability (Ainley et al., 2002). This advantage can provide strong motivation to students to continue learning mathematics (Ajisuksmo & Saputri, 2017) and at the same time get rid of negative perceptions of mathematics (Ganal & Guiab, 2014). Stimulated interest helps students to build high confidence to achieve good result in this subject. This confidence

was built after going through a prolonged process of learning and reinforcement training. If students' confidence is low, it will affect the students' learning process (Inkeeree et al., 2017; Mahmud & Yunus, 2018).

The results of the latest STPM Trial Examination showed that there were 15.1% who got A, A- (9.0%), B+ (18.5%), B (14.7%) dan B- (7.6%). A total of 166 (78.7%) students from the samples fully passed this subject. This indicates that students' anxiety on this subject is at a moderate level. Pre-university students at Kinta Utara have a moderate level of anxiety and this can be monitored by the level of student achievement in the STPM Trial Examination for this subject. Students with low levels of anxiety have high levels of cognitive and students can make full use of the metacognitive ability they possess (Bahari & Maat, 2018; Hoorfar & Taleb, 2015). If students' level of anxiety in learning Mathematics T increases, students will experience increased stress (Cumhur et al., 2019) and it will affect students' interest and confidence in learning this subject. Studies also show that students have a good perception towards the usefulness of mathematic they learnt. According to Adelson & McCoach (2011), students who have a good perception towards mathematic usefulness perceive that the content of Mathematics studied is appropriate for current and future purposes as well as relevant to school, career and daily life.

Conclusion

In conclusion, the four components of attitude, interest, confidence, anxiety, and students' perception of mathematic usefulness, correlate with students' achievement in Mathematics T subject in Kinta Utara. There was no difference in attitudes between male and female pre-university students in this district. The four components play their respective roles and are interrelated with each other to form a good student learning attitude towards Mathematics T. To ensure the level of achievement in the district is maintained and improved, Mathematics T teachers should maintain the use of teaching techniques that include diversity or no barriers to mathematics learning, reduce student anxiety, increase students' active interest, and to apply Mathematics in daily life.

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