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The Relationship of Affective Factors in Mathematics Learning Amid Pandemic Covid-19

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Abstract

Although mathematics is commonly viewed as cognitive discipline, the affective factors in mathematics learning should not be neglected especially when it comes to learning amid pandemic Covid-19. Undoubtedly this pandemic emergency has caused many uncertainties in students and has affected their mathematics achievement. Thus, this quantitative correlational study aims to investigate the relationship between the affective factors such as mathematics anxiety, attitudes towards mathematics and mathematics self-efficacy towards mathematics achievement among secondary school students amid pandemic Covid-19. To examine the relationship between the variables, survey questionnaires were constructed to collect data through snowball sampling. The questionnaires were distributed to closest acquaintances and shared via link at messaging applications to students from few different schools who currently attending their secondary level within Puchong area. A total of 81 respondents from the questionnaires. The items used to measure the variables chosen are within a high internal consistency range ($\alpha \geq 0.9$), such as mathematics anxiety (0.921), attitude towards mathematics (0.915) and mathematics self-efficacy (0.932). Mathematics achievements were measured through self-reported grade by the students. The data obtained is then analysed through Pearson correlation analysis through the Statistical Package of Social Science, SPSS. Result revealed that there were moderate positive relationships between all three affective factors chosen with mathematics achievement (r = $0.4 < r \leq 0.59$, $p < 0.01$) such as mathematics anxiety (0.524), attitudes towards mathematics (0.426), mathematics self-efficacy (0.502). These results suggest that high in the affective factors result in high mathematics achievement and vice versa.

Keywords: Mathematics Anxiety, Attitudes Towards Mathematics, Mathematics Self-Efficacy, Mathematics Achievement.

Introduction

All educational institutions are forced to close as to curb the rapid transmission of Covid-19. The school closure has impacted over 80% of world learners (UNESCO, 2020) and disrupted the typical lifestyle (Amran & Jamaludin, 2021). Various efforts conducted in ensuring the continuity of the instructional process during the closure (Lailiyah et al., 2021). Many schools opted for online distance learning, and many were caught unprepared due to the emergency

implementation (Daniel, 2020). The change in the environment has forced students to adapt to the new norms of learning and the transition from physical class to online mode have made the learning process to be revised again, especially in learning mathematics (Negara et al., 2021). Many students struggled in adapting to the changes which affecting their motivation and emotional state (Dennon, 2020). They faced many unexpected challenges in the learning process, and these brought emotional burden to students especially when dealing with distance learning issues such as technological readiness, technological literacy, facilities, financials, emotional and domestic situations (Ahmadon et al., 2020). Thus, pandemic surely has caused many uncertainties that give impacts to academic achievement. The uncertainties and challenges consequently lead to learning anxiety in students, affecting students' attitudes and self-efficacy.

Affective Factors in Mathematics Learning

Anxiety in Mathematic

Anxiety and fear are defined as unpleasant emotions usually experienced in performance settings (Zhang et al., 2018). Mathematics anxiety defined as a state of panic and helplessness that occurs when learners are required to involve in activities such as solving mathematics problems (Jolejole-Caube et al., 2019). Students who feel tension and strained in mathematics activities are said to have mathematic anxiety consequently interfere students' academic performance (Desa et al., 2016). Not only that, but mathematics anxiety could cause individuals to forget and lose self-confidence in solving any mathematical questions. Raju (2018) mentioned that there are three categories under mathematics anxiety: mathematics test anxiety, numerical anxiety, and abstraction anxiety. Mathematics text anxiety commonly associated with experience before, during and after any mathematics tasks. Numerical anxiety happens when an individual performing fundamental operations or combination of the operations. While abstraction anxiety occurs when there is involvement of algebraic notation or symbols and principles or properties to work on equations. Many studies have treated anxiety as single entity however, according to Wigfield and Meece (1988), mathematics anxiety consists of two dimension, namely cognitive and affective. Cognitive labeled as "worry" when it comes to performances and consequence of failure while affective labeled as "emotionality" usually refers to the feelings such as nervous and tension when it comes to testing situations. Several reasons could lead to mathematics anxiety in students. These include going through embarrassing situations when performing tasks related to mathematics (Jolejole-Caube et al., 2019), exposure to incorrect and inappropriate teaching method (Cuñado & Abocejo, 2018) and labelling the males students as better at mathematics than females (Vakili & Pourrazavy, 2017).

Attitude towards Mathematics

According to Ajzen and Fishbein (1977) as cited by Fishman et al (2021), attitude towards a behavior is an evaluative response that conditioned individuals favorable and unfavorable towards performing the behavior. According to Ngussa and Mbuti (2017) attitude is considered as the key contributor to the level of mathematics achievement. Kibrislouglu (2016) defined attitude towards mathematics can be as liking or disliking the subject. Ayob and Yassin (2017) stated that attitude towards mathematics are emotional responses when individuals involve themselves in any mathematical tasks or activities. These emotional responses can be positive or negative based on certain reasons. This is in-lined with definition by Aguanta and Tan (2018) wherein the positive emotional disposition results in positive

attitude that increases the willingness of students to learn mathematics and vice versa. In social psychology, attitudes consist of three major components; cognition, affection, and behavior (Early & Chaiken, 1998 as cited by Kiss, 2018). Kiss (2018) stated that the cognitive component refers to an individual's belief or knowledge about mathematics, the affective component involves feelings about mathematics and the behavior component refers to influence of attitude on how people react. Capuno et al (2019) added that attitudes can be changed as it develops through experience, it is not through inheritance. This is aligned with Syyeda (2016) that mentioned about attitudes can be changed and developed over time. Once students have positive attitude, it can improve the learning. On the other hand, a negative attitude impedes effective learning consequently impacts students' achievement. There are several factors that influence students' attitude towards mathematics (Aguanta & Tan, 2018). The factors are over demanding tasks, uninteresting lessons, less positive attitude possessed by educators and pressure to perform well.

Mathematics Self-Efficacy

Academic achievement is often related to self-beliefs which self-concept and self-efficacy are considered as the most dominant in self-beliefs. Self-efficacy is an individual's belief in his or her own ability to perform a specific task (Bandura, 1997 as cited by Ozcan & Kultur, 2021). In mathematics field, mathematics self-efficacy can be defined as a person's beliefs in his or her own capability in solving any given set of mathematics problems (Bandura, 1986 as cited by Schober et al., (2018). Mathematics self-efficacy can also be defined as a person's belief about his or her own capability in overcoming certain tasks or problems related to mathematics (Masitoh & Fitriyani, 2018). Studied conducted by Masitoh and Fitriyani (2018) emphasized on three aspects in mathematics self-efficacy: strength, magnitude, and generality. Strength refers to resilience and persistency in students in solving various mathematics question.

Magnitude refers to students' confidence level in solving mathematics problems at different difficulties. Lastly, generality refers to beliefs in a person's capability in accomplishing any mathematics tasks or activities. According to Garfield and Ben-Zvi (2009), to do well in mathematics, knowing how to do is not enough, but it must be accompanied by self-efficacy about the correctness of concepts and procedures. An example, when students are doing calculation either manually or by using calculator, the element of self-efficacy will increase the certainty in students in their own calculations. Besides, self-efficacy also determines the motivation level in students. Self-efficacy in students can be based on the effort made, the time they devoted in completing the task and producing certain result. Meanwhile students with low self-efficacy are less likely to put effort and complete the task.

Mathematics Achievement

Namkung et al (2019) stated that mathematics achievement has becoming a concern in in today's world as it driven by the importance of mathematics in formal learning education and daily lives. Moreover, mathematics achievement is related to well-being, health, income, satisfaction in life, employability, and longevity (Lipnevich et al., 2016). Thus, mathematics achievement can be defined as students' competencies in mathematics (Pandey, 2017). Mathematics competencies is students' abilities to do mathematics, understand, judge, and apply mathematical concepts and procedures in relevant context (Firouzian et al., 2016). Besides, according to Huang (2018), competency can be an indication about how good

individuals make relevant decision and implement proper actions in a real-world. At school, mathematics achievement usually measured through score or grade that the students obtain.

Problem Statement

William et al (2020) mentioned that many educational technology companies provide free subscriptions to educational institutions as a proposed solution to pandemic pedagogy. However, thinking that technology is the only solution for all the online learning issues would be remised because many educators averse to online teaching (Crittenden, 2020) and unaware of the best practices for distance learning (Baggaley, 2019). Besides that, the psychological consequences initiated by the pandemic such as isolation and confusion have been manifested by students (Dhawan, 2020). Relatedly, the detrimental effect of loneliness is worsened by the enforcement of physical distancing and fewer social gathering which these can reduce individuals' self-control (Killgore et al., 2020). Lack of self-control in students result in ineffective learning eventually reduces their academic performance (Skinner et al., 1998 as cited by Rippé et al., 2021). This leads to failure in learning process that reduces the learning enthusiasm, creates learning anxiety (Lailiyah et al., 2021), inhibits students from achieving good outcome (Abdul et al., 2021) and affecting students' self-efficacy. At the same time, apart from lack in technical skills to operate and manage online application, students experience technical difficulties too.

In mathematics learning, Nakamura et al (2018) mentioned that many educators experienced difficulties in explaining mathematical concepts via online, which caused them ill-equipped to facilitate students. Gu and Lee (2019) also added that when it comes to more difficult topic related to mathematics, students still prefer a face-to-face instruction rather than online course as more intense explanations are required especially when it comes to mathematics working (Bringula et al., 2021). For achievement, larger declines in mathematics during pandemic Covid-19 and students made gains at lower rate as compared to pre-pandemic trends due to pandemic fatigue (Locke et al., 2021; Hollaron et al., 2021). This transition has surely invited numerous issues which include the technical and psychological difficulties in mathematics learning.

Numerous studies have shown that affective factors play significant role in mathematics achievement, with mathematics anxiety playing a particularly crucial role (Miller and Bisher, 2004 as cited by Dowker et al., 2016). Dowker et al (2016) added that mathematics anxiety correlates negatively with test scores involving mathematical aptitude and achievement, while no indication of significant relationship when it comes to verbal aptitude and achievement. One of many reasons for the negative association between anxiety and performances is avoidance behaviors especially in situations involving mathematics. Besides that, much research conducted to investigate the gender differences in mathematics anxiety.

Thus, the affective factors in mathematics learning should not be neglected although mathematics is commonly viewed as a cognitive discipline (Recber et al., 2018). Hence, this study intends to investigate how affective factors such as mathematics anxiety, attitude towards mathematics and mathematics self-efficacy can influence mathematics achievement amid pandemic Covid-19 specifically among secondary school students.

Theoretical Framework

Expectancy Value Theory (EVT) is the underlying theory behind predicting the students' performances and achievements. This theory was first developed by Atkinson in 1957 and expanded by Eccless-Parsons et al. (1983) as a framework to understand early adolescents' and adolescents' performance and choice in mathematics achievement. Eccles-Parsons et al. (1983) as cited by Wigfield, and Gladstone (2019) proposed that individuals' expectancies and values have impact on the performance and task choice. These two components are influenced by task-specific beliefs such as competence-belief, goal-belief, self-schema together with affective memories for different achievement-related events. Drew (2022) stated that if both components lined up well, a person is expected to be motivated to complete a task successfully. Wigfield and Gladstone (2019) defined expectancies for success as beliefs about how well individuals can do on the upcoming task. Competence-beliefs or ability are about evaluation of their current ability based on their own interpretation and how they think about themselves as compared to others. Drew (2022) mentioned that this is a very similar idea of "locus of control" and "self-concept or self-efficacy", in which a person believes in his or her capacity to execute behaviours necessary to produce specific performance attainments (Bandura, 1977). Besides, Eccles and her colleagues defined values depending on the qualities of different tasks in relation to subject areas and how those qualities effect the individuals' desire to do the task. This brings the term, subjective task values. Eccless-Parsons et al (1983) stated that individuals overall subjective task values effected by four aspects: attainment, intrinsic value, usefulness of task and cost. (1) Attainment value or importance is about how a person see important it is to do well on a task. If a particular task is important to oneself, he or she will be motivated and put in more effort to execute the task. (2) Intrinsic value is about how a person enjoy doing the task. When a person intrinsically values a task, he or she often deeply engaged in it and hardly give up. (3) Usefulness or sometimes called as Utility Value (UV) is about how the task fits into a person individual's future. (4) Cost is about what does the task cost a person. In other words, cost makes a person thinks of whether giving up in completing the task is worth sacrificing. In conclusion, the predictors of this theory are aligned with the independent variable of this current study: mathematics anxiety, attitude towards mathematics, mathematics self-efficacy towards the dependent variable, mathematics achievement.

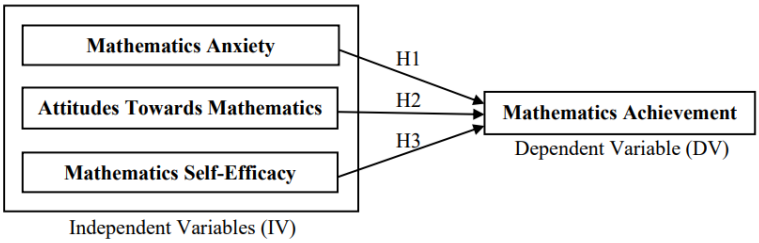

Figure 1 Theoretical Framework

Research Objectives

The main objective of this study is to examine the relationship between the chosen affective factors and mathematics achievement. From the general objective above, three specific objectives of the study are formed.

1: To investigate the relationship between mathematics anxiety and mathematics achievement among the secondary school students.
2: To seek the relationship between attitude towards mathematics and mathematics achievement among the secondary school students.
3: To determine the relationship between mathematics self-efficacy and mathematics achievement among the secondary school students.

Method

The approach of this study is quantitative with correlational design. This is a type of non-experimental research that aims to describe the relationship among variables using statistical analysis (Seeram, 2019). The research design is selected as it is aligned with the objective to this current study; to seek the relationship between the affective factors: mathematics anxiety, attitudes towards mathematics, mathematics self-efficacy and mathematics achievement among the secondary school students. Structured questionnaires were distributed among the targeted population in the data collection process.

Participants

The sample of this study have been narrowed down into students who are currently attending few different secondary schools within Puchong area. For the sample size, the minimum of 30 respondents are considered sufficient for a significant statistic (Conroy, 2016). Therefore, this study has successfully recruited 81 respondents whereby this number surpasses the minimum number of respondents as suggested earlier.

The Unit of Analysis

The unit of analysis of this study is set to be an individual which refers to secondary level students with minimum age of 13 years old (Form 1) to 17 years old (Form 5) regardless streams that they are studying, race and gender. This unit of analysis is chosen based on the objective of this present study, that is to investigate the relationship between the affective factors chosen: mathematics anxiety, attitudes towards mathematics, mathematics self-efficacy with mathematics achievement among secondary school students.

Instruments

The instrument used in this research was developed by the researchers based on previous research and literature. The instrument, which is in the form of a questionnaire, has 3 parts: Part A contains a demographic information of respondents, Part B contains an affective factor in mathematics (Mathematics Anxiety, Attitudes Towards Mathematics and Mathematics Self-Efficacy) and Part C consists only one question whereby students are required to do self-reporting grade through score obtained in the recent test or examination conducted by school. The grades are standardized according to the recent grading system by 'Majlis Peperiksaan Malaysia' (MPM) as shown in table 1. The information on the grades obtained is then categorized based on five groups shown in table 2, further, to be translated into 5-points Likert-scale. This method is adapted from (Wang and Eccless, 2013).

Table 1
Malaysian Grading System

Grade	Marks
A+	90-100
A	80-89
A-	70-79
B+	65-69
B	60-64
C+	55-59
C	50-54
D	45-49
E	40-44
G	0-39

Table 2
Grades Grouping Translated into 5-points Likert Scales

Marks	Grade Grouping	Translated Grouping (SPSS)
0-39	Most E and fail	1
40-49	Mostly D	2
50-59	Mostly C (C+, C)	3
60-69	Mostly B (B+, B)	4
70-100	Mostly A (A-, A, A+)	5

For part B, item for mathematic anxiety is adapted from the original Fennema-Sherman Mathematics Anxiety Scale (FSMAS), 1978 and used by many previous literatures (Dowker et al., 2016). The reported Cronbach alpha for the original FSMAS is 0.89 and from previous studies were 0.912 by Mkhize (2019) and 0.792 by (Lacia et al., 2020). The rest reported high internal consistency and reliability based on 60-years of mathematics anxiety across multiple research (Dowker et al., 2016). The original FSMAS have four subscales (1) thinking about mathematics, (2) taking Math's test, (3) learning maths lesson and (4) solving mathematics problems. Besides that, item for Attitudes Towards Mathematics is adapted from the Modified Fennema-Sherman Mathematics Attitudes Scales (MFSMAS), 1976 and used by many previous literatures such as in studies by (Andamon & Tan, 2018; Dan'inna, 2016). The reported Cronbach alpha for the original MFSMAS is 0.96, and previous studies were 0.91 by Andamon and Tan (2018), 0.762 by Dan'inna (2016) and 0.90 by Williamson, Williamson et al. (2020). The items of MFSMAS measures based on four subscales (1) confidence in mathematics, (2) usefulness of mathematics, (3) mathematics as a male domain and (4) teacher perception. However, only subscale (1) and (2) are used for this current study to represent students' attitudes towards mathematics. Lastly, for item Mathematics Self-Efficacy is adapted from the Mathematics Self- Efficacy Questionnaires (MSEQ), 2009 as cited and used by (Chan and Abdullah, 2018; Karbasi and Samani, 2016; Kundu and Ghose, 2016; Rosly et al., 2017). Original reported Cronbach alpha by May (2009) was 0.96 and from previous studies, Cronbach alpha measured were 0.939 (Chan & Abdullah, 2009) and 0.93 (Annurwanda, 2018). This is a unidimensional scale that only measure one construct that is, mathematics self-efficacy that refers to students believe on their own abilities in dealing with mathematical tasks.

Results

Demographic Characteristics

The demographic data were collected through profiling from Part A of the survey questionnaire. Table 3 below shows the demographic distribution of survey respondents by gender, race, and level of study among the secondary school students that have been recruited through snowballing method for this present study.

Table 3
Demographic distribution of survey respondents

Details	Category	N (N=81)	Percentage (%)
Gender	Male	38	46.9
	Female	43	53.1
Race	Malay	43	53.1
	Chinese	13	16.0
	Indian	19	23.5
	Others	6	7.4
Level of Study	Form 1	9	11.1
	Form 2	14	17.3
	Form 3	9	11.1
	Form 4	14	17.3
	Form 5	35	43.2

According to Table 1, it can be statistically observed that majority of respondents are females. 43 female students (53.1%) participated in this study and the remaining were 38 male students (46.9%). For race, it can be observed that Malay formed the largest distribution, 43 out of 81 students in total (53.1%). The Indian formed the second highest with 19 students (23.5%). This is followed by Chinese with 13 students (16%). The least were recorded by "Others" category which consists of only 6 students (7.4%). Out of these 6 students, 4 students were Bumiputera (Sabah/Sarawak), and the remaining 2 students were international students who live around Puchong area and attending the secondary school nearby. Beside that's, the result indicated that majority of students who participated in this study were Form 5 students that is 35 out of overall 81 students (43.2%). This is followed by Form 2 and Form 4 students which constituting of 14 students (17.3%) each of the form. The least were recorded by Form 1 and Form 3 students that is only 9 students (11.1%), respectively.

Level of Mathematic Anxiety

The table 4 below shows the eight (8) items for the independent variable of Mathematics Anxiety. From the table, the overall average mean is 2.98 and the average of standard deviation is 1.206. It can be statistically observed that the highest mean is 3.30 for item "Maths is not scary at all". The lowest mean is 2.81 for item "I never get nervous during maths test". Other than that, the highest standard deviation is 1.249 for item "I am not able to think clearly when working with maths problems" and the lowest standard deviation is 1.148 for item "Maths's test would scare me".

Table 4
Mean and Standard Deviation of Mathematics Anxiety

No	Statement (Items)	Mean	SD
1	**Maths is not scary at all.**	**3.30**	**1.198**
2	Maths always makes me uncomfortable and nervous.	2.96	1.219
3	I never get nervous during maths test.	2.81	1.226
4	Maths always makes me feel uneasy, confused, and nervous.	3.04	1.229
5	I am always calm during maths tests.	2.86	1.159
6	Maths's test would scare me.	2.79	1.148
7	I am always calm during maths class.	3.20	1.219
8	I am not able to think clearly when working with maths problems	2.88	1.249
	Average	2.98	1.206

Level of Attitude towards Mathematics

The table below shows the eight (8) items for the independent variable of Attitudes Towards Mathematics. From the table, the overall average mean is 3.54 and the average standard deviation is 1.161. It can be statistically observed that the highest mean is 4.00 for item "Studying maths is a waste of time" and the lowest mean is 2.91 for item "I can handle more difficult maths questions". Other than that, the highest standard deviation is 1.260 for item "I am not the type that do well in maths" and the lowest standard deviation is 1.046 for item "I am sure that I can learn maths".

Table 5
Mean and Standard Deviation of Attitudes Towards Mathematics

No	tatement (Items)	Mean	SD
1	I am sure that I can learn maths.	3.83	1.046
2	I am not the type that do well in maths.	3.01	1.260
3	I am sure that I will need maths in my future.	3.98	1.183
4	Maths is difficult for me.	2.96	1.239
5	Maths is a necessary subject.	3.90	1.056
6	Maths is not important in my future life's work.	3.74	1.160
7	I can handle more difficult maths questions.	2.91	1.247
8	**Studying maths is a waste of time.**	**4.00**	**1.095**
	Average	3.54	1.161

Level of Mathematics Self-Efficacy

The table 6 shows the eight (8) items for the independent variable of Mathematics Self-Efficacy. From the table, the overall average mean is 3.10 and the average standard deviation is 1.168. It can be statistically observed that the highest mean is 3.57 for item "I believe that I can learn well in maths classes" and the lowest mean is 2.67 for item "I believe that I can solve any HOTS maths questions". Other than that, the highest standard deviation is 1.305 for

item "I [24] believe that I can get an "A" in maths test" and the lowest standard deviation is 1.097 for item "I believe that I can solve any mathematical problems".

Table 6
Mean and Standard Deviation of Mathematics Self-Efficacy

No	atement (Items)	Mean	SD
1	**I believe that I can learn well in maths classes.**	**3.57**	**1.083**
2	I believe that I can answer well in every maths tests.	3.19	1.174
3	I believe that I can get an "A" in maths test.	3.19	1.305
4	I believe that I can solve any mathematical problems.	2.85	1.097
5	I believe that I can solve any HOTS maths questions.	2.67	1.118
6	I feel confident that I can finish maths test within stipulated time.	3.11	1.118
7	I feel confident to use maths outside the school compound.	3.11	1.162
8	I feel confident to ask questions especially during maths class.	3.12	1.288
	Average	3.10	1.168

Mathematics Achievement

According to table 7, majority of participants scored mostly C (50-59) in the most recent mathematics examination conducted by school which this consists of 24 out of overall 81 students (29.6%). This followed by 18 students (22.2%) scored mostly B (60-69), 15 students (18.5%) scored mostly D (40-49) and 13 students (16%) scored E or fail (0-39). While the lowest frequency with only 11 students (13.6%) scored mostly A (70-100) in the most recent mathematics examination conducted by school.

Table 7
Frequency and Percentage of Mathematics Achievement

Translated Grouping (SPSS)	Frequency	Percentage (%)
1	13	16.0
2	15	18.5
3	24	29.6
4	18	22.2
5	11	13.6
Total	81	100

Based on the Table 8, the mean of the self-reported grade in the most recent mathematics examination conducted by the school for this current study is 2.99 that can be round-off and translated into "3" which refers to most students scored within the range 50-59 that falls under the category of "Mostly C". Other than that, the standard deviation calculated based on SPSS for the dependent variable, Mathematics Achievement is 1.270.

Table 8
Mean and Standard Deviation of Mathematics Achievement

ependent Variable (Items)	**Mean**	**SD**
Self-reported grade in most recent examination conducted by school	2.99	1.270

Relationship Between Mathematics Anxiety, Attitude Towards Mathematics and Mathematics Self-Efficacy towards Mathematics Achievement Among the Secondary School Students

For this study, Pearson Product Moment Correlation coefficient is used to measure the strength and direction of relationship that exists between two variables through the r-value. Based on Table 8, the value of r can be vary. The closer the r-value to 1 indicates that the two variables are very highly correlated, and vice versa. In addition to this, if the computed r-value is a negative value, this shows that the two variables are in opposite direction while if the computed r-value is a positive value, the two variables studied are in the same direction.

Table 9
The Guide for Pearson's Correlation Coefficient (r range)

Scale for Correlation Coefficient	**Value**
$0 < r \leq 0.19$	Very low correlation
$0.2 < r \leq 0.39$	Low correlation
$0.4 < r \leq 0.59$	Moderate correlation
$0.6 < r \leq 0.79$	High correlation
$0.8 < r \leq 1.0$	Very high correlation

Source from Selvanathan et al (2020)

Based on Table 10 below, the Pearson correlation of mathematics anxiety and mathematics achievement was found to be a moderate positive correlation (r = 0.525). This shows that the increase in mathematics anxiety results in the increase of mathematics achievement and vice versa. While the Pearson product correlation of attitudes towards mathematics and mathematics achievement was found to be a moderate positive correlation (r = 0.4256). This shows that when students' have positive attitudes towards mathematics results in the increase of mathematics achievement and vice versa. Lastly, the Pearson product correlation of mathematics self-efficacy and mathematics achievement was found to be a moderate positive correlation (r = 0.502). This shows that the increase in mathematics self-efficacy in students results in the increase of mathematics achievement and vice versa. To conclude, all three affective variables chosen for this study correlate positively with mathematics achievement.

Table 10
The correlation of independent variables and mathematics achievement

Variables	**Pearson Correlation (r)**
Mathematics Anxiety	.525**
Attitudes Towards Mathematics	.426**
Mathematics Self-Efficacy	.502**

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

Based on the result, the overall hypothesis of this current study can be explained. According to the first hypothesis (H1), the alternate hypothesis H1: "There is a relationship between mathematics anxiety and mathematics achievement", is accepted. This is based on table 10, there is an indication of a significant moderate positive correlation between mathematics anxiety and mathematics achievement which r = 0.525, p < 0.01. Thus, the null hypothesis H0: "There is no relationship between mathematics anxiety and mathematics achievement, is rejected.

The second hypothesis (H2) which refers to the alternate hypothesis H1: "There is a relationship between attitudes towards mathematics and mathematics achievement", is accepted in this study. This is based on Table 10, there is an indication of a significant moderate positive correlation between attitudes towards mathematics and mathematics achievement which r = 0.426, p < 0.01. Thus, the null hypothesis H: "There is no relationship between attitudes towards mathematics and mathematics achievement, is rejected. The third hypothesis (H3) which refers to the alternate hypothesis H1: "There is a relationship between mathematics self-efficacy and mathematics achievement", is accepted in this study. This is based on Table 10, there is an indication of a significant moderate positive correlation between attitudes towards mathematics and mathematics achievement which r = 0.502, p < 0.01. Thus, the null hypothesis H0: "There is no relationship between attitudes towards mathematics and mathematics achievement, is rejected. As conclusion, all the alternative hypotheses proposed for H1, H2 and H3 are accepted in this study.

Overall, this chapter discusses the analysis performed to test the study hypotheses. Table 11 below shows a summary of the study findings for the study hypotheses tested.

Table 11
Summary of Study Hypothesis

Hypothesis	**Statement**	**Findings/Results**
Ho1	There is no relationship between mathematics anxiety and mathematics achievement	Rejected
Ho2	There is no relationship between attitudes towards mathematics and mathematics achievement	Rejected
Ho3	There is no relationship between mathematics self-efficacy and mathematics achievement	Rejected

Discussion

The mutual direction of correlation states that increase in mathematics anxiety will result in higher mathematics achievement and vice versa. this shows that the feelings of nervousness, worry and tensions are needed in students. These somehow help them perform better during any mathematics activities in class that would include solving mathematical problems or tasks and, in quizzes, tests or examinations. This correlation is supported by Kaba and Sengul (2018) that revealed mathematics anxiety makes students learn better and possibly increase their mathematics achievement. This is also aligned with findings by Yahya and Amir (2018) in which mathematics anxiety are positively correlated with performances. Both parallel studies emphasized on the appropriate level of mathematics anxiety that can be considered enough to boost students' mathematics achievement. Thus, anxiety should not be viewed as a negative trait from the beginning as it has its own role in motivating students to achieve good grade in mathematics and can a good push factor for better management of self-regulation during mathematics class and students' independent learning. This statement is strongly supported by Majali (2020) that mentioned about positive anxiety required in students to help improve academic performances. The study found that the optimal level of anxiety has contributed to the successful educational processes. Besides, it helps to increase attention, thinking process and students' intellectual abilities. Furthermore, Zinchenko et al (2020) found that students with optimal level of anxiety manage to control their emotional state and assess situation objectively. The finding obtained is contradict with majority studies such as by Jolejole-Caube et al (2019); Kundu and Kar (2018); Lailiyah et al (2021) that found a negative correlation. This shows that this finding should not be generalised to all countries as different country would have different education system. As conclusion, mathematics anxiety should be given attention besides the cognitive aspect as a controlled mathematics anxiety can give a positive impact in students' achievement (Yahya & Amir, 2018).

High mathematics attitudes indicate that students have more positive attitude in dealing with any mathematical tasks in class or examinations. This positive attitude creates a positive emotion in students towards mathematics subject, eventually influence their willingness to put effort in any mathematical tasks and perform their level best in mathematics quizzes, tests, or examinations. This correlation is consistent with numerous studies such as Andamon and Tan (2018); Capinding (2021); Capuno et al (2019) that strongly emphasized on positive attitude will increase motivation in students and influence their willingness towards the subject. Students become more confident in dealing with any mathematical tasks or solving any mathematics problems. They find that when they work on mathematics problems, their thinking and reasoning are sharpened. This is aligned with Subia et al (2018) that mentioned about sharpening of thinking and reasoning skills in mathematics will be useful for students' future. Thus, it can be observed that students with high attitudes towards mathematics, find mathematics as particularly useful not only for their achievement but also to be successful in life. These kinds of students will view mathematics as a necessary subject with high of usefulness, resulting in them putting effort in class. This directly improves their mathematics learning and achievement. While decrease in mathematics attitude will result in poorer performance as students are easily give up and do not see mathematics as something useful for their future. Due to this, students will feel negative towards the subject and highly likely to spend less time to work mathematical tasks or activities (Walberg et al., 1986). Thus, this eventually led to low mathematics performances.

High mathematics self-efficacy shows that students have high believe in their own abilities in overcoming any mathematics problems and tasks. This high self-belief makes students more confident and persistence in solving mathematics problems and involving themselves in mathematics' class activities. This correlation is parallel with many studies such as (Negara et al., 2021; Wang et al., 2017; Bangga, 2021). High mathematics self-efficacy gives confident in students that they can rely on their own abilities in solving mathematics problems. This is very much needed especially when dealing with calculation as to ensure the correctness of concepts and procedures that they used. As simple activity such as computing numbers in calculator, the element of self-efficacy in students help them to be certain about their own way of computing the numbers and produce a correct answer at the end. This directly help to improve mathematics learning and achievement. This statement is strongly supported by Negara et al (2021) and these researchers also added that students who have high self-efficacy will display high mathematical competency in completing any mathematics assignment. Bangga (2021) mentioned about cognitive engagement in relation to mathematics self-efficacy. High mathematics self-efficacy in students make them more cognitively engaged with the subject. They have high tendency to give extra effort in learning the subject and have more persistency. Hence, this helps them to achieve better in mathematics. Opposite to this, students with low mathematics self-efficacy will result in poorer achievement as they are easily giving up and less persistence when dealing with mathematical tasks and examinations conducted by the school.

Conclusion

The affective factors such as mathematics anxiety, attitudes towards mathematics and mathematics self-efficacy should not be neglected in mathematics learning although mathematics are often associated with cognitive aspect. These affective factors must be thoroughly studied as they can be considered as crucial predictors in mathematics achievement. The emergence of pandemic has forced people to adapt to the new norm of learning. Simultaneously, the uncertainties caused by the pandemic has affected students' learning whereby there was a larger decline in mathematics achievement and students made a lower gain as compared to pre-pandemic trend. Due to these reasons, these three affective factors are chosen for this study as the factors have their own potential consequences on students' mathematics achievement. At the end of this study, it was found that there is a significant positive correlation between mathematics anxiety, attitudes towards mathematics, mathematics self-efficacy and mathematics achievement. The result indicates a mutual direction between the affective factors chosen for this study towards mathematics achievement. This simply means that students who possess high affective factors mentioned earlier will have higher mathematics achievement and vice versa. After concluding the result, the findings can be used by school stakeholders to strategize what would be the best way to improve mathematics achievement among secondary school students.

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