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THE RELATIONSHIP BETWEEN MATHS ANXIETY, ATTITUDE TOWARDS MATHEMATICS AND MATHS PROBLEM-SOLVING SKILLS AMONG PRIMARY SCHOOL PUPILS IN KEDAH

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Abstract:

Pupils in primary schools faced as much daunting and foreboding experiences in Maths. Maths anxiety and attitude towards Mathematics are psychological indicator of poor Maths problem solving skills. This study investigated the relationship between Maths anxiety, attitude towards Maths and Maths problem-solving skills among primary pupils in Kedah state. A questionnaire was developed based on *Math Anxiety Questionnaire Children*, *Attitudes Towards Problem-Solving Skills* and a Mathematical problem-solving test administered to 450 primary school pupils. Data were analysed using IBM Statistics and Smart-PLS version 4 software. Results indicated that Maths anxiety and attitude towards Mathematics had a direct influence on Math problem solving.. This research highlighted Maths anxiety as an important factor on Maths problem solving skills as well as pupils' attitudes towards Mathematics, and teachers should consider this factor an important construct to consider when examining sources of individual differences in Math problem solving skills.

Keywords:

Young Learners, Learning Anxiety, Maths Anxiety, Maths Problem-Solving Skills

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Introduction

Maths problem solving skills not only depends on cognitive factor but also affective factors (Mason, 2016; Kohen et al., 2019; Hui & Rosli, 2021). Effective factors that are studied include motivation, interest, self-efficacy, Math anxiety and students' attitudes towards Mathematics. One of the factors often associated with low Math problem solving skills is the Math anxiety (Nachiappan et al., 2016; Yahya & Amir, 2018; Wakefield et al., 2018). Maths anxiety increases when students find it difficult to understand Maths problem-solving questions (Rajkumar & Hema, 2019; Piccolo et al., 2019; Sorvo et al. 2017). Maths anxiety can cause low pupils' Maths problem-solving skills (Skilling, Bobis, & Martin, 2020) and the students' involvement becomes less active, especially in activities related to numbers such as in Mathematical learning, assignments and exams (Murphy , 2018). Furthermore, attitude towards Mathematics is another factor that has given the attention of past researchers affect Math problem solving skills(Hashim & Ahmad, 2016; Vitaloka et al., 2020). Pupils' attitudes towards Mathematics such as careless, forget easily, lack caution in calculations, negative perception about Mathematics and laziness have created feelings of dislike and disinterest in learning Mathematics (Hashim & Ahmad, 2016; Vitaloka et al., 2020). Although studies on attitudes towards Mathematics have been studied for a long time either in the country (Noor Erma & Leong, 2014; Nur Thara Atikah, Amran & Jaratin, 2017) or abroad (Bayaga & Wadesango, 2014) ; Altawallbeh et al., 2015; Wan & Qiping, 2015) but the students still lack in solving Maths problems and a further study has to be done.Therefore, low Math problem solving become an important issue to be solved especially among primary school pupils.

Problem statement

The performance of Malaysian primary pupils in Maths subject is relatively low, especially the level of Maths problem-solving skills that do not sufficiently equate with the efforts made by the government to improve pupils' overall achievement (Wildani, 2020; Mahmud, Yunus, Ayub & Sulaiman, 2020; Ali & Harun, 2017; Puteh & Khalin, 2016). Maths problem-solving skills at school are also taught by trained teachers who receive teacher training at the Teacher Education Institute (IPG) in the Maths Teaching Bachelor's Degree Program (PISMP Maths) (Syed Khalid, 2018). Ideally, pupils should be able to solve Math problem-solving skills considering the various efforts made by the Ministry of Education in terms of strengthening the curriculum, 21st-century PdP practices, and trained teachers who follow teacher training to help pupils achieve the main goal in Maths education.

However, Math problem solving skills still at a poor level (Anggraini, Budiyono & Pratiwi, 2019; Khalid et al., 2020). This is clearly shown in the international assessment results of *Trends in International Maths and Science Study* (TIMSS) and *Programme for International Student Assessment* (PISA) 2019 which are less encouraging (Subeli & Rosli, 2021). Based on the assessment of TIMSS, the average score of Malaysian pupils in Maths is 461 compared to the highest achievement of pupils from other countries which is 764. It shows that Malaysian pupils' performance are quite far behind the countries participating in TIMSS. This is probably due to the weighting of questions in TIMSS which includes 65% of problem-solving questions. Similarly, the achievement is recorded in the 2019 *Primary School Achievement Test* (UPSR) which shows an unsatisfactory level of achievement among primary Malaysian pupils.

Additionally, there is also a significant relationship between attitude and Maths achievement (Ajisuksmo & Saputri, 2017; Bakar & Ayub, 2020). Pupils are more likely to be prepared to respond to tough math questions when they have a good attitude toward Mathematics

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(Maharani et al., 2019). Nevertheless, because they view Maths as a challenging subject, pupils frequently have a negative attitude toward the subject and avoid solving math problems (Hagan et al., 2020). According to a study by Ngah and Zakaria (2016), pupils' attitudes toward Mathematics and their ability to answer math problems are at a moderate level, and it is a given for them to give up if they fail to solve Maths problems.

These scenarios raised crucial questions that will be answered through this study:

1. Is there a significant relationship between Maths anxiety and Maths problem-solving skills among primary school pupils in the state of Kedah?
2. Is there a significant relationship between Maths anxiety and Maths attitudes among primary school pupils in the state of Kedah?

Literature Review

Maths Anxiety

Maths anxiety is defined as a feeling of stress, fear, nervousness, and worry that can arouse or cause nervousness in the student's ability to solve Maths problems (Khasawneh, Gosling, & Williams, 2021), as pupils who have math anxiety will feel stressed, anxious and avoid numbers and figures and solving math problems in life (Puteh, 2002). Math anxiety occurs due to several factors such as feelings of shame, negative experiences in learning Maths, pressure in terms of internal and external factors, weak teaching methods of teachers, negative perceptions of Maths, negative perceptions of oneself, anxiety towards teachers, and low Maths scores (Rusyda et al., 2021).

More recent studies (Dowker, Sarkar & Looi, 2016; Hunt & Zakaria, 2018; Prodromou & Frederiksen, 2018) refer to math anxiety as a feeling of fear or phobia that produces a specific negative response to learning, or the performance of math activities that disrupt performance. This is based on the experience of pupils who fail to solve Maths problems in class and exams (Khawsaneh et al., 2021). Nevertheless, Anggraeni (2022) argues that the definition of Maths anxiety used is sometimes rather vague and different in each situation. Meanwhile, Lailiyah, Hayat, Urifah, and Setyawati (2021) defined Math anxiety as a feeling of restlessness when carrying out Math tasks caused by anxiety, resentment, tension, frustration, and fear, and also influenced by environmental factors (negative experiences in class), intellect (degree of thinking), and personality. For this study, Maths anxiety is defined as a state of restlessness, agitation, and nervousness of individuals toward numbers or figures (Mohammed & Mudhsh, 2021).

Maths anxiety has detrimental effects that are extensive: in comparison to their less nervous counterparts, Mathsly anxious pupils enjoy Maths less, have poorer assessments of their Maths competence, and do not understand the importance of math in daily life (Ashcraft, Krause, & Hopko, 2007; Vukovic, Kieffer, Bailey, & Harari, 2013). It was also found that Mathsly anxious primary pupils participate less in Maths classes in secondary school and avoid Maths majors in their tertiary education (Hunt & Zakaria, 2018).

Maths Problem-Solving Skills

Maths problem-solving skills is one of the main focus in the Malaysian Education Development Plan (PPPM) 2013-2025. Maths problem-solving skills are the backbone of the Maths subject

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which emphasizes thinking skills and the process of solving Maths problems. This in turn will result in pupils thinking creatively and critically as well as synthesizing in finding the answer (Novita & Putra, 2016). Furthermore, Maths problem-solving skills are defined as a process of finding solutions for problems that have never been encountered (Van De Walle et al., 2013), also unique and novel (Esan, 2015). Maths problem-solving skills involve the skills of reading, understanding, transferring information, analyzing, and finding answers (Polya, 2014) as well as involving the skills of analyzing, interpreting, reasoning, predicting, evaluating, and reflecting (Raifana et al., 2016).

Past studies have found that Math problem solving skills are still weak among students (Mokhtar et al., 2019; Arihasnida Ariffin, Zainora Baisar, Norhasyimah Hamzah, 2018). Although various methods and strategies are used in teaching and learning, students are weak in understanding math problem solving questions. (Abdullah et al., 2015). The study of Maloney, Ansari and Fugelsang (2011) found that students who face problems in answering Mathematical questions is due to the difficulties and failure to apply Mathematical skills. Poor student achievement in solving Maths problems also occurs at the school level and in public examinations in Malaysia (Rusdin & Dollah, 2018).

Among the factors of pupils' low math problem-solving skills is that they tend to focus more on memorization techniques and working memory of various concepts, theorems, and formulas in Maths (Kenedi, Helsa, Ariani, Zainil & Hendri, 2019; Mahmud, Yunus, Ayub & Sulaiman, 2020). This is an indicator that the pupils actually do not understand the question even if their answer is correct. Maths problem-solving questions that are difficult, especially questions related to real life, do not have specific formulas, use various strategies, and involve creative and critical skills that affect Maths problem-solving skills (Memnun, 2015). This is because students lack exposure to complex questions involving high-level questions (Hendriana, Johanto, & Sumarmo, 2018; Singga & Zakaria, 2020).

Puteh and Khalin's (2016) study found that a negative relationship between Maths anxiety and achievement. Based on their study on 190 secondary pupils in Malaysia which results show that pupils with high Maths anxiety will have a low Maths score. Moreover, Zhang et al. (2019) revealed that Maths anxiety is high when pupils solve complex problem-solving skills. Yahya and Amir's (2018) study proved that 69 fourth grade pupils had a moderate level of math anxiety. The level of Maths anxiety among male pupils was found to be higher than the level of Maths anxiety among female pupils. However, the researchers found that the study sample used was relatively small compared to other studies. Overall, based on previous studies, Maths anxiety was studied against Maths achievement. Therefore, a study should be conducted to prove the existence of aspects of Maths anxiety toward Maths problem-solving skills among pupils in primary schools.

Based on the highlights of this literature, the first hypothesis has been built:

H1: *There is relationship between Maths anxiety and Maths problem-solving skills among primary school pupils in the state of Kedah.*

Maths Attitude

Zan and Di Martino (2007) define attitude towards Maths as positive or negative emotions towards Maths. Attitudes can be formed from beliefs, emotional reactions, and individual

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behaviors. A person determines what to think and feel and how the individual behaves to form an attitude (Leder, 1992). Attitude towards Maths appeared multi-dimensions, with Hart (1989) defining attitude towards Maths as one's emotions towards Maths, one's beliefs, and behavior towards Maths.

Meanwhile, Hannula (2002) on the other hand classified the attitude towards Maths into the evaluation process as follows: i) emotions are affected by activities involving Maths, ii) emotions are enhanced by the concept of Maths, iii) evaluation of the effect of doing Maths, iv) the value of Maths for the future. Attitude toward Maths is also defined as liking or disliking the subject; the tendency to engage in or avoid Maths activities; the belief that a person is positive or negative in Maths (Kibrislioglu, 2015).

Sturm and Bohndick (2021) stated that a person's success in solving Mathematical problems depends on the attitude towards Mathematics and belief. But it is not an easy to change the attitude towards Mathematics, especially for those who are not confident about their own ability (Mason & Scrivani, 2004). Furthermore, attitudes towards Mathematics are unlikely to be changed in a short period of time (Hannula et al., 2019). Therefore, the role of the teacher is very important in teaching and learning to ensure that students have a positive attitude towards Mathematics.

There are several elements that affect attitudes towards Mathematics such as motivation, usefulness, math anxiety, self-efficacy, interest, self-evaluation, seeking help, self-response, belief in the usefulness of Maths in real life, and teacher involvement (Escalera Chávez, Moreno García, & Rojas Kramer, 2019; Marchis 2011) as well as interventions in Maths teaching. Positive attitudes occur when they are interested but interest is lost when they are worried and unsure of their own abilities (Escalera Chávez et al., 2018).

Overall, studies state that primary school pupils' attitudes toward Maths tend to be positive, but decline as they age (Krinzinger, Kaufmann, & Willmes, 2009; Ma & Kishor, 1997). Petronziet al. (2019) reported significant levels of Maths anxiety in pupils as young as five years old. In contrast to the general findings that show a decline in attitudes with age, Sorvo et al. (2017) found that Finnish children in Year 2 showed greater anxiety compared to children in later elementary grades. A study by Akin and Kurbanoglu (2011) revealed that Maths anxiety is among the factors that determined a positive or negative math attitude.

Based on the highlights of this literature, the second hypothesis has been made:

H2: *There is relationship between attitude towards Mathematics and Maths problem solving skills among primary school pupils in the state of Kedah.*

Methodology

Data were collected using multi-stage sampling methods, namely cluster and simple random sampling techniques. This study involved 450 primary school students in the state of Kedah. Four instruments were used in this study, namely Math Anxiety Questionnaire for Children (MAQC), Attitudes Towards Problem-Solving Skills (ATPSS) and a Mathematical problem-solving test. The research population consists of Year Five pupils in primary schools, in the state of Kedah. The sample was carried out in the nine (9) primary schools; and all 450-respondent considered for further analysis. Data were collected via questionnaires. The items

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in the instrument were designed based on the fivepoint Likert scale, ranging from strongly agree (5) to strongly disagree (1).

To minimize the measurement error, common method bias is taken care of because it will influence the validity and conclusion of the relationship among variables (Podsakoff et al., 2003). The content validation of the instrument was done through expert interviews, school teachers and academicians. The instrument is assessed to make sure that all the items are understandable and meaningful, and that it will gather the information that is intended to collect for the research. The content validity index for all the considered variables is more than 0.71, and it indicates that the instrument is valid concerning the contents of the items (Wilson et al., 2012; Lawshe, 1975). Further Nunnally, 1978 suggested that the reliability of the instrument can be measured by conducting a test for the internal consistencies, and the coefficient value should be more than 0.6. The Cronbach's alpha coefficient value for Mathemathical Anxiety is 0.818, 0.812 for Maths Attitude and for Math Problem Solving Skills is 0.704. The result advocates that the instrument has good internal consistency and reliability.

Maths Anxiety

This instrument that measures Mathematics anxiety is adapted from the *Math Anxiety Questionnaire Children* (MAQC) which was developed based on the Mathematics Anxiety Scale in Young Children (MAYSC; Harari et al., 2013) and the Scale for Early Mathematics Anxiety (SEMA; Wu, et al., 2012)). MAYSC items built by Harari et al., (2013) The items in the MAQC and SEMA instruments were modified according to the scope of students' concerns and the four-point scale used was also modified. Thus, the MAQC instrument is appropriate to use because this instrument has been tested to measure math anxiety among eleven-year-old students (Szczygieł, 2020).

Maths Problem-solving Skills

This instrument consists of 10 problem-solving questions in the Year 5 Numbers and Operations topic (KPM, 2017). Before constructing the questions, we refer to the DSKP Year Five Maths Review to ensure that the constructed questions involve Maths processes that support effective Maths learning such as problem-solving; reasoning; Maths communication; relevance, and representation. The researcher adapted past questions in UPSR and modified the questions by referring to topics in DSKP Year Five Maths Review such as Round Numbers and Operations, Fractions, Decimals and Percents, and Money. The researcher then constructs questions ranging from TP4 to TP6 where this TP tests the skills of analyzing, evaluating, and creating.

Maths Attitude

The instrument is adapted from the Attitudes Towards Problem Solving Skills (ATPSS; Charles, Lester & O'Daffer, 1987). In this instrument, there are three dimensions measured, namely; willingness, perseverance, and self-confidence.

Findings

This study was set to answer two questions which are i) Is there a significant relationship between Maths anxiety and Maths problem-solving skills among primary school pupils in the state of Kedah? ii) Is there a significant relationship between Maths anxiety and Maths attitudes among primary school pupils in the state of Kedah?

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Respondent Background

A total of 450 respondents were involved and returned the given questionnaire. Table 1 summarizes the distribution of respondents based on their background.

Table 1: Background of the Respondents

	Frequency	Percentage
Gender		
Male	194	43.1
Female	256	56.9
Residential Location		
Urban	286	63.6
Rural	184	36.4
School Location		
Urban	401	89.1
Rural	49	10.9
Math Proficiency Level (MP)		
MP1	0	0
MP2	1	0.2
MP3	80	17.8
MP4	276	61.3
MP5	93	20.7
MP6	0	0
Total	**450**	**100.0**

Based on Table 1, the study found that 194 respondents (43.1%) were male pupils while 256 respondents (56.9%) were female pupils, with 286 (63.6%) pupils living in the city and 184 (36.4%) %) of respondents live in rural areas. The data distribution also shows a total of 401 respondents (89.1%) who study in urban areas. Meanwhile, a total of 49 respondents (10.9%) were in rural areas. The data also shows that no respondents obtained MP1 and MP6. Whereas, only one respondent (0.2%) obtained MP2 and 80 respondents (17.3%) obtained MP3 in their assessment. The most recorded mastery level is MP4 which is 276 respondents (61.3%). There are 93 respondents (20.7%) who obtained MP5.

Descriptive Analysis of Maths Anxiety, Math Problem-solving Skills, and Maths Attitude

Table 2: Descriptive Analysis of Level of Maths Anxiety

Variable	Mean	SD	Level
Maths Anxiety	3.56	0.73	High

Based on the table 2, the interpretation of the mean score obtained shows that the pupils' level of Maths anxiety is at a high level with (M=3.56, SD=.73).

Table 3: Level of Maths Problem-solving Skills

Variable	Mean	SD	Level
Maths problem-solving skills	3.37	1.32	Medium

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Furthermore, the results of the analysis recorded the level of Maths problem-solving skills at a medium level (M=3.37, SP= 1.32). Overall, the pupils have relatively simple skills in solving Maths problems.

Table 4: Level of Attitudes toward Maths

Variables	Mean	SD	Level
Attitudes toward Maths	3.47	.83	Medium
Willingness to solve problems	3.55	.97	High
Perseverance to undergo the Math problem-solving process	3.42	.86	Medium
Self-confidence	3.41	.92	Medium

Next is the analysis of pupils' Maths attitudes. The score is measured based on: the willingness to solve Math problems ii) the perseverance to undergo the Math problem-solving process and iii) self-confidence. The overall results show that the level of attitude towards Maths among the respondents involved is at a moderate level (M=3.47, SP=.83). The dimension of willingness to solve Maths problems shows a mean value (M=3.55, SP=.97). Meanwhile, the average mean value recorded is the dimension of perseverance to go through the solution process which is (M=3.42, SP=.86). The dimension of student self-confidence shows the lowest mean value which is (M=3.41, SP=.92).

Relationship among Variables

In order to identify the factors that have an association among variables, correlation analysis was conducted where the correlation coefficient illustrates the relationship between the independent and dependent variables. According Hair et al., (2006), the number representing the Pearson correlation is referred to as a correlation coefficient. It ranges from – 1.00 to + 1.00, with zero representing absolutely no association between the two metric variables. The larger the correlation coefficient the stronger the linkage or level of association. A strong correlation is represented by a coefficient exceeding the value of 0.5 whereas a medium or modest correlation is when the coefficient has a value of between 0.5 and 0.2. Any coefficient possessing a value less than 0.2 will be deemed as showing a weak correlation. Hair et al. (2010) suggested a rule of thumb, that the correlation coefficients that exceed 0.9 (very strong correlation) will likely to result in multicollinearity. Cohen (1988) has put forward a guideline on the effect sizes of the correlation coefficients in social science studies as: small effect size, r = 0.1 – 0.29, medium: r = 0.30 – 0.49, and large: r = 0.50.

Table 5: Relationship Among Variables

	Math Skills	Math Anxiety	Math Attitude
Math Skills	1		
Math Anxiety	-.713**	1	
Math Attitude	.725**	-.741**	1

Notes: **p < 0.01; *p < 0.05

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As illustrated in Table 5, independent variables (math anxiety and math attitude) was found to have significant relationship with math problem solving skills as follows: math anxiety ($r = -0.713$, $p<0.01$) and math attitude ($r = 0.625$, $p<0.01$). The result indicated the negative relationship between math anxiety and math problem solving skills.

Hypotheses Testing

Hypotheses were tested using multiple linear regression. The basic idea of regression analysis is to use data on a quantitative independent variable to predict or explain variation in a quantitative dependent variable. The regression equation is as follows:

$$Y = \beta 0 + \beta 1\, X + \varepsilon i$$

$\beta 0$ is the intercept of the regression line and $\beta 1$ is the slope of that line. The other quantity εi represents random error term. A hypothesis can be defined as a tentative, yet testable, statement, which predict what the researchers expect to find in their empirical data. Hypotheses are derived from the theory on which the conceptual model is based and are often relational in nature (Sekaran. & Bougie. 2016). This weight, given in terms of a probability, is called the level of significance (or alpha p-value) of the statistical test. More formally, the level of significance is defined as the probability of obtaining a value of the test statistic that is as likely or more likely to reject H_o as the actual observed value of the test statistic. For the instance of this study, linear regression was carried out to examine the effect of independent variables (math anxiety and math attitude) on dependent variables (math problem solving skills). Results were illustrated in Table 6.

Table 6: Factors Effecting Math Problem Solving Skills

Independent Variables	B	t	Sig.
Math Anxiety (H1)	-.062	-2.337	.020
Math Attitude (H2)	.879	6.969	.000
R^2	0.791		
F	42.548		
Sig.	0.000		

As indicated in Table 6, both math anxiety and math attitude explained 79.1 percent of math problem solving skills ($R^2 = 0.791$, $F = 42.548$, $p<0.01$). Both factors were also found to be significant predictor to math problem solving skills. Math anxiety was found to have the biggest significant effect on math problem solving skills ($B = 0.879$, $t = 6.969$, $p<0.01$), followed by math anxiety ($B = -0.062$, $t = -2.337$, $p<0.05$). These findings have successfully support H1 and H2.

Discussions

This study has found that Maths anxiety has a direct negative influence on Math problem-solving skills. The higher the Maths anxiety the lower the Maths problem-solving skills shown by the pupils and the lower the Maths anxiety the higher the Maths problem-solving skills they master. This finding is consistent with Puteh and Khalin's (2016) study that found a correlation between Maths anxiety and achievement. This finding is also consistent with Zhang et al. (2019) study that found Maths anxiety negatively impacts pupils, especially when tested on their problem-solving skills. Therefore, the Maths anxiety factor is a factor that teachers and educators need to pay attention to when teaching math problem-solving.

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Furthermore, this study has also found a significant correlation between Maths anxiety and Maths attitudes among primary school pupils in Kedah. This means that Maths anxiety affects pupils' attitudes towards Maths. Pupils with high math anxiety try to avoid solving difficult or challenging questions. Meanwhile, pupils with low math anxiety try hard to solve the question. This finding is consistent with Akin and Kurbanoglu's (2011) study that found a correlation between Maths anxiety and Maths attitudes.

The findings from this study is beneficial for teachers and policymakers to understand anxiety in learning, especially in younger pupils. The findings have proven that anxiety exists in all age group, therefore careful attention needs to be given to children from a young age.

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