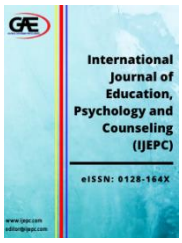
International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 8 Issue 51 (September 2023) PP. 148-162
DOI 10.35631/IJEPC.851010



INTERNATIONAL JOURNAL OF EDUCATION, PSYCHOLOGY AND COUNSELLING (IJEPC)
www.ijepc.com

IMPACT OF GROWTH MINDSET INTERVENTION (GMI) IN ATTITUDE TOWARDS MATHS AMONG SECONDARY SCHOOL STUDENTS

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Article Info:

Article history:
Received date: 03.07.2023
Revised date: 13.07.2023
Accepted date: 17.08.2023
Published date: 11.09.2023

To cite this document:

Noh, N. A. M., Ma'rof, A. M., & Yusof, Y. M. (2023). Impact Of Growth Mindset Intervention (GMI) In Attitude Towards Maths Among Secondary School Students. *International Journal of Education, Psychology and Counseling, 8* (51), 148-162.

DOI: 10.35631/IJEPC.851010

Abstract:

Attitude toward maths is shaped by cognitive components such as beliefs and perception. By having a positive attitude, students are more likely to embrace challenges, seek out new opportunities to learn, and develop resilience in the face of setbacks. This can open doors to a wide range of career opportunities and improve academic performance. Therefore, this study aimed to investigate the impact of a growth mindset intervention (GMI) on secondary school students' attitudes towards maths by using quasi-experimental design. A total of 69 form two students from two secondary schools in Kedah, Malaysia participated and were randomly assigned to the control (n=35) or treatment group (n=34). The GMI module, consisting of seven sessions covering seven topics, was implemented in the treatment group. Data were analyzed using descriptive and inferential statistics in SPSS Version 26. Descriptive analysis indicated that the respondents had a moderate level of attitude towards maths. To evaluate the effectiveness of the intervention, Multivariate Analysis of Covariance (MANCOVA) was used, while controlling for covariate variables such as math's score and gender. The results showed a significant improvement ($p < .05$) in the treatment group's attitudes towards maths compared to the control group in the post-test. This study highlights the importance of creating a growth-mindset-oriented classroom environment and integrating growth mindset elements into maths teaching to enhance students' beliefs about their abilities and intelligence.

Keywords:

Growth Mindset, Fixed Mindset, Attitude Towards Maths, Quasi-Experimental, Secondary Students, Classroom Environment

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Introduction

Mathematics is a subject that is perceived as abstract, difficult to understand, occasionally uninteresting, and seemingly disconnected from everyday life experiences for certain secondary school students. As students' progress from primary to secondary school, their initial enthusiasm for mathematics tends to diminish, and they gradually develop a dislike for the subject, often feeling uncomfortable and anxious when faced with mathematical tasks (DiStefano et al., 2020). As a result, these students may experience a lack of self-confidence and motivation when engaging in problem-solving activities. For some students, the idea of persisting and studying advanced mathematics has become a source of anxiety and distress. Students may feel anxious when faced with mathematical tasks, leading to a fear of failure and avoidance of the subject (Dweck, 2006). This can lead to negative attitude towards maths.

Maths is a fundamental subject in many fields. In fact, the significance of learning mathematics beyond the required level may be lost on certain students. If students hold a negative attitude towards the subject, they may struggle to see the relevance of mathematical concepts beyond the confines of the classroom. This, in turn, can hinder their ability to effectively apply their mathematical knowledge and skills to solve real-world problems (Bakar et al., 2019; Ashcraft, 2002). Students who lack proficiency in maths may be unable to pursue careers in fields that require mathematical skills (Bakar et al., 2019; Schmidt et al., 2017).

Even though over 80% of students demonstrate a positive attitude towards mathematics, a significant majority still struggle to achieve satisfactory grades in their mathematics examinations. Academic achievement in maths is an issue of great concern to educators and cognitive psychologists alike. Past studies conducted many interventions related to pedagogies techniques, exercises, and curriculum to help students with low performance in maths at schools (Siti Ramizah et al., 2020; Suriati et al., 2019; Siti Nursyahirah et al., 2018). However, all of the interventions are more centered on application to improve and strengthen the students' maths skills and concepts. There is a lack of intervention in terms of cognitive and affective that can help students to have positive thinking and mindset about maths and enhance their interest in learning maths.

In this regard, individuals who possess a positive attitude, strong beliefs, and exemplary values, combined with a deep conceptual understanding and proficiency in mathematics, are more likely to thrive in today's challenging global world. Not all individuals hold the same belief in their abilities and intelligence, as evidenced by a past study conducted by Dweck (2006). This study highlights the significance of mindset and thinking patterns in shaping an individual's perception of their intelligence and capabilities. This has been demonstrated through numerous studies that have investigated the effects of mindset changes on individuals' ability to face challenging situations (Schmidt et al., 2017; Yeager et al., 2016; Paunesku et al., 2015; Esparza et al., 2014; Blackwell et al., 2007).

Individuals with a fixed mindset believe that their efforts are futile due to their perceived lack of numerical and mathematical ability (Dweck, 2006). Students with fixed mindsets are more likely to give up or avoid challenging tasks due to fear of failure and a lack of coping skills (Degol et al., 2018), leading to defensive pessimism and poor performance in mathematics. Many students who hold a fixed mindset view mathematics as a discipline in which getting the correct answer is the sole indicator of learning (Boaler, 2016; Sparks, 2015), further exacerbating their difficulties in learning mathematics.

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Thus, it is important for students to be aware that mindset plays a significant role in their beliefs about the source of intelligence and ability (Smith & Capuzzi, 2019). By trying new things and allowing themselves to make mistakes, students can develop a belief in their own capabilities while simultaneously learning new things (Blad, 2015; Boaler, 2016; Hochanadel & Finamore, 2015; Sparks, 2015; Blackwell et al., 2007). Thus, it is essential to expose students to the differences between growth and fixed mindsets and the consequences of having each type of mindset. Therefore, the purpose of the study to evaluate the effectiveness of GMI to improve students' attitude towards maths.

Literature Review

There are three points will be discussed in this literature review. The first points is related to the attitude towards maths among secondary schools students and the second topic is the relationship between attitude towards maths and students mathematical mindset.

Attitude towards Maths Among Secondary School Students

Researchers have identified various components of attitude towards mathematics from multidimensional perspectives. For instance, Davadas and Lay (2017) proposed motivation, enjoyment, self-confidence, and value as components of attitude towards mathematics based on survey data from 318 secondary school students in Malaysia. Similarly, Di Martino and Zan (2011) analyzed writing from 1,496 Italian students ranging from grade 2 to grade 13, and identified three components: "emotional disposition, vision of mathematics, and perceived competence". In a similar vein, the Trends in International Mathematics and Science Study (TIMSS) researchers investigated students' attitude towards mathematics using three components: enjoyment of mathematics, value of mathematics, and confidence in mathematics (Mullis et al., 2020).

Several studies have shown that students' attitudes about maths are linked to their academic achievement directly and substantially. Mensah and Kurancie (2013) discovered a strong positive connection between students' attitudes and performance in Ghana. Whereas Ngussa & Mbuti (2017) performed research with secondary school students in Arusha, Tanzania, and found out that the teachers employed humour as a teaching method which showed a modest link between student attitude and performance. They concluded that improving students' positive attitudes can help them perform better in maths. Numerous studies in the larger literature have shown that a variety of factors influence students' attitudes.

Attitude encompasses a learned inclination of an individual to respond positively or negatively to an object, situation, concept, or another person (Sarmah & Puri, 2014). It is noteworthy that attitudes can evolve and change over time (Syyeda, 2016), and the development of a positive attitude can positively impact students' learning (Akinsola & Olowojaiye, 2008; Mutai, 2011). Conversely, a negative attitude can impede effective learning and subsequently impact learning outcomes and performance (Joseph, 2013). Thus, attitude is a crucial factor that cannot be overlooked in the context of education.

Relationship Between Mathematical Mindset and Attitude Towards Maths

The absence of useful study skills, socioeconomics, fear of failure, limited parental education, fear of success, parental and teacher expectations, social aspects and innate characteristics of student's attitudes and social-cognitive influences such as academic self-efficacy, academic motivation, and mindset are the reason of low academic achievement based on previous study

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(Rhew et al., 2018; Erdem, Senturk, & Arslan, 2007; Dweck & Leggett, 1988). According to Ashcraft (2002) highly anxious mathematic students will avoid situations in which they have to perform mathematical calculations. Unfortunately, mathematic avoidance results in less competency, exposure and maths practice, leaving students more anxious and mathematically unprepared to achieve. This kind of attitude could interfere their ability to perform with full potential in learning (Demedts et al., 2022).

This is also supported by a study from Boaler (2015) who also found that students who were taught with a "mathematical mindset" approach had improved attitudes towards maths and improved maths achievement. Another study was by Hong and Lin-Siegler (2012) which examined the relationship between mindset and mathematics achievement in high school students found that students who had a growth mindset had higher maths achievement scores and were more likely to pursue math-related careers compared to students who had a fixed mindset. Whereas the students that have negative attitude towards maths showed a poor attitude towards maths (Githaiga, 2019; Ndinda (2016) which can lead to poor performance (Oyugi, 2018).

Consistent with a study by Chen and colleagues (2016) who investigated the relationship between mindset and attitudes towards mathematics among college students in China. They found that students who had a growth mindset had more positive attitudes towards mathematics and were more likely to engage in adaptive learning behaviours, such as seeking help and putting in extra effort, compared to students who had a fixed mindset. They belief that abilities and talents can be developed and improved through effort, feedback, and learning. This belief encourages individuals to adopt effort-oriented strategies to achieve their goals and to be more resilient and persistent in the face of challenges or difficulties. This kind of attitude is also associated with a belief in improvement and a willingness to learn and grow (Tao et al., 2022).

Overall, understanding and fostering a growth mindset in students is a priority for educators, as it can lead to increased enjoyment of learning, improved performance, and a broader range of students succeeding in mathematics. therefore, by instilling a growth mindset, students can take on challenges, learn from them, and increase their abilities and achievement over time. This could make their positive attitude towards learning maths will long lasting. Therefore, the purpose of the study to restructure and instil mindset to growth mindset indirectly improve students' attitude towards maths. Having growth mindset not only beneficial them in learning but also having a growth mindset can lead to numerous benefits (Limeri et al., 2020; Dweck, 2012) in various aspects of life, that give advantage for their future life.

Methodology

Research Design

This study used quasi-experimental study using quantitative analysis. This study was conducted to the two secondary schools in Kedah. The respondents were selected from the students that need to attend the extra maths class after the formal class. These students were selected because of their maths performance is moderate to low level. Past studies have shown that students with negative attitude towards math is associated with low math performance and can have various consequences for students (Zamir et al., 2022; Moussa & Saali, 2022; Belbase, 2013). Therefore, 69 students from the extra maths classes were participating in the study after got their consent. The students were randomly assigning into treatment (35 students)

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and control group (34 students). The intervention was conducted after school for an hour. A total of 69 students participated and completed the intervention for seven weeks correspondently. Before administering the questionnaires for data collection, researcher was conducted a pre-test with a small group of individuals. This helps identify any issues or problems with the questionnaire, such as confusing or biased questions. Pre-testing allows for adjustments and refinements to ensure the clarity and validity of the questionnaire (Van Teijlingen & Hundley, 2001; Hasan et al., 2006).

They need to answer the questionnaire at the beginning of the intervention (pre-test) and at the end of the intervention (post-test). However, unlike the control group, the participant in the treatment group were provided the GMI during the seven weeks. The researcher administered the pre-test and post-test questionnaires using the same procedures and conditions. This to ensure that students are provided with clear instructions and a similar environment for both tests. Students need to answer all the items in the questionnaire within the time given. They are not allowed to discuss the questions among them. All the student's information were anonymous.

Instruments

The measures of growth mindset and attitude towards maths were translated into Malay by two translators and were then back translated by two other translators, which ensured that the meanings of the Malay version are in line with the English version. All scaled were scored so that higher scores represented higher levels of the variable. The first instrument used was Implicit Theory of Intelligence Scale to assess students' implicit belief in maths learning was adapted for this study. The Revised Implicit Theories of Intelligence Scale was revised by Castella and Byrne (2015) based on the original version developed by Dweck (1999). The items instrument (Dweck et al., 1995) was modified to fit the maths context. The instrument consists of eight questions that measure growth mindset (4 items) and fixed mindset (4 items) of an individual using a five-point Likert-scale. The reliability for this measure ranging from .87 to .90.

For the attitude towards maths, Short Form of Attitudes toward Maths Inventory (ATMI) developed by Lim and Chapman (2013) that revised from the existing ATMI of 40 items by Tapia and Marsh (2004) were used. This form consists of 19 items that were divided into four subscales which are enjoyment (5 items), motivation (4 items), self-confidence (5 items) and value (6 items). The items were constructed using Likert-scale format and the students respond to the statement in five-point Likert-scale. The reliability for this inventory was .93. This study refers to table of interpretation by Moidunny (2009) as shown in Table 1.

Table 1 Mean Score Interpretation

Mean Score	Interpretation
1.00 – 1.80	Very Low
1.81 – 2.60	Low
2.61 – 3.20	Medium
3.21 – 4.20	High
4.21 – 5.00	Very High

Source: Moidunny (2009)

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Intervention: Growth Mindset Intervention (GMI)

This module was adapted from previous module on maths' growth mindset by Joe Boelar known as *thecubed.org* and Stanford's Project for Education Research That Scales (PERTS) research center (2016) collaborated with Joe Boelar and Carol Dweck. Stanford's PERTS research center has been an organization whose goal is to translate research findings into practical solutions for educators to implement in their classrooms. Aside from that, some previous theories related to growth mindset and cognitive restructuring was referred. Students in the treatment group were taught growth mindset through seven lessons for one hour that did not take away time from the mathematics instruction.

Findings

Descriptive Analysis of the Attitude towards Maths

Attitude towards maths in this study was divided into four constructs which are Enjoyment (ENJ), Motivation (MOT), Self-confidence (SCI) and Value (VAL). The overall result of the level of maths anxiety is shown in Table 2 below:

Table 2 Level of Attitude Towards Maths

Construct	N	Mean	S. D	Interpretation
Enjoyment	69	2.98	.532	Medium
Motivation	69	3.24	.578	High
Self-confidence	69	2.58	.393	Low
Value	69	3.97	.648	Medium
Attitude Towards Maths	69	3.19	.293	Medium

The result showed that the level of self-confidence towards maths was the lowest (mean = 2.58, SD = .393) followed by enjoyment (mean = 2.98, SD = .532). Meanwhile, the level of value towards maths shows the highest level (mean = 3.97, SD = .648) followed by motivation (mean = 3.24, SD = .578). The overall result show that the students is at medium level. This analysis shows that students have low self-confidence towards maths but they realised that maths is an important subject that they need to be master even though it is not a favourable subject to learn.

Differences Between Treatment and Control Groups After Controlling the Covariates at the Baseline

One-way MANCOVA using pre-test score was carried out to identify the differences between control and treatment groups of student's attitude towards maths constructs before the intervention while controlling the gender and math's score. The constructs are enjoyment, motivation, value and self-confidence. Before One-way MANCOVA analysis was conducted, the researchers first carried out a test to determine the homogeneity of the variance-covariance matrix using Box's M test. Box's M test analysis can be seen in Table 3 below:

Table 3 Box' M Test of the Attitude towards Maths between Treatment and Control Groups

Box's M	F-Value	df1	df2	Sig.
8.417	.787	10	21418.2008	.641

International Journal of Education, Psychology and Counseling
IJEPC
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Table 3 shows that there is no significant difference in variance-covariance among the dependent variables for all level of independent variables with the value of Box's M = 8.417 and Sig = 0.641 (p> 0.05). This means that the variance-covariance of dependent variable is homogenous across the independent variables. Therefore, One-way MANCOVA tests can be performed to see the difference in student's attitude towards maths between control and treatment groups.

To measure how well each function effectively distinguishes into distinct groups, Wilks' lambda was used.

Table 4 Wilks' Lambda Value for Student's Mathematical Mindset, Maths Anxiety and Attitude towards Maths

Effect	*Wilks' Lambda* Value	F Value	DF between groups	DF in group	Sig
Group	0.990	.153	4	69	0.961

Table 4 shows that the Wilks' λ value= 0.990, F (4,69) = 0.961 (p <0.05) which implies that there are no significant differences between the constructs at the baseline.

Table 5 One-way MANCOVA for Attitude towards Maths Constructs

Attitude towards Maths Constructs	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Enjoyment	.041	1	.041	.149	.701	.002
Motivation	.094	1	.094	.282	.597	.004
Self-confidence	.022	1	.022	.139	.711	.002
Value	.002	1	.002	.005	.946	.000

The results of the one-way MANCOVA of the post-test scores indicate that there are no significant differences of the students' attitude towards maths for enjoyment, F (1,69) = .149, p = .701, partial η2 = .002; motivation, F (1,69) = .149, p = .597, partial η2 = .004; self-confidence F (1,69) = .139, p = .711, partial η2 = .002 and value F (1,69) = .005, p = .946, partial η2 = .000 between the treatment and control groups. These results indicate the student's level of attitude towards maths were similar for the treatment and control group.

The Effect of GMI between Treatment and Control Groups After Controlling the Covariates.
After the intervention, only 33 students from the treatment group and 31 students from the control group were valid for the analysis. Table 6 shows that the Wilks' λ value= 0.569, F (4,57) = 10.795 (p <0.05) which implies that there are significant differences between control and treatment groups for the attitude towards math's after the intervention.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 8 Issue 51 (September 2023) PP. 148-162
DOI 10.35631/IJEPC.851010

Table 6 Wilks' Lambda Value of Pre-test score for Attitude towards Maths between Treatment and Control Groups

Effect	*Wilks' Lambda* Value	F Value	DF between groups	DF in group	Sig
Group	0.569	10.795	4	57	.00

This result shows that there are differences between the means of identified groups of subjects on a combination of dependent variables. Table 7 below shows the results of One-Way MANCOVA of the post-test score between the constructs in attitude towards maths.

Table 7 One-way MANCOVA for the Attitude towards Maths between Control and Treatment Group.

Attitude towards Maths Constructs	Type III Sum of Squares	df	Mean Square	F	Sig.
Enjoyment	2.238	1	2.036	12.560	.001
Motivation	.001	1	.001	.002	.965
Self-confidence	1.694	1	1.694	9.886	.003
Value	7.911	1	7.911	38.075	.000

The results of the one-way MANCOVA of the post-test scores indicate that there are significant differences for the enjoyment, F (1,62) = 6.113, p = .016 and value F (1,56) = 2.607, p = .017 between the treatment and control groups. While the motivation F (1,56) = .370, p = .326, and self-confidence, F (1,56) = .910, p = .078 shows there were no significant difference between treatment and control groups. These results indicate that the were some improvements in the enjoyment and value of learning math's compared to before the intervention. However, the other two constructs of attitude towards math's which are motivation and self-confidence did not show any difference between the treatment and control groups.

Table 8 below presents the summary of descriptive analysis of the pre and post-test between the control and treatment groups.

Table 8 Descriptive Analysis of the Attitude towards Maths between Control and Treatment Groups

Construct	Group		Mean	Std. Deviation	N
Enjoyment	Control	Pre-Data	3.1882	.38120	34
		Post-Data	3.2452	.56736	31
		Total	3.2154	.47606	65
	Treatment	Pre-Data	3.2571	.38370	35
		Post-Data	3.5394	.40151	33
		Total	3.3941	.41461	68
Motivation	Control	Pre-Data	2.8088	.40386	34
		Post-Data	3.1129	.63521	31

International Journal of Education, Psychology and Counseling
IJEPC
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Volume 8 Issue 51 (September 2023) PP. 148-162
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		Total	2.9538	.54467	65
	Treatment	Pre-Data	2.8000	.41034	35
		Post-Data	3.2576	.57447	33
		Total	3.0221	.54419	68
Self-confidence	Control	Pre-Data	3.3294	.38101	34
		Post-Data	3.3742	.47817	31
		Total	2.7477	.51390	65
	Treatment	Pre-Data	3.3543	.41752	35
		Post-Data	3.7152	.44167	33
		Total	3.5294	.46330	68
Value	Control	Pre-Data	3.4059	.37005	34
		Post-Data	3.3226	.39557	31
		Total	3.3662	.38172	65
	Treatment	Pre-Data	3.2400	.45710	35
		Post-Data	3.6182	.48827	33
		Total	3.4235	.50612	68

The descriptive analysis of the variables revealed that the treatment group had a higher overall post-test mean compared to the control group after controlling for gender and students' math grade. Specifically, the mean score for enjoyment in the treatment group (mean = 3.54, SD = .402) was higher than the control group (mean = 3.25, SD = .567) after the intervention. Similarly, the treatment group exhibited higher mean scores for self-confidence (mean = 3.72, SD = .442) and value (mean = 3.62, SD = .488) compared to the control group, where self-confidence had a mean score of 3.37 (SD = .478) and value had a mean score of 3.32 (SD = .396).

While the motivation level (mean = 3.26, SD = .574) for the treatment group shows only a slight increase compared to the control group (mean = 3.12, SD = .635), the results indicate an improvement in the level of attitude towards maths following the treatment. This improvement can be attributed to the students' understanding of the value of having a positive or growth mindset in their learning journey. As a result, students become more confident in their ability to learn maths, even in the face of potential mistakes. Overall, the findings suggest that students in the treatment group exhibit a noticeable improvement in their positive attitude towards learning maths compared to the control group.

Discussion

Level of Attitude towards Maths

The level of attitude towards maths among students was at the medium level. While students exhibited a positive attitude towards some aspects of maths, they also showed negative attitudes towards certain aspects they did not enjoy. Among the various constructs, the mean score for value towards maths was found to be the highest, followed by motivation. However, the mean score for self-confidence towards maths was found to be the lowest, followed by enjoyment. These findings suggested that although students have low self-confidence towards maths, they are aware of the subject's importance and the need to master it, despite not finding it particularly enjoyable.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 8 Issue 51 (September 2023) PP. 148-162
DOI 10.35631/IJEPC.851010

This result is parallel with the previous research that showed the students' positive attitude towards mathematics is at medium level and the study also find out there is no gender difference in their attitudes (Mohamed & Waheed, 2011). Studies have shown that students' attitude in general "moderately" influences their academic achievement (Oracion & Abina, 2021). This suggests that having a moderate level of attitude towards learning can have a moderate impact on academic performance. Without any further intervention to improve the attitude might lead to negative attitude. Moderate level of attitude should be concerning by various parties. There were many factors that push the students towards negative attitude.

The important of having positive attitude was also mentioned by study from Hwang and Son (2021). The study revealed that there exists a positive correlation between students' attitudes towards mathematics and their achievement in the subject. Students who demonstrate a liking for mathematics and engage in related activities, possess a belief that learning mathematics will lead to favourable outcomes such as success in academics and career prospects, and possess confidence in their mathematical skills, are more likely to attain high levels of mathematical achievement. Positive attitude is thought to have a stronger influence, a moderate level of attitude can still contribute to academic success, however, it is important to foster the attitude towards maths into higher level so that they can have long-lasting benefits in educational and professional journeys. Thus, it is important for educators to foster a positive attitude towards learning and address any negative beliefs or attitudes that may hinder students' academic progress.

Differences Between Treatment and Control Groups of Attitudes Towards Maths After the Intervention

The findings revealed that the implementation of GMI had a significant impact on students' emotions and responses towards mathematics. As described by Rodríguez et al. (2020), attitude towards maths encompasses an individual's beliefs, interest, and perceived competence in performing mathematical tasks in various academic and real-world contexts. The attitude towards mathematics is influenced by one's cognitive, affective, and behavioral tendencies when engaging with mathematical tasks, as supported by previous research (Han and Carpenter, 2014). The findings of this study align with the research conducted by Koichu and Rosen (2019), which demonstrated that a growth mindset intervention positively influenced students' attitudes towards mathematics and their overall math achievement.

These results are also consistent with the study conducted by Boaler (2015), who found that students who were exposed to a "mathematical mindset" approach displayed improved attitudes towards mathematics and achieved higher levels of math proficiency. Moreover, a study by Hong and Lin-Siegler (2012) investigated the correlation between mindset and math achievement among high school students, providing further evidence of the important relationship between mindset and academic performance in the mathematics domain. These studies collectively emphasize the significance of cultivating a growth mindset and implementing mindset-oriented strategies to enhance students' attitudes towards mathematics and promote their overall math achievement. According to Mazana et al. (2018), certain attitude factors such as motivation, confidence, value, increased anxiety, and enjoyment contribute to students' learning and subsequently improve their performance.

In addition, past study also discovered that students possessing a growth mindset exhibited higher mathematics achievement scores and demonstrated a greater inclination toward

International Journal of Education, Psychology and Counseling
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pursuing math-related careers, in contrast to students with a fixed mindset (Limeri et al., 2020). As is known, math is a fundamental skill in various fields, including science, technology, engineering, and mathematics (STEM). It can open doors to a wide range of career opportunities that require strong quantitative and analytical skills. Students with a positive attitude are more likely to pursue further education and careers in STEM fields, which offer numerous professional growth and job prospects.

The interconnectedness of attitudes and beliefs regarding learning and intelligence provides strong support for the positive outcomes observed in successful interventions centered around the concept of malleable intelligence. An example illustrating this connection could be seen in a student who comprehends that the brain has the inherent capacity for change, thereby fostering a more favourable disposition towards learning and exerting effort (Hedlund, 2021). The interventions rooted in the notion of a growth mindset have generally yielded favourable outcomes.

They are more likely to embrace challenges, seek out new opportunities to learn, and develop resilience in the face of setbacks. These skills are not only valuable in math but also transferable to other areas of life and future career endeavours and their life wellbeing. Therefore, it is importance to have good mindset to fosters intrinsic motivation and a genuine interest in learning. When students have a positive outlook, they are more likely to be engaged, enthusiastic, and persistent in their learning endeavours. This motivation fuels their desire to explore new concepts, overcome challenges, and seek a deeper understanding.

Limitation and Future Research

This study interviewed a small sample of students using quasi-experimental research design. There were a lot of internal threats that need to be controlled and it is a bit difficult to capture all the threats. So, the small sample size is the main limitation of this study. The findings could not be generalized to other population or sample, where the results might differ depending on the student's location or places. Another drawback was the lack of empirical studies about PRTs working with special needs primary children in Palestine. Future studies can conduct longitudinal research or mixed method to explore the long-term effects of mindset interventions on attitude towards math, and academic performance. A longitudinal study involves tracking students over an extended period to examine how mindset interventions impact these variables over time. By collecting data at multiple points in time, researchers can detect trends and patterns that may not be apparent in cross-sectional or one-time studies. This type of study can provide valuable insights into the long-term impact of mindset interventions.

Conclusion

Interventions, such as the implementation of a growth mindset, have the potential to effectively fostering a positive attitude towards mathematics. Within the realm of mathematics education, a growth mindset intervention offers students the opportunity to cultivate a favorable outlook on maths, enhance their confidence in learning and excelling in the subject, and embrace a more adaptable and open-minded approach to problem-solving. By encouraging students to perceive mistakes and challenges as avenues for growth and learning, as well as providing collaborative and stimulating problem-solving activities, these interventions provide valuable opportunities for students to thrive. Furthermore, these interventions have the added benefit of enhancing students' self-efficacy and motivation, both of which play crucial roles in the process of learning mathematics.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 8 Issue 51 (September 2023) PP. 148-162
DOI 10.35631/IJEPC.851010

It is recommended that teachers adjust their instructional approaches to accommodate the diverse needs and learning barriers of their students. This can be achieved by minimizing fear, fostering active interest, and promoting enjoyment in the subjects being taught. Teachers should also implement corrective measures to alleviate tension and offer support to students whenever needed, thereby creating a non-threatening environment for teaching and learning. Therefore, it is useful in the creation of policies and programmes aimed at improving the well-being in the future (Ooi, Hamzah & Thien, 2022).

Acknowledgements

The authors would like to thank to the schools that got involved in this study. The authors also acknowledge the infrastructure and support of the University of Putra Malaysia (UPM). The authors received no financial support for the research, authorship, and publication of this manuscript.

References

Azman, N., & Maat, S. (2021). Persepsi dan Amalan Guru Terhadap Pengintegrasian Unsur Sejarah dalam Pengajaran dan Pembelajaran Matematik di Sekolah Menengah. *Jurnal Dunia Pendidikan,* 3(1), 718-728. https://myjms.mohe.gov.my/index.php/jdpd/article/view/12416

Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current Directions in Psychological Science, 11*(5), 181–185. https://doi.org/10.1111/1467-8721.00196

Bakar, S., Mohd Ayub, A. F., Gopal, K. & Salim, N. (2019). The Influence of Students' Beliefs on Mathematical Problem Solving towards Mathematics Achievement among Malaysian Matriculation Students. *Universal Journal of Educational Research, (*7), 2243-2247. https://doi.org/10.13189/ujer.2019.071025

Belbase, S. (2013). Images, anxieties, and attitudes toward mathematics. *International Journal of Education in Mathematics, Science and Technology,* 1(4), 230-237.

Beilock, S. L., & Maloney, E. A. (2015). Math Anxiety: A Factor in Math Achievement Not to Be Ignored. *Policy Insights from the Behavioral and Brain Sciences*, (2), 4-12. https://doi.org/10.1177/2372732215601438

Blackwell, L. & Trzesniewski, K. & Dweck, C. (2007). Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: *A Longitudinal Study and an Intervention. Child development.* 78. https://doi.org/10.1111/j.1467-8624.2007.00995.x.

Boaler, J. (2016). Mathematical mindsets: Unleashing Students' Potential Through Creative Math, Inspiring Messages and Innovative Teaching. Jossey-Bass.

Chen, L., Bae, S. R., Battista, C., Qin, S., Chen, T., Evans, T. M., & Menon, V. (2018). Positive attitude toward math supports early academic success: Behavioral evidence and neurocognitive mechanisms. *Psychological Science, 29*(3), 390-402. https://doi.org/10.1177/0956797617735528

Davadas, S. D., & Lay, Y. F. (2018). Factors Affecting Students' Attitude toward Mathematics: A Structural Equation Modeling Approach. *Eurasia Journal of Mathematics, Science and Technology Education,* 14(1), 517-529. https://doi.org/10.12973/ejmste/80356.

Degol J. L., Wang M. T., Zhang, Y., Allerton, J. (2018). Do Growth Mindsets in Math Benefit Females? Identifying Pathways between Gender, Mindset, and Motivation. *J Youth Adolesc.* 47(5):976-990. https://doi.org/10.1007/s10964-017-0739-8.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 8 Issue 51 (September 2023) PP. 148-162
DOI 10.35631/IJEPC.851010

Demedts, F., Reynvoet, B., Sasanguie, D., & Depaepe, F. (2022). Unraveling the role of math anxiety in students' math performance. Frontiers in Psychology, 13, 979113. https://doi.org/10.3389/fpsyg.2022.979113

DiStefano, M., O'Brien, B., & Storozuk, A., Ramirez, G., Maloney, E. A. (2020). Exploring math anxious parents' emotional experience surrounding math homework-help. *International Journal of Educational Research*, (99), 101526. https://doi.org/10.1016/j.ijer.2019.101526

Dweck, C. S. and Leggett, E.L. (1988) A Social-Cognitive Approach to Motivation and Personality. *Psychological Review*, (95), 256-273.

Dweck, C. S. (2006). Mindset: The New Psychology of Success. New York: Random House Publishing Group.

Emily, R., Jody, S. P., Pauline, G. & Patricia, C. (2018) The effects of a growth mindset on self-efficacy and motivation, *Cogent Education*, 5(1), 1492337, https://doi.org/10.1080/2331186X.2018.1492337

Fennema, E., & Sherman, J. A. (1976). Fennema-Sherman Mathematics Attitude Scale: Instruments designed to measure attitudes toward the learning of mathematics by females and males. *JAS Catalog of Selected Documents in Psychology*, (6), 31. https://doi.org/10.19126/suje.533645

Haase, V. G., Guimarães, A.P.L. & Wood, G. (2019). Mathematics and emotions: the case of math anxiety. In. International Handbook of Mathematical Learning Difficulties (pp. 469-503), Springer Cham.

Hassan, Z. A., Schattner, P., & Mazza, D. (2006). Doing A Pilot Study: Why Is It Essential? *Malaysian Family Physician : The Official Journal of the Academy of Family Physicians of Malaysia*, *1*(2-3), 70-73. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4453116/

Han, S., & Carpenter, D. (2014). Construct Validation of Student Attitude toward Science, Technology, Engineering, and Mathematics Project-Based Learning: The Case of Korean Middle Grade Students. *Middle Grades Research Journal*, (9), 27-41. https://doi.org/10.4236/psych.2019.102017

Hedlund, A. (2021). Beliefs and Attitudes that Influence Learning: A Mind, Brain, and Education Literature Review. *GiLE Journal of Skills Development*, *1*(2), 44 – 57. https://doi.org/10.52398/gjsd.2021.v1.i2.pp44-57.

Hochanadel, A., Finamore, D. (2015). Fixed and Growth Mindset in Education And How Grit Helps Students Persist in The Face of Adversity. *Journal of International Education Research*, 11(1). https://doi.org/10.19030/jier.v11i1.9099

Hong, H. & Lin Siegler, X. (2012). How Learning About Scientists' Struggles Influences Students' Interest and Learning in Physics. *Journal of Educational Psychology*. (104). 469-484. https://doi.org/104. 469-484.10.1037/a0026224.

Lim, S. Y., & Chapman, E. (2013). Development of a Short Form of the Attitudes toward Mathematics Inventory. *Educational Studies in Mathematics: An International Journal*, 82, 145-164. https://doi.org/10.1007/s10649-012-9414-x

Limeri, L. B., Carter, N. T., Choe, J., Harper, H. G., Martin, H. R., Benton, A., & Dolan, E. L. (2020). Growing a growth mindset: Characterizing how and why undergraduate students' mindsets change. *International Journal of STEM Education*, *7*(1), 1-19. https://doi.org/10.1186/s40594-020-00227-2

Liou, P. Y., & Lin, J. J. H. (2021). Comparisons of Science Motivational Beliefs of Adolescents in Taiwan, Australia, and the United States: Assessing the Measurement Invariance

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 8 Issue 51 (September 2023) PP. 148-162
DOI 10.35631/IJEPC.851010

Across Countries and Genders. *Frontiers in Psychology*, (12), 674902. https://doi.org/10.3389/fpsyg.2021.674902

Mensah, J. K., Okyere, M., & Kuranchie, A. (2013). Student Attitude towards Mathematics and Performance: Does the Teacher Attitude Matter? *Journal of Education and Practice*, (4), 132-139. http://doi.org/10.4236/ce.2019.103041

Mohamed, L., & Waheed, H. (2011). Secondary Students' Attitude towards Mathematics in a Selected School of Maldives. *International Journal of Humanities and Social Science*, (1), 227-281. http://doi.org/10.4236/psych.2017.813137

Moussa, N. M., & Saali, T. (2022). Factors Affecting Attitude Toward Learning Mathematics: A Case of Higher Education Institutions in the Gulf Region. *SAGE Open*. https://doi.org/10.1177/21582440221123023

Musa, N. H., & Maat, S. M. (2021). Mathematics Anxiety: A Case Study of Students' Learning Experiences through Cognitive, Environment and Behaviour. *International Journal of Academic Research in Business and Social Sciences,* 11, (3), 932-956. http://doi.org/10.6007/IJARBSS/v11-i3/8992

Ngussa, B. M., & Mbuti, E. E. (2017). The Influence of Humour on Learners' Attitude and Mathematics Achievement: A Case of Secondary Schools in Arusha City, Tanzania. IJRDO- *Journal of Educational Research*, 2(3), 170-181. https://doi.org/10.53555/er.v2i3.165

Ooi, H. X., Hamzah, A., Thien, L. M. (2022). Gender and University Support towards Psychological Well-being: An Exploratory Study in Malaysia. *International Journal of Academic Research in Progressive Education and Development*. 11(2), 879 – 894. https://doi.org/10.6007/IJARPED/v11-i2/13853

Paechter, M., Macher, D., Martskvishvili, K., Wimmer, S., & Papousek, I. (2017). Mathematics Anxiety and Statistics Anxiety. Shared but Also Unshared Components and Antagonistic Contributions to Performance in Statistics. *Frontiers in psychology*, 8, 1196. https://doi.org/10.3389/fpsyg.2017.01196

Rodríguez-Muñiz, L.J., Aguilar-González, Á., Lindorff, A. et al. (2022). Undergraduates' conceptions of mathematics teaching and learning: an empirical study. *Educ Stud Math,* 109, 523–547. https://doi.org/10.1007/s10649-021-10105-5

Oracion, Q. Jr G., & Abina, I. L. S. (2021). The mediating effect of students' attitude to student career aspiration and mathematics achievement. *JRAMathEdu (Journal of Research and Advances in Mathematics Education),* 6(3), 158-173. https://doi.org/10.23917/jramathedu.v6i3.13784

Samuel, T. & Warner, J. (2019). "I Can Math!": Reducing Math Anxiety and Increasing Math Self-Efficacy Using a Mindfulness and Growth Mindset-Based Intervention in First-Year Students. *Community College Journal of Research and Practice*, (45), 1-18. https://doi.org/10.1080/10668926.2019.1666063.

Sarmah, A., & Puri, P. (2014). Attitude towards Mathematics of the Students Studying in Diploma Engineering Institute (Polytechnic) of Sikkim. *IOSR Journal of Research & Method in Education, (4),* 06-10. https://doi.org/10.1177/1475725719836641

Smith, T. F., & Capuzzi, G. (2019). Using a mindset intervention to reduce anxiety in the statistics classroom. *Psychology Learning & Teaching, 18*(3), 326–336. https://doi.org/10.1177/1475725719836641

Süren, N. & Kandemir, M. (2020). The Effects of Mathematics Anxiety and Motivation on Students' Mathematics Achievement. *International Journal of Education in Mathematics, Science and Technology*. (8). 190. https://doi.org/10.46328/ijemst.v8i3.926.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 8 Issue 51 (September 2023) PP. 148-162
DOI 10.35631/IJEPC.851010

Siti Ramizah Khairunnisa Mohd Radzi, Nor Azura Adzharuddin, Jusang Bolong,Mohd Nizam Osman (2020). Personaliti, Motivasi Dan Kesediaan Melakukan Tular Dalam Media Sosial: Sebuah Idea Awal. *International Journal of Modern Trends in Business Research (IJMTBR)*, 3(11), 1 - 12.

Syyeda, F. (2016). Understanding Attitudes Towards Mathematics (ATM) using a Multimodal Model: An Exploratory Case Study with Secondary School Children in England, *Cambridge Open-Review Educational Research e-Journal (CORERJ)*, (3), 2056-7804 https://doi.org/10.17863/CAM.41157

Tao, W., Zhao, D., Yue, H., Horton, I., Tian, X., Xu, Z., & Sun, H. (2022). The Influence of Growth Mindset on the Mental Health and Life Events of College Students. *Frontiers in Psychology*, *13*, 821206. https://doi.org/10.3389/fpsyg.2022.821206

Tapia, M., & Marsh, G. E., II. (2004). An instrument to measure mathematics attitudes. *Academic Exchange Quarterly*, 8(2), 16-21.

Van Teijlingen, E., & Hundley, V. (2001). The importance of pilot studies. Social Research Update, 35, 1-4.

Wakhata, R., Mutarutinya, V. & Balimuttajjo, S. (2022). Secondary school students' attitude towards mathematics word problems. *Humanit Soc Sci Commun*, (9), 444. https://doi.org/10.1057/s41599-022-01449-1

Zamir, S., Yang, Z., Wenwu, H., & Sarwar, U. (2022). Assessing the attitude and problem-based learning in mathematics through PLS-SEM modeling. *PloS one*, *17*(5), e0266363. https://doi.org/10.1371/journal.pone.0266363

Zan, R. & Di Martino, P. (2007). Attitude toward mathematics: Overcoming the positive/negative dichotomy. *Montana Council of Teachers of Mathematics*, (3), 157-168.