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SECONDARY SCHOOL STUDENTS' ATTITUDE AND ITS EFFECTS ON MATHEMATICS ACHIEVEMENT

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ABSTRACT

This study examines students' attitudes and motivation toward learning mathematics. The purpose of the study is to determine the relationship between the variables of students' attitudes toward mathematics and their motivation to learn mathematics. The study also addresses the question of how non-intelligence variables affect student achievement. To answer the research questions, a questionnaire was administered to 150 grade 4 students who were surveyed. From the results, the relationship between these two variables is shown to be significant. However, the variables did not seem to affect the students' performance. It appeared that although the students had a positive attitude towards the subject and were highly motivated to learn mathematics, their performance in the exam was still poor. In conclusion, students' attitudes and motivation are variables that are closely related but may have no influence on students' performance in the subject. Further research on this topic can include elements that might be related to students' academic progress.

Keywords*: Mathematics Achievement, Motivation Level, Secondary School Students, Students' Attitude, Students' Motivation.*

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1. Introduction

Mathematics is important for the development of Malaysia's national agenda (Kharuddin & Azid, 2021). In fact, in the work-life situation, many professional jobs require advanced education and training in mathematical skills as a criterion of employability. Conversely, as an academic course, Mathematics is considered a foundation of basic knowledge and is taught in all levels of education (Yusof et al., 2021). Generally, students in secondary schools often find mathematics difficult to master (Bajuri & Othman, 2021). This could be considered a typical situation because different students have different approaches and perspectives in mathematics. Those who dislike mathematics may find the simplest mathematics problem difficult while those who like mathematics may find it easy. Such behavior can often be

related to the students' attitudes and motivation in learning mathematics. In mathematics education, teachers utilize three learning domains to create lessons. One of the domains is affective which involves social, emotional, and feeling. Affective learning is shown by behaviors indicating attitudes of awareness, interest, attention, responsibility, ability to listen and respond to others, and ability to demonstrate those attitudinal values suitable to the situation and the field of study (Rao, 2020). Affective objectives can be further divided into a hierarchy which is ordered from simpler feelings to those that are more complex. Affective and cognitive abilities are often related as one deals with emotions while the other deals with knowledge and the development of intellectual skills.

This study aims to investigate if there is a relationship between attitudes and effects on mathematics achievement among upper secondary school students. Therefore, there are two variables involved in this study: student's attitudes towards mathematics, and their motivation level. To achieve a good result in examinations, students' must be in a good psychological state as cognitive and affective abilities often affect each other. These two domains could influence students' achievement in academics too. In fact, a study suggested that one's own attributions influence their achievement (Oczan, 2021). The most important factors affecting attributions are ability, effort, task difficulty, and luck. The theoretical framework and conceptual framework related to this study are presented in this chapter. Next, Section 2 contains the literature review. Section 3 presents the method that is involved in this study. Section 4 and Section 5 are the results and discussion and lastly, Section 6 shows the conclusions of this study.

2. Literature Review

One of the non-intelligence factors that affect students' learning is attitude. Attitude refers to a pattern of beliefs developed over time in each socio-cultural context. These beliefs play a crucial role in the learning process (Liu, 2014). A research study that interviewed 257 students in India argues that modern research shows that there is a relationship between achievement and attitudes towards education (Das et al., 2014). They suggest that several components play a role in the formation of attitudes among students such as emotional, cognitive, and behaviours. These components form the general attitudes of students as they experience the world, their thoughts and emotions come together with their attitudes.

Research conducted among senior high school students found that a complex array of factors has impacted students' beliefs and attitudes toward their mathematics learning. These include individual students' knowledge and experiences (Kele, 2018). The outcomes of this research are that students expressed factors based on personal affective domains and personal cognitive domains which impacted their mathematics learning. These factors can play a vital role in influencing beliefs and attitudes in mathematics classrooms. It is proven that students with good behaviours towards mathematics subjects will perform better meanwhile, students who have negative attitudes will perform poorly. Student attitudes can influence classroom interactions, as well as how students react to other students and teachers (Mazana et al., 2019). Hence, students' attitudes do affect their academic success.

In another study conducted, there was a slight positive change in students' enjoyment, self-confidence, and value of Mathematics after they intervened in students' learning by providing tablets to all students (Fabian et al., 2018). They suggest that the use of mobile technologies elicit positive responses from students. Therefore, it is true that learning attitude is an important attribute because students who have a good attitude towards a subject can do well. According to Othman et al. (2017) learning mathematics using PowerPoint applications gives positive feedback because the students can use the application anywhere and anytime, they want when learning mathematics. The students can look past conventional methods. Next, research that consisted of 258 boys and 289 girls as its sample among Grade 7 learners indicated that both boys and girls showed a higher preference for Mathematics as their favourite subject (Reddy, 2017). Moreover, the students responded most favourably to the aspect of enjoyment in the learning of science subjects in school. Some learners also

recommended the inclusion of gadgets such as iPads and tablets to increase their interest in learning. The authors agree that technology needs to be incorporated more in the teaching and learning process to raise students' liking towards mathematics.

According to research, there are differences between students of mathematical-program gymnasiums and language-program gymnasiums regarding their motivation for learning Mathematics (Pavlin-Bernardić et al., 2017). I acknowledge this finding because it runs in our autonomy. We usually excel in what we master. The same goes for students' achievement in Mathematics. Those who are motivated to learn Mathematics can achieve success in that subject. This statement is supported by a study that states, positive motivation stimulates the desirable behaviours of students in which a positive attitude towards the subject plays a valuable role in learning mathematics (Acharya, 2017). Students' activities can be increased through ethnomathematics-based learning, as well as their motivation, interest, and confidence can be increased (Widada et al., 2018). Students' confidence and motivation were conceptualized to have a direct effect on their interest in Mathematics. This study is a conjecture on the hypothesis that confidence and motivation influence students' interest in learning Mathematics (Otoo et al., 2018). They found that students' motivation to study Mathematics depends largely on their knowledge of the usefulness of mathematics. A student becomes motivated to learn that subject when they have the confidence to excel. The research found that the effect of students' motivation on their attitudes in Mathematics was still not significant. According to the researchers, their findings contradicted the study of another research which showed that motivational-related variables are the main predictors of attitudes towards mathematics. A study by Kyndt et al. (2015), revealed that the teaching of mathematics should be geared towards introducing students to the real-world application of Mathematics and making them understand its usefulness. This will fuel their motivation to learn and increase their positive attitudes toward learning mathematics. The researchers' suggestion that attitudes and motivation are closely related makes sense. Both non-intelligence factors play a big role in students' psychological state that affects their achievement. Teaching the students about real-world situation that connects with mathematics could increase their interest and attention in the class.

On the other hand, a study defines attitude towards mathematics as liking or disliking the subject; a desire to participate in or avoid mathematical activities; a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless in the real world (Kibrislioğlu & Haser, 2015). Attitude is a bipolar judgment that one associates with a subject, concept, or object. It is a subjective judgment that may cause one to like or detest things, which may be positive or negative. In another research, a factor that hinders the learning process and has an impact on students' attitudes and motivation to learn Mathematics, was explored. That factor is Mathematics anxiety (Getahun et al, 2016; Ahmed, 2017). This finding supported another research that established Mathematics anxiety is negatively correlated with metacognitive knowledge which is the ability to reflect, understand, and control one's learning (Hoorfar & Taleb, 2015). The findings from both research are agreeable. Mathematics anxiety could make it difficult to encourage good attitudes and motivate students to learn Mathematics which could affect their Mathematics achievement.

In this study, two variables that affected students' success in Mathematics are highlighted. The variables are students' attitudes and their level of motivation. The conceptual framework for this study is presented in Figure 1.

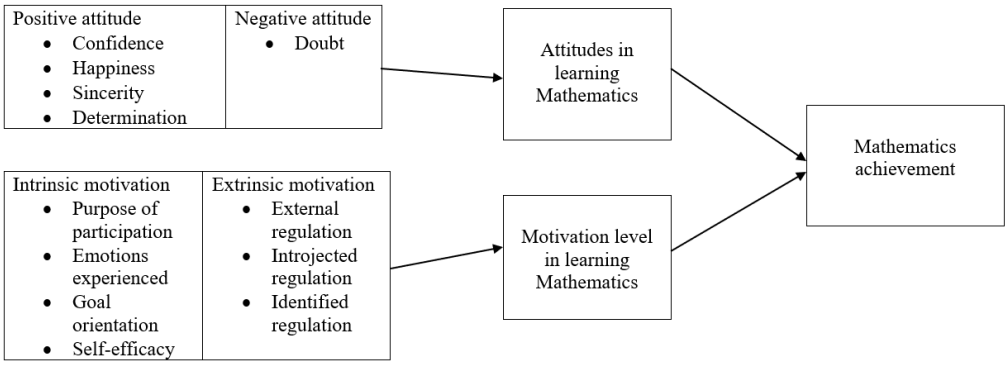

Figure 1. Conceptual Framework

3. Research Methodology

The study was conducted by a pilot study on students at a secondary school in Ampang, Malaysia. The questionnaire will be given through the Google Form platform to get a better reach of the respondents. A pilot study is carried out for Form 4 students as well but on a smaller scale compared to the number of actual samples of the study. The sampling number for the pilot study is 150 respondents.

The survey consists of three parts which are part A, part B, and part C. In part A, Closed-ended questions are used for respondents' demography. Part B consists of questions regarding students' attitudes toward learning Mathematics. The SurveyMonkey form is used and adapted so it is suitable for today's settings. Part C is made up of questions that are associated with students' motivation level in their Mathematics class. Parts B and C, employ the Likert scale which contains five responses for each item. The options range from 1 (Strongly Disagree) to 5 (Strongly Agree). Each item in the research instrument will be analyzed using Cronbach alpha in SPSS. According to Taber (2018), Cronbach alpha is a statistic commonly quoted by authors to demonstrate that tests and scales that have been constructed or adapted for research projects are fit for the purpose. Cronbach alpha is a measure of internal consistency to see how closely related a set of items are as a group. By conducting Cronbach alpha for each item, the scale of reliability can be measured and used as evidence that the instrument is consistent.

4. Result and Analysis

This study used a descriptive survey with a cross-sectional design. The research aims were accomplished using a self-report questionnaire. The samples were taken from students in Form 4 at a secondary school in the district of Ampang, Malaysia. The surveys were distributed to 150 students.

Part A: Demographic Profile

The respondents were 42.7% male (N=64), and 57.3% female (N=86) as shown in Table 1.

Table 1. Demographic of respondents by gender (N=150)

Gender	Frequency	Percent
Male	64	42.7
Female	86	57.3
Total	150	100.0

Table 2 represents the division of respondents according to students' ethnicity. Based on the table, this research consists of 87.3% (N=131) of Malay students, Chinese and Indian students having the same percentage which is 5.3% (N=8) and the remaining 2.0% (N=3) are

from other races.

Table 2. Demographic of respondents by ethnicity

Ethnicity	Frequency	Percent
Malay	131	87.3
Chinese	8	5.3
Indian	8	5.3
Others	3	2.0
Total	150	100.0

Table 3 presents the breakdown of students based on their family household income. According to the table, 54% of respondents (N=81) come from households with an income below RM3000, 21.3% (N=32) fall within the income range of RM3001 to RM4500, while 16% (N=24) belong to the upper M40 group. The remaining 8.7% of respondents (N=13) report an income exceeding RM7000.

Table 3. Demographic of respondents by family household income (N=150)

Household Income	Frequency	Percent
Below RM3000	81	54.0
RM3001 – RM4500	32	21.3
RM4501 – RM7000	24	16.0
Above RM7000	13	8.7
Total	150	100.0

Part B: Students' Attitudes towards Mathematics

To measure the positive and negative attitudes towards the subject, the study uses the mean and standard deviation to determine the students' confidence, happiness, sincerity, determination, and doubt. According to the data in Table 4, most students expressed a genuine interest in learning mathematics (Mean=3.9033). It indicates that no one is pressuring them to learn mathematics in school. In addition, the respondents are determined to do well in mathematics class (Mean=3.6527). Furthermore, the respondents express confidence in their ability to learn the subject (Mean=3.4800), followed by delight in their ability to gain a working grasp of mathematics (Mean=3.4567). However, whenever they attempt to answer a mathematics question (Mean=3.1311), they continue to have doubts about their abilities and are fearful of receiving poor grades.

Table 4. Demographic of respondents by family household income (N=150)

Sub-Scale Rank	Factor Rank	Sub-Scale	Factor	Mean	Std. Deviation
1.		Positive Attitude			
	1.		Confidence	3.4800	.69137
	2.		Happiness	3.4567	.93216
	3.		Sincerity	3.9033	.68773
	4.		Determination	3.6527	.57852
2.		Negative Attitude			
	1.		Doubt	3.1311	.75766

Table 5 shows clearly which predominant attitude the students have when they are learning in mathematics. The first study question is concerned with determining students' attitudes about mathematics in general. A descriptive analysis was conducted on the ratings that students gave to the 28 items on the attitudes scale, which was administered to them. The findings from Table 5 indicate that, on the whole, students exhibit positive sentiments toward the subject (mean=3.5693, standard deviation=.51168).

Table 5. Overall mean and standard deviation of students' attitudes toward mathematics (N=150)

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Mean Attitude Valid N (listwise)	150 150	1.61	4.57	3.5693	.51168

Part C: Students' Motivation Level in Learning Mathematics

To measure the motivation levels in learning mathematics among the respondents, the researcher uses mean and standard deviation to determine the students' intrinsic and extrinsic motivation. According to Table 6, there are two sorts of motivation which are intrinsic and extrinsic. For intrinsic motivation, most of the student's report having positive emotions while in Mathematics class (Mean=3.7383), indicating that they feel at ease and peace while studying this subject. Additionally, most of the respondents report having a clear vision and being goal-oriented while obtaining mathematics knowledge (Mean=3.7381). The respondents are motivated to participate in class (Mean=3.5622). This demonstrates that students are prepared to participate in class regardless of their level of mastery. Finally, their self-efficacy level (Mean=3.3844) indicates that they have a modest amount of confidence in their ability to achieve the intended goals.

Extrinsic motivation is the second type of motivation. Most respondents believed that they are capable of learning mathematics (Mean=4.3133) if they study appropriately or else their well-being will suffer. They believe that rewarding themselves will increase their motivation (Mean=3.8867). Finally, respondents indicate that their incentives for studying mathematics are influenced by their introjected regulation extrinsic motivational style (Mean=3.7433).

Table 6. Mean and standard deviation of students' motivation level in learning Mathematics (N=150)

Sub-scale Rank	Factor Rank	Sub-scale	Factor	Mean	Std. deviation
1.		Intrinsic Motivation			
	1.		Purpose of participation	3.5622	.65269
	2.		Emotions experienced	3.7383	.67948
	3.		Goal orientation	3.7381	.62510
	4.		Self-efficacy	3.3844	.64966
2.		Extrinsic Motivation			
	1.		External regulation	3.8867	.70243
	2.		Introjected regulation	3.7433	.82074
	3.		Identified regulation	4.3133	.81213

Table 7 represents the students' predominant motivation level in learning mathematics. The purpose of this data is to exhibit the respondents' level of motivation in general when they are studying the subject. The second research question attempts to discover the level of motivation that students have for learning mathematics. A descriptive analysis was carried out on the ratings that students gave to the 29 items on the motivation scale, which was administered to them. According to Table 7, it can be concluded that students demonstrate a high level of motivation for the subject (mean=3.6641, SD=.50519).

Table 7. Overall mean and standard deviation of students' motivation level in learning mathematics (N=150)

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Mean Motivation Valid N (listwise)	150 150	1.76	4.86	3.6641	.50519

To explore the third research question, Pearson's correlation coefficient is employed to examine the relation between the dependent variables, which are students' attitudes and motivation levels regarding their performance in mathematics. The findings are presented in Table 8.

Table 8. Pearson's correlation coefficient to test the relationship between two variables (N=150)

Correlations			
		Mean Attitude	**Mean Motivation**
Mean Attitude	Pearson Correlation Sig. (2-tailed) N	1 150	.808** .000 150
Mean Motivation	Pearson Correlation Sig. (2-tailed) N	.808** .000 150	1 150

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

In Table, the Pearson correlation test was conducted to determine the relationship between students' attitudes while studying mathematics and their motivation level. The result found that $r = 0.808$ and $alpha = .000$ which is smaller than .05. This indicates that there is a significantly strong positive relationship between the two variables tested. This result can also be observed in Figure 1. In other words, as attitudes in learning the subject become increasingly positive, their motivation level also increases. The following hypotheses are thus formulated for this purpose:

H_0: There is no relationship between the students' attitudes and their motivation level.

H_1 : There is a relationship between the students' attitudes and their motivation level.

Since the value of $r = 0.808$ and $alpha = .000$, based on the research hypotheses made, H_0 is rejected.

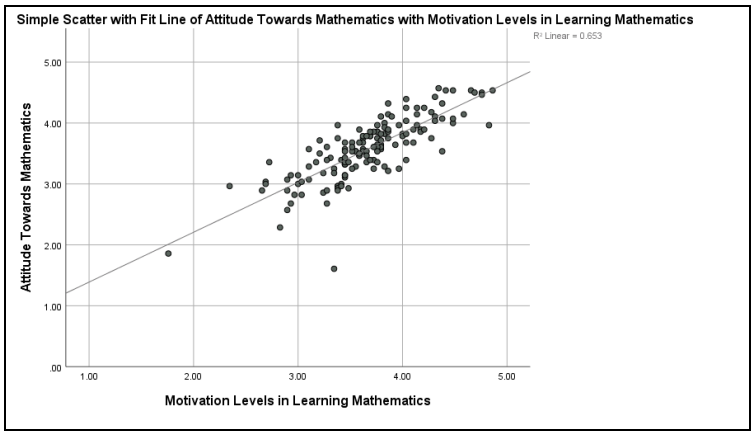

Figure 2. Scatter plot of attitude towards mathematics with motivation levels in learning mathematics

5. Discussion

Attitude and motivation are inextricably intertwined and can serve as powerful motivators for an individual's ability to work efficiently and reach their goals. An attitude is a state of mind, whereas motivation is the cause of the behaviours. The objectives of this study were to explore whether these two non-intelligence factors can influence students' achievement in mathematics. This study answered three research questions as listed as follows:

Research Question 1: What are the students' attitudes towards Mathematics in the class?

The identified the students' attitudes towards mathematics in which students' sense of confidence, happiness, sincerity, determination, and doubt were being measured through 28 items in the questionnaire.

The findings showed a distinct tendency by the 150 respondents to express a genuine interest when learning the subject. Sincerity is an emotional component in forming someone's attitude and has the highest value of mean among the components of positive attitude (Mean=3.9033). The second component with a high value of mean is determination (Mean=3.6527). This result demonstrates that Form 4 students have equal level of compassion in mathematics despite the distinct difference between the number of high and low achievers. The 150 respondents also feel confident in learning the subject (Mean=3.4800) and happy when acquiring a knowledge of mathematics in the class (Mean=3.4567). These two components interrelated with each other. When one is confident in things that they do, they will feel content. This finding is supported by Das et al. (2104) who stated that emotion is one of the components that establish attitudes towards education.

On the other hand, the negative attitude, which is doubtful, has the lowest mean (Mean=3.1311). The result illustrates that the respondents often have doubts when learning the subject. However, comparing the positive and negative attitudes, the four components of positive attitudes have the highest mean than one negative attitude. This outcome is supported by Kele (2018) that stated students with good behaviours towards mathematics will perform better and vice versa.

Overall, based on the mean value computed to represent the overall attitudes of 150 respondents about mathematics, it can be determined that most respondents frequently have a favourable attitude toward the topic (Mean=3.5693). Positivity toward learning a subject enables learners to concentrate on and absorb knowledge as they learn. As a result of this study, it can be concluded that a positive attitude does not guarantee good performance among students. This may be noticed by comparing the computed value of the overall mean to the total number of pupils. While the mean indicates that students typically have a positive attitude toward the subject, most of them nonetheless perform poorly on examinations.

Research Question 2: What are the students' motivation levels when learning Mathematics?

The furnished students' motivation level in terms of intrinsic and extrinsic for learning the subject. Based on the result obtained, intrinsic motivation is divided into four components: the purpose of participation, emotions experienced, goal orientation and self-efficacy. Meanwhile, extrinsic motivation is sorted into three elements: external regulation, introjected regulation and identified regulation.

Two components of intrinsic motivation have the same mean value which are emotions experienced (Mean=3.7383) and goal orientation (Mean=3.7381). This demonstrates that respondents frequently exhibit an elevated level of pleasant feelings. Additionally, the students' favorable feelings improved their intrinsic drive. By contrast, goal orientation reveals that respondents are motivated mostly by internal factors. The high mean rating shows that 150 respondents are inquisitive, willing to be challenged, and desirous of mastering the subject area.

Next, the purpose of participation (Mean=3.5622) is a component with a high mean value. This demonstrates that the respondents are participating in the class for their own personal reasons that may be beneficial to them, rather than to get some external reward or avoid some external penalty from the instructor. Purpose is one of the most important factors in intrinsic motivation because everything that is taught in school has a purpose, and one should not find themselves justifying their existence in their daily lives.

Finally, self-efficacy (Mean=3.3844) is a component of intrinsic motivation. One's self-efficacy is defined as a person's unique set of beliefs that determines one's ability to successfully execute an action plan in each situation (Bandura, 1977). Motivation, on the

other hand, is founded on an individual's desire to attain a goal. The mean value demonstrates that the respondents frequently have high self-efficacy, which will result in strong motivation, and vice versa, as indicated by the mean value.

Following that is extrinsic motivation. Identified regulation is defined as the component with the highest mean value (Mean=4.3133). The term "identified regulation" refers to an individual's behaviour that is expressly recognized and valued. There is only one item in Section C that embodies specified regulation: the seventh item, "Getting a good mark in this class is the most pleasant thing for me." This indicates that most respondents are driven to pursue mathematics for personal gain.

External regulation is the second component (Mean=3.8867). This component is the most prevalent but least autonomous form of extrinsic drive, i.e., obtaining rewards and avoiding punishment. Teenagers are infamous for doing things for a purpose. Mathematics is one of the subjects that are required in schools. For this study, it may be summarized that respondents were considering the repercussions of failing the examination to avoid being punished by their parents.

Finally, introjected regulation (Mean=3.7433) is included. Introjected regulation is a type of motivation that is not based on external rewards and punishments and is driven by self-control, attempts to safeguard the self, and internal rewards and punishments. The respondents seem to believe they have a responsibility to study and that they are responsible if they do not obtain a satisfactory result is an indication of their feeling of personal responsibility.

Given the calculated mean value (Mean=3.6641), it can be concluded that both intrinsic and extrinsic motivation are equally important in driving respondents to pursue mathematics education. Students who maintain their motivation while learning mathematics have a better chance of achieving success in the subject. This, however, is in direct conflict with the findings of the study. The vast majority of those who responded are from the low achiever group, but their level of motivation to learn mathematics is high.

Research Question 3: Is there a relationship between the students' attitudes and their motivation levels?

The relationship between two factors, namely, students' attitudes toward mathematics and their degree of motivation, and how these attitudes and motivations affect their performance in the subject is investigated. According to the Pearson correlation test, there is a statistically significant and strong positive association between the two variables, which demonstrates this point in the results produced. This implies that the more positive students' attitudes toward mathematics are, the greater their degree of motivation to learn the subject.

6. Conclusion

This study suggests that students nowadays generally maintain a positive attitude toward learning mathematics. They exhibit determination, find joy in studying the subject, and show enthusiasm for learning. Exploring these non-intelligence factors, students exhibit a positive attitude and eagerness toward the subject. As discussed earlier, these two aspects rely on each other, influencing good behaviors that lead to positive outcomes. However, it's important to highlight that these positive attitudes and high motivation levels do not necessarily translate into better academic performance, as many students still experience poor academic performance. Poor achievement cannot be solely attributed to attitude and motivation levels. While this study enhances our understanding of students' attitudes and motivation in learning mathematics, the positive mindset and motivation observed do not consistently correlate with academic success. The findings offer insights for future research and encourage modifications in teaching and learning practices to enhance enjoyment in mathematics, as well as improve performance in the subject.

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Author Contribution

Author1 did the research as part of her final year project. Author 2 and Author 3 oversaw the article writing and reconfirmed the statistical analysis and the results.

Conflict of Interest

Regarding the research, writing, and/or publication of this paper, the authors declared that they had no conflicts of interest.

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