The Effect of Gender and Ethnicity on Selected Topics in Mathematics among Secondary School Students

Hasni Shamsuddin[1,4], Jazimah Shamsuddin[2], Azwan Hairi Rabas[3], Nurul Nor Shahda Abd Talib[4], Nurul Syazwani Ismail[4] & Ahmad Zamri Khairani[1]*

[1]School of Educational Studies, Universiti Sains Malaysia, Pulau Pinang, Malaysia
[2] Sekolah Menengah Sains Tapah, Tapah, Perak, Malaysia
[3]Sekolah Menengah Kebangsaan Datuk Haji Ahmad Badawi, Kepala Batas, Pulau Pinang, Malaysia
[4]Sekolah Menengah Sains Kepala Batas, Kepala Batas, Pulau Pinang, Malaysia

**Corresponding author: ahmadzamri@usm.my*

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ABSTRACT

Mathematics is indispensable in daily activities and is a required subject in the education system. By understanding the possible factors contributing to students' ability to learn mathematics, paving solutions to overcome the debility is conceivable. This study aims to examine the effect of gender and ethnicity on students' performance in the topics of Rational Number, Factors and Multiples, and Algebraic Expressions. A total of 181 secondary school students from eight schools (male = 97, female = 84; Malay = 109, Chinese = 44, Indian = 28) were selected as sample of this study. Their response in a nine-item mixed-format mathematics test was thoroughly analysed to provide coherent information on their performance on each topic. Results showed that there was no significant difference in the students' performance based on gender. Yet, Chinese students demonstrated higher mean scores in all topics compared to their Malay and Indian counterparts. This article provides a discussion on the results obtained from the cultural perspective.

Keywords: Ethnicity, Form 1, gender, mathematics, Students' performance

ABSTRAK

Matematik sangat diperlukan dalam aktiviti harian dan merupakan mata pelajaran yang penting dalam sistem pendidikan. Dengan memahami faktor-faktor yang mungkin menyumbang kepada kemampuan pelajar untuk belajar matematik, penyelesaian untuk mengatasi kelemahan dapat difahami. Kajian ini bertujuan untuk mengkaji pengaruh jantina dan etnik terhadap pencapaian matematik murid dalam topik Nombor Nisbah, Faktor dan Gandaan, dan Ungkapan Algebra. Seramai 181 murid daripada lapan buah sekolah menengah (lelaki = 97, perempuan = 84; Melayu = 109, Cina = 44, India = 28) telah dipilih sebagai sampel kajian ini. Respons murid daripada ujian matematik yang terdiri daripada sembilan item format kredit separa telah dianalisis untuk memberikan maklumat yang koheren mengenai prestasi murid pada setiap topik. Hasil kajian menunjukkan bahawa tidak terdapat perbezaan yang signifikan dalam prestasi murid berdasarkan jantina. Namun, murid Cina menunjukkan skor min yang lebih tinggi dalam semua topik berbanding dengan rakan berbangsa Melayu dan India. Artikel ini membincangkan hasil dapatan kajian dari perspektif budaya.

Kata kunci: *Etnik, tingkatan 1, jantina, matematik, pencapaian murid*

INTRODUCTION

Mathematics is a core compulsory subject in the national primary and secondary education system in Malaysia. The mathematics curriculum aims to develop the knowledge and skills of the students so they can think logically and critically while being more analytical, creative, and innovative in solving problems. Eventually, the knowledge and skills will provide a solid foundation for the students to find solutions to daily life problems, further their studies to a higher level, and consequently contribute to a competent workforce. The mathematics for Standard-Based Secondary School Curriculum (KSSM) is essentially a continuation of the knowledge and skills learned at the primary school level. The content covers five main areas, including Numbers and Operations, Measurement and Geometry, Relationship and Algebra, Statistics and Probability, and Discrete Mathematics in five years' period (Ministry of Education, 2016).

Thus, students should have maximum comprehension in the KSSM mathematics for Form 1 since it contains the fundamental topics of mathematics knowledge and skills. To illustrate, Rational Numbers, Factors and Multiples, and Algebraic Expressions are the essential topics in the learning area of Numbers and Operations, as well as Relationship and Algebra. The failure in understanding the fundamental mathematics knowledge might lead to negative perceptions among students towards the subject (Najua et al., 2017).

As the result, the performance of the students in the subsequent content level in mathematics and other subjects, which are directly related to the fundamental knowledge and skills will be affected as well. For example, lack of comprehension in the essential knowledge and skills in algebraic expressions could consequently affect the pace of their learning the Pythagoras Theorem not only in mathematics but also in physics subject. Furthermore, proficiency in fundamental mathematics can increase the students' interest in the mathematics disciplines to the whole extent (Clements, 2001). Therefore, it is deemed justifiable that an emphasis is needed to determine the extent of knowledge and skills learned by the students in mathematics based on their different backgrounds and abilities.

PROBLEM STATEMENT

Differences in gender performance on mathematics tests have long been the focus of research. Previous studies garnered mixed results from researchers interested in the phenomenon. In general, the stereotype presumption that males perform better in mathematics than females were reported in many studies such as Awofala (2017), Heidari and Rajabi (2017) as well as Matteucci and Mignani (2021). Ghasemi et al. (2019), on the other hand, reported no gender difference in among 48 countries, while Bee Fang and Hooi Lian (2019) showed no gender difference among lower secondary school students in Malaysia. Apart from that, there was also an abundance of studies that revealed gender differences in specific areas in mathematics. For instance, a study by Harris et al. (2021) indicated no gender in mathematics performance but significant difference in spatial reasoning among fifth grade students. Meanwhile, using Rasch model analysis at item level, Hasni et al. (2020) found no conclusive results regarding difference in the topics of Rational Numbers, Factors and Multiples, Squares, Square Roots, Cubes, and Cube Roots, Ratios, Rates and Proportions, Algebraic Expressions, and Linear Equations. Several factors have been identified as the impetus, such as cognitive and non-cognitive factors (such as general cognitive abilities, mathematics anxiety and mathematics self-esteem, Samerarao et al., 2020), learning strategies (Fukaya et al., 2017), and culture (Hu et al., 2018). Nevertheless, studies in Malaysian school context were rather scarce with some studies used large-scale assessment such as TIMSS and PISA to gauge information (such as Thien, 2016). Nevertheless, it is not clear how this information is able to help teachers to improve their learning and teaching since the content covered in TIMSS and PISA is not in line with the national curriculum.

Likewise, the effect of ethnicity on mathematics achievement has long been the fixation of many studies as well. These studies primarily discuss the White, Black, and Hispanic students' mathematical performance. For example, by Kevelson (2019) found considerable gap between Black–White and Hispanic–White mathematics achievement gaps. A study by Saw and Chang (2018) showed that the Hispanics trail other racial/ ethnic groups in math cognitive achievement. Ethnicity is also considered as important mediator in relationship between non-cognitive factors and mathematics achievement (Hinnant-Crawford et al., 2016). Similar differences regarding ethnicities were also observed in Brazil (Rocha & Nascimento, 2019). Nevertheless, not much information is available in the Malaysian context despite ethnicity was seen as important factor that influence students' achievement (Saw, 2016).

In the meantime, research by Birenbaum and Nasser (2006) also presented the effect of ethnicity on mathematics achievement in which they asserted that the Jewish students perform significantly better than the Arab students. Locally, studies on the effect of ethnicity on mathematics achievement in Malaysia were rather scarce and have not been explicitly conducted. Instead, Malaysian researchers tend to use findings from other studies to infer the effect. For example, in the study of The Trends in International Mathematics and Science Study (TIMSS) in 1999, it was found that the language spoken at home has a substantial influence on the students' level of mathematics achievement (Nor Azina & Awang, 2007). Since the Malay, Chinese, and Indian students mostly speak their mother tongue at home, we may speculate that ethnicity does influence students' mathematics performance.

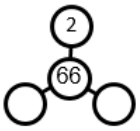
OBJECTIVES

The objectives of the present study are to examine the effect of gender and ethnicity on students' mathematical performance in the topics of Ratio Number, Factors and Multiples, and Algebraic Expressions.

RESEARCH METHODOLOGY

The present study adopts a cross-sectional study design, where data were collected in a single time period during the year-end examination. The study also follows descriptive design, in which data collected was used to describe the difference in mathematics achievement according to gender and ethnicity. Using the purposive sampling, this study employed responses from 181 Form 1 students with an average age of 13 years old in the state of Penang. Purposive sampling was used in order to have good representation of the Malays, Chinese, and Indian students. Male students comprised of 53.6% (N = 97), while female students comprised of 46.4% (N = 84). With regards to ethnicity, the Malay students represented 60.2% (N = 109) of the sample compared to the Chinese (24.3%, N = 44), and the Indian (15.5%, N = 28). We employed a partial credit format to gauge information regarding the students' performance on the three important topics, (1) Ratio Number, (2) Factors and Multiples, and (3) Algebraic Expressions. These topics were considered vitally important since they were also specified in the mathematics curriculum in Form 2 as well as in Form 3 (Ministry of Education 2016; Ministry of Education 2017). Content validity of the items was observed by the head of mathematics panel of the school, while quality of the items was reported in the finding section. Examples of items for both formats are given in the following Table 1.

Table 1: Example of Items

No	Topic	No of Items	Example of Item
1	Rational Number	1	Circle the number which has the highest value [1mark] –7 –11 0 –1
2	Factors and Multiples	5	The diagram below shows the prime factor for 66. Write another two prime factors in the circle.  [2marks]
3	Algebraic Expressions	3	State the coefficients for each of the following algebraic terms Algebraic Term: $-\frac{2}{9}rs^2t$; Variable: rt; Coefficient: Algebraic Term: $7gh^2$; Variable: gh; Coefficient: [2marks]
	Total	**9**	

Scoring was conducted using the following procedure: For multiple-choice (objective) items, one mark was awarded for the correct answer and no mark for the incorrect ones. For the partial credit items, the scoring was given based on the number of steps given to solve the question. An example of scoring for partial credit items is given as follows:

Question:
Given r and s respectively are 3 and -2, find the value of the algebraic expression below.

$$5r - 3s + s^2$$

[2marks]

Scheme of work:

$5(3) - 3(-2) + (-2)^2$	…….1 mark
25	…… 1 mark
Total	…… 2 marks

Figure 1: Item Scoring

The instrument was employed as a year-end examination with each student was allocated two hours to answer. The teacher provided scoring and the responses were then inputted into an electronic database. Data were analysed descriptively using IBM SPSS 23. Means and standard deviations were employed to describe the basic features of the data across different gender and ethnicity. The independent sample t-tests were used to compare the difference in the mean scores of the selected topics between males and females. At the same time, the one-way analysis of variance (ANOVA) was applied to study the effect of ethnicity on the students' performance on the selected topics. These parametric analyses were employed since the data was in the continuous form. In addition, even though non-parametric analyses have advantages when the population distribution is unknown (as in the study), transforming the data from continuous into categorical form is always complicated (Chen & Wang, 2014).

RESEARCH FINDINGS

Table 2 shows the mean and standard deviations of the Rational Number, Factors and Multiples, and Algebraic Expressions according to gender and ethnicity. In general, it can be observed that the male students scored relatively higher than their female counterparts in the topics of Factors and Multiples as well as in Algebraic Expressions. Altogether, the Chinese students scored highest in all the topics measured, followed by the Malays and the Indians.

Table 2: The Mean and Standard Deviation in Gender and Ethnicity by the Topics

Demography	Mean (Standard Deviation)		
	Rational Number	**Factors and Multiples**	**Algebraic Expressions**
Gender			
Male	.80 (.41)	3.43 (2.30)	2.69 (1.65)
Female	.69 (.47)	3.99 (2.81)	2.98 (1.80)
Ethnicity			
Malay	.73 (.44)	3.38 (2.90)	2.66 (1.68)
Chinese	.93 (.26)	4.77 (2.96)	3.73 (1.638)
Indian	.50 (.51)	3.21 (2.54)	2.04 (1.458)

An independent sample t-test was carried out to compare the effect of gender on the performance of the selected topic. Result showed that the mean difference was statistically not significant for the topic of Rational Numbers [t (166.276) = 1.580, p = .116], Factors and Multiples [t (179) = −1.279, p = .202], as well as Algebraic Expressions [t (179) = −1.114, p = .267]. A one-way ANOVA was employed to test the effect of ethnicity on the students' performance. Results in Table 3 shows that there were significant differences in the mean score of Rational Numbers [F (2,178) = 9.248, p = .000], Factors and Multiples [F (2,178) = 4.179, p = .017], and Algebraic Expressions [F (2,178) = 10.507, p = .000]. Bonferroni post-hoc test (Table 3) showed that the mean score for the Chinese was significantly higher than that of both the Malay and the Indian students. The mean score of the Malay students was also relatively higher than the Indian students in the topic of Rational Numbers, but not in the topic of Factors and Multiples and Algebraic Expressions. Further analysis using the Bonferonni post-hoc test showed that, for the Rational Number and Algebraic Expressions, the Chinese students demonstrated a significantly higher mean score compared to both the Malay and the Indian students. With regards to the topic of Factors and Multiples, it was found that there was a significant difference between the mean score of the Chinese and Malay students, but none between the Chinese and the Indian students.

Table 3: Mean Differences According to Topics

Ethnicity difference	Mean difference (p-value)		
	Rational Number	**Factors and Multiples**	**Algebraic Expressions**
Malay - Chinese	-. 20(.024*)	-1.40 (.019*)	-1.07 (.001*)
Malay - Indian	. 23 (.024*)	.16 (.962)	.62 (.171)
Chinese - Indian	. 43 (.000*)	1.56 (.066)	1.69 (.000*)

*significant at p = .05

DISCUSSIONS

The purpose of this study was to examine the effect of gender and ethnicity on students' mathematical performance in the topics of Ratio Number, Factors and Multiples, and Algebraic Expressions. Results from the independent sample t-tests showed that there was no significant difference between the male and the female students on the topics mentioned above. The result contradicts the study of TIMSS 2015, which conclude that the female students perform better compared to the male in

mathematics. One possible reason that may help to explain this finding was the difference in types of mathematics skills assessed in the tests. In this study, we pivoted our focus on measuring students' performance on items that were associated with specific learning outcomes specified in the curriculum specifications.

In contrast, items in the TIMSS benchmark test concentrated on higher-order mathematics skills such as problem-solving, reasoning, and making connections. As such, we theorise that the difference in students' performance might occur in the cognitive skills such as problem-solving and metacognitive skills in attempting to solve questions between genders rather than the difference in how they perceived instructions from the teachers. Nevertheless, it is important to investigate why understanding instruction did not translate into the ability to solve high order thinking among the male students.

In terms of ethnicity, we found that the Chinese students displayed significantly higher mean scores compared to the Malays in all three topics. In explaining these results, we tend to agree with Yoong, Santhiram, Fatimah, Lim, and Munirah's (1997) hypothesis that the cultural advantages may be the reason behind this since the number system in the Chinese language is relatively simpler compared to the Malay language. For example, the number system of one to ten in Chinese only consists of only one syllable in *yi, er, san, si, wu, liu, qi, ba, ju,* and *shi* (Hanyu pinyin version), while the Malay language contains up to three syllables in *sa-tu, du-a, ti-ga, em-pat, li-ma, e-nam, tu-juh, la-pan, sem-bi-lan,* and *se-pu-luh*. As such, the addition of eight and nine is equal to *shi-qi* (two syllables) in Chinese, while it is a whopping four syllables and two words of *tu-juh be-las* in the Malay language. It can be seen that the number system becomes more complicated and more difficult to comprehend when the number is getting bigger in the Malay language compared to the Chinese language.

Yet, Sam (2003) cautions that a more in-depth study needs to be conducted to confirm the hypothesis, especially when her research shows that Malay students in Chinese schools that use the Chinese number system also face some difficulties in counting. She then argues that besides language, the school's environment is also an important, influential factor. She further observes that in Chinese schools, the environment encourages active learning in mathematics, especially in computational skills, with more homework, quizzes, as well as practice sessions are imparted with the students.

While there seem to be satisfactory explanations for the higher mathematical performance of the Chinese students, the same cannot be said when it comes to explaining the Indian students' achievement. This is partly due to the scarcity of research on examining the performance of Indian students in mathematics. However, literature shows that family background massively influences the Indians' performance (Subra et al., 2019; Naciappan et al., 2017). For instance, research by Kamoo (2015) identifies education level, the absence of a father, and parents' motivation among others, as factors that require further investigations to explain the Indian students' achievement. Still, we are in agreement with researchers such as Hu et al. (2018) and Hofstede et al. (2010) that culture has a significant influence on mathematics achievement, as shown by the Chinese students in this study. As such, it is about time to look into this matter, perhaps by looking through the cultural lens in providing some baseline data regarding the performance of the Indian students in mathematics in comparison with their Malay and Chinese counterparts.

CONCLUSION

The present study provides some useful insights regarding the effect of gender and ethnicity on students' performance in the topics of Ratio Number, Factors and Multiples, and Algebraic Expressions. Resultantly, we found that there is no significant difference between the male and the female students' performance in each topic studied. However, we found that ethnicity does affect the students' performance with the Chinese students outperform both the Malay and the Indian students in

all topics. This study is essential in understanding the factors influencing the mathematical performance of the students, particularly by looking into the cultural perspective.

REFERENCES

Awofala, A. O. A. (2017). Assessing secondary school students' mathematical proficiency as related to gender and performance in mathematics in Nigeria. *International Journal of Research in Education and Science (IJRES), 3*(2), 488-502. https://doi.org/10.21890/ijres.327908.

Bee Fang, L., & Hooi Lian, L. (2019). Effects of the metaphor in algebra learning among students in lower secondary. *Jurnal Pendidikan Sains dan Matematik Malaysia, 5*(2), 51-70.

Beekman, J. A., & Ober, D. (2015). Gender gap trends on mathematics exams positive girls and young women for STEM careers. *School Science and Mathematics, 115*, 35-50. https://doi.org/10.1111/ssm.12098.

Bezzina, F. H. (2010). Investigating gender differences in mathematics performance and in self-regulated learning: An empirical study from Malta. *Equality, Diversity, and Inclusion: An International Journal, 29*(7), 669-693. https://doi.org/10.1108/02610151011074407.

Birenbaum, M., & Nasser, F. (2006). Ethnic and gender differences in mathematics achievement and in dispositions towards the study of mathematics. *Learning and Instruction, 16*(1), 26-40. https://doi.org/10.1016/j.learninstruc.2005.12.004.

Chen, H. C., & Wang, N. S. (2014). The assignment of scores procedure for ordinal categorical data. *The Scientific World Journal, 2014*, 304213. https://doi.org/10.1155/2014/304213.

Clements, D. H. (2001). Mathematics in the preschool. *Teaching Children Mathematics, 7*, 270-275.

Cvencek, D., Meltzoff, A. N., & Greenwald, A. G. (2011). Math-gender stereotypes in elementary school children. *Child Development, 82*, 766-779. https://doi.org/10.1111/j.1467-8624.2010.01529.x.

Fryer, R., & Levitt, S. (2010). An empirical analysis of the gender gap in mathematics. *American Economic Journal: Applied Economics, 2*9(2), 210-240. https://doi.org/10.1257/app.2.2.210.

Fukaya, T., Uesaka, Y., Ota, Y., Koizumi, K., & Ichikawa, S. (2017). Improving students' performance in an elementary mathematics class: Focusing on students' knowledge acquisition, utilization, and learning strategies using a "thinking after instruction" approach. *Japanese Journal of Educational Psychology, 65*(4), 512-525. https://doi.org/10.1111/10.5926/jjep.65.512.

Ghasemi, E., Burley, H., & Safadel, P. (2019). Gender differences in general achievement in mathematics: An international study. *New Waves Educational Research & Development, 22*(1), 27-54.

Hall, C. W., Davis, N. B., Bolen, L. M., & Chia, R. (1999). Gender and racial differences in mathematical performance. *The Journal of Social Psychology, 139*(6), 677-689. https://doi.org/10.1080/00224549909598248.

Harris, D., Lowrie, T., Logan, T., Hegarty, M. (2021). Spatial reasoning, mathematics, and gender: Do spatial constructs differ in their contribution to performance? *British Journal of Educational Psychology, 91*(1), 409-441. https://doi.org/10.1111/bjep.12371.

Heidari, R. & Rejabi, F. (2017). An investigation of the relationship between mathematics performance of students in a non-routine problem, according to grade and gender. *International Journal of Innovation in Science and Mathematics Education, 25*(3), 11-19.

Hasni Shamsuddin, Nordin Abd. Razak, Lei Mee Thien, & Ahmad Zamri Khairani. (2020). Do boys and girls interpret mathematics test items similarly? Insights from Rasch model analysis. *Asia Pacific Journal of Educators and Education, 35*(1), 17-36. https://doi.org/10.21315/apjee.35.1.2.

Hinnant-Crawford, B. N., Faison, M. Z., & Chang, M. L. (2016). Culture as mediator: Co-regulation, self-regulation, and middle school mathematics achievement. *Journal for Multicultural Education, 10(*3), 274-293. https://doi.org/10.1108/JME-05-2016-0032.

Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind(3rded.)*. New York, NY: McGraw-Hill.

Hu, X., Leung, F. K. S., & Teng, Y. (2018). The Influence of culture on students' mathematics achievement across 51 countries. *International Journal of Science and Mathematics Education, 16*, 7-24. https://doi.org/10.1007/s10763-018-9899-6.

Kamoo, G. (2015). Pengaruh latar belakang keluarga dan pencapaian akademik pelajar India di Malaysia. *Jurnal Penyelidikan Pendidikan, 16*, 110-123.

Kevelson, M. J. C. (2019). The measure matters: Examining achievement gaps on cognitively demanding reading and mathematics assessments. *ETS Research Report Series, 2019 (1),* 1-28. https://doi.org/10.1002/ets2.12278.

Lachance, J. A., & Mazzocco, M. M. M. (2005). A longitudinal analysis of sex differences in math and spatial skills in primary school age children. *Learning and Individual Differences, 16*, 195-216. https://doi.org/10.1016/j.lindif.2005.12.001.

Liu, O. L., & Wilson, M. (2009). Gender differences in large-scale math assessments: PISA trend 2000 and 2003. *Applied Measurement in Education, 22*, 164-184. https://doi.org/10.1080/08957340902754635.

Matteucci, M., & Mignani, S. (2021). Investigating gender differences in mathematics by performance levels in the Italian school system. *Studies in Educational Evaluation, 70*, 101022. https://doi.org/10.1016/j.stueduc.2021.101022.

McGraw, R., Lubienski, S. T., & Strutchens, M. E. (2006). A closer look at gender in NAEP mathematics achievement and affect data: Intersections with achievement, race/ethnicity, and socioeconomic status. *Journal for Research in Mathematics Education, 37*(2), 129-150. https://doi.org/10.2307/30034845.

Ministry of Education (2016). *Dokumen standard kurikulum dan pentaksiran matematik Tingkatan 1(English version)*, Putrajaya, Kementerian Pendidikan Malaysia.

Ministry of Education (2016). *Dokumen standard kurikulum dan pentaksiran matematik Tingkatan 2*, Putrajaya, Kementerian Pendidikan Malaysia.

Ministry of Education (2017). *Dokumen standard kurikulum dan pentaksiran matematik Tingkatan 3*, Putrajaya, Kementerian Pendidikan Malaysia.

Nachiappan, S., Muthaiah, L., & Suffian, S. (2017). Analisis sikap murid terhadap mata pelajaran Sains di Sekolah Jenis Kebangsaan (Tamil). *Jurnal Pendidikan Sains dan Matematik Malaysia, 7*(2), 85-105. https://doi.org/10.37134/jpsmm.vol7.2.7.2017.

Najua Syuhada, A. A., Mohd Salleh, A., & Abdul Halim, A. (2017). Hindering factors in mastering higher-order thinkings skills: Application of Rasch measurement model. *Man in India*, *97*(19), 275-280.

National Center for Education Statistics (2013). *The nation's report card*, Washington, DC: Institute of Education Sciences, US Department of Education.

Penner, A. M., & Paret, M. (2008). Gender differences in mathematics achievement: Exploring the early grades and the extremes. *Social Science Research, 37*, 239-253. https://doi.org/10.1016/j.ssresearch.2007.06.012.

Rocha, L. E. C., & Nascimento, L. F. (2019). Assessing Student's Achievement Gaps between Ethnic Groups in Brazil. *Journal of Intelligence, 7*(1), 7.

doi: 10.3390/jintelligence7010007.

Royer, J. M., & Walles, R. (2007). Influences of gender, ethnicity, and motivation on mathematical performance, in D. B. Berch & M. M. M. Mazzocco (Eds.). *Why is math so hard for some children? The nature and origins of mathematical learning difficulties and disabilities*. Paul H Brookes Publishing, Baltimore, MD, US, pp. 349-367.

Semeraro, C., Giofrè, D., Coppola, G., Lucangeli, D., & Cassibba, R. (2020). The role of cognitive and non-cognitive factors in mathematics achievement: The importance of the quality of the student-teacher relationship in middle school. *PLoS ONE*, *15*(4). e0231381. https://doi.org/10.1371/journal.pone.0231381

Sam, L. C. (2003). Cultural differences and mathematics learning in Malaysia. *The Mathematics Educator, 7*(1), 110-122.

Saw, G. K. (2016). Patterns and trends in achievement gaps in Malaysian Secondary Schools (1999–2011): gender, ethnicity, and socioeconomic status. Educational Research Policy and Practice, *15*, 41-54. https://doi.org/10.1007/s10671-015-9175-2.

Saw, G., & Chang, C.-N. (2018). Cross-lagged models of mathematics achievement and motivational factors among Hispanic and non-Hispanic high school students. *Hispanic Journal of Behavioral Sciences, 40*(2), 240–256. https://doi.org/10.1177/0739986318766511.

Subra, T. H., Abdullah, M. A. I. L., & Devi, K. (2019). Family's socio-economic influence on the dropout of Indian students: A case study in the district of Kuala Muda Kedah. *International Journal of Modern Trends in Social Sciences, 2*(9), 77-91. https://doi.org/10.35631/IJMTSS.29007.

Thien, L.M. (2016). Malaysian students' performance in mathematics literacy in PISA from gender and socioeconomic status perspectives. *Asia-Pacific Education Researcher, 25*, 657-666. https://doi.org/10.1007/s40299-016-0295-0.

Tsui, M. (2007). Gender and mathematics achievement in China and the United States. *Gender Issues, 24*, 1-11. https://doi.org/10.1007/s12147-007-9044-2.

Yoong, S., Santhiram, R., Fatimah, S., Lim, C. S., & Munirah, G. (1997). *Basic number concepts acquisitions in mathematics learning: An exploratory cross-cultural study*. Unpublished Research Report.