

The Relationship between Mental Calculation Ability and Score in Mathematics Subject among Primary School Students in Zone Jempol

Aszila Asmat, Nazihah Ismail, Nazirah Ramli
Faculty of Computer and Mathematical Sciences
Universiti Teknologi MARA (Pahang)
26400 Jengka, Pahang DarulMakmur
aszila@pahang.uitm.edu.my

Jumaina Jusoh
SekolahKebangsaan LKTP Jengka 5
Wilayah Persekutuan Kuala Sentul
26500 Maran
Pahang, Malaysia

Abstract— Mental calculation can be defined as the ability to carry out the arithmetical operation without using any external device. The ability becomes the most important skills needed in daily activities, for example to calculate duration of time needed in order to reach to a destination, to compute daily expenses for food and beverages, and to measure the distance from one location to another. Furthermore, it is vital in Mathematics subject especially for primary school students. Therefore, this study aims to identify the relationship between mental calculation ability and the score for Mathematics subject. In order to achieve the objective, data of 152 primary school students were obtained. The ordinal regression analysis was used to identify the relation between the variables. From this study, it is found that there is a fairly strong correlation between mental calculation ability and Mathematics score. Students with weak, average and good mental calculation ability tend to get lower grade in Mathematics subject compared to those who are excellent. Thus, based on the finding, it is hoped that it can provide some useful information to those who involve in the process of teaching and learning Mathematics subject in primary school.

Keywords— *Mental calculation, Mathematics, regression*

I. INTRODUCTION

Generally, the main goals of Primary School Mathematics Curriculum are to help students to acquire the basic computation skills and the ability to use these skills to solve problems. In summary, the curriculum is outlined so that the students will be able to solve their daily routines problems effectively. The problems may involve numbers, weight, measurement, money, distance, space and time. In line with this, the ability of mental calculation becomes the most important skills as the skills will be applied constantly to the students' real life experiences. Furthermore, in Mathematics examination for primary school students, paper 1 specifically emphasises the students to apply mental calculation skills in answering objective questions where 60 minutes is given to solve 40 questions.

According to Sowder[1], mental calculation is the process of carrying out the arithmetical operations without

using any tools or devices. Mental calculation is the technique which comprises arithmetical calculations using only the human brain, and this does not exclude the need for recording symbolization to assist mathematical reasoning [2]. In addition, mental computation encourages students to devise ingenious computational short cuts and helps them to understand the relationship between numbers [3]. As stated by Maclellan [4], mental calculation has to be understood and acknowledged in all its complexity. It should not be categorized simplistically and exclusively.

Meanwhile, Thompson [5] has suggested that mental calculation strategies are about calculating and finding answers for the combination of number facts with specific properties of the number system, at a faster rate. Students are able to use different solutions in answering a particular question, and the strategies will be based on their mental calculation ability. This implies that mental calculation skills are closely related to the ability to master in subtraction, addition, multiplication and division basic facts. Furthermore, the skills are commonly applicable impractical situations on daily basis routines [6]. To perform accurately, mastering basic mathematics facts requires recapping, recollecting the facts at a fast rate. Haring and Eaton [7] have referred the ability as fluency while [8] defined the ability as automaticity. Students who able to respond quickly or automaticity, will complete the task at a faster rate. This will allow them likely to have more opportunities to respond, which can enhance accuracy, fluency and maintenance [9]. Therefore, in this preliminary work, the researchers try to relate the relationship between mental calculation ability and the score for Mathematics subject.

II. RESEARCH METHODOLOGY

A. Participants

The sample consisted of 152 Year 6 students from four different primary schools in zone Jempol. There are total of 12 primary schools in the zone, however due to some limitations only SK Jengka 1, SK Jengka 3, SK Jengka 5, and SK Jengka 10 were involved in the present study. All

Year 6 students from the four selected schools were participated.

B. Instruments

In order to investigate the mental calculation ability/skill among students, a set of mental calculation question, referred as metal calculation test was developed and used to collect the data in the study. The mental calculation test contains 100 questions with 25 addition questions, 25 subtraction questions, 25 multiplications and the rest are division questions. Students are only allowed to complete the test in 60 minutes. Marks of the test were calculated in term of percentage and then classified to four different levels of achievement as stated in the Table 1.

TABLE I. LEVEL OF ACHIEVEMENT

Mark (in percentage)	Level of Achievement
0 to 39	Weak
40 to 59	Average
60 to 79	Good
80 to 100	Excellent

This study is interested to identify the students' achievement in Mathematics subject; therefore the result of Ujian Penilaian Sekolah Rendah (UPSR) trial examination for Mathematics of each student was obtained and used in this study.

C. Procedure

The Statistical Procedures for Social Sciences (SPSS) 20.0 (SPSS Inc, 2008) was used to code and analyze the data. Firstly, the data were tested for the correlation to see whether there is a relationship between the two variables as mentioned earlier. The analysis continued with the Chi-square test whereas the analysis shows the ordinal regression model is fit to the data. Then the goodness of fit was tested to signify the consistency of the internal component. The proportion of variation of the response variable was assessed through Nagelkerke statistic.

III. FINDINGS AND DISCUSSION

Total of 152 Year 6 students from primary schools in zone Jempol were involved in the study with 48% of them are male and 52% are female. The students were from four different schools namely SK Jengka 1, SK Jengka 3, SK Jengka 5 and SK Jengka 10. The details about the selected primary schools along with the number of sample chosen are shown in the Table 2.

TABLE II. THE DISTRIBUTION OF STUDENTS ACCORDING TO SCHOOLS

Name	Number of students
SK Jengka 1	43
SK Jengka 3	48
SK Jengka 5	21
SK Jengka 10	40

The results of the mental calculation test shows that only 100 (66%) students are able to answers the entire question in 60 minutes while 52 (34%) students are unable to complete according to the time duration given.

In this study, Mathematics grade is selected as the response variable, to be predicted by the mental calculation ability. There are four levels of mental calculation ability (coded 1= weak, 2=average, 3=good, 4=excellent) and four grades for Mathematics subject (A, B, C, D). Both level of measurements are in ordinal form suggested the spearman's rank correlation to be performed in order to identify the relationship between them. The result of spearman's rank analysis revealed that the correlation is highly significant since p-value is less than 0.05 (p-value=0.000). Meanwhile, the correlation coefficient of 0.529 revealed that there is a positive fairly strong relationship exists between mental calculation ability and Mathematics grade. Therefore, ordinal regression analysis can be carried out for further analysis.

Before conducting the ordinal regression analysis, the test for model fitting was first examined. Result in Table 3 gives the -2 Log Likelihood value for the model without any predictor variables (intercept only) of 96.469, whereas the final model with at least one predictor is added to the model has the value of 40.902. The Chi-Square test of 55.567 (p-value=0.000) revealed that the final model is significant which indicates that the ordinal regression model gives a significant improvement and has the ability to predict the outcome. Referring to the goodness of fit as shown in Table 4, the insignificant result for both pearson (p-value = 0.224) and deviance statistics (p-value = 0.109) show that the model is consistent and fit the data very well.

TABLE III. MODEL FITTING

Model	-2 Log Likelihood	Chi-Square	df	p-value
Intercept only	96.469			
Final	40.902	55.567	3	0.000

TABLE IV. GOODNESS OF FIT

	Chi-Square	df	p-value
Pearson	8.198	6	0.224
Deviance	10.398	6	0.109

Referring to the parameter estimates in Table 5, mental ability of level 1 (weak), 2 (average) and 3 (good) are statistically significant to model since the p-values of the three coefficients are less than 0.05. The results indicate that there is an existence in a relationship between mental calculation and Mathematics grade. The coefficient for weak mental ability of -3.845 shows for any grades, students with weak mental calculation ability scores lower than excellent students in Mathematics subject. In addition, students leveled as in average and good mental calculation ability also score lower than excellent students with coefficients of -2.046 and -2.344 respectively.

The results also revealed that one unit increases in mental calculation ability (from weak to excellent), it is expected that 0.03 increases the odds of getting higher in Mathematics grade, while the other variables held constant. Students with average mental calculation ability increased the odds of getting higher score in Mathematics subject by a factor of 0.13 times. Furthermore, students with average mental calculation ability are 0.10 times more likely to get higher grade in Mathematics subject.

TABLE V. PARAMETER ESTIMATES

		Estimate	Std Error	Wald	df	Sig.
Threshold	[Test=A]	-7.079	1.410	25.214	1	0.000
	[Test=B]	-5.119	1.338	14.633	1	0.000
	[Test=C]	-3.766	1.336	7.950	1	0.005
Location	[MentalAbility=1]	-3.845	0.662	33.771	1	0.000
	[MentalAbility=2]	-2.046	0.708	8.355	1	0.004
	[MentalAbility=3]	-2.344	0.734	10.202	1	0.001

Results from performing the Pseudo R-square statistics indicates that the mental calculation explains about 32.7% of the variation between students in the Mathematics results for trial examination (Nagelkerke = 0.327), while the other 67.3% can be explained by the other predictors.

IV. CONCLUSION AND RECOMMENDATION

This study represents the relationship between mental calculation ability and Mathematics grade among primary school students. In order to have better understanding about the relationship of the two variables, spearman’s rank correlation was first examined. Then, the results were obtained in this study show that there is a significant relationship exists between mental calculation ability and Mathematics grade. The analysis continued with the ordinal

regression model to get better understanding of the correlation between the two variables. The results also revealed that mental calculation ability associated with the grade for Mathematics subject. In addition, students with weak, average and good mental calculation ability tend to score lower grade in Mathematics subject compared to those who are excellent.

In this study, only score for mental calculation test is known to predict students’ grade in Mathematics subject. Therefore, it is suggested for future study to include more variables that may influence students’ grade in Mathematics subject. Thus, by having this finding, it is hoped could provide some useful information to those who are involved in the process of teaching and learning Mathematics subject in primary school.

REFERENCES

- [1] J. Sowder, “Mental computation and number comparison: Their roles in the development of number sense and computational estimation, In Heibert& Behr (Eds.),” Research Agenda for Mathematics Education: Number Concepts and Operations in the Middle Grades, 1988, pp 192-197, 1988.
- [2] T. Harries, and M. Spooner, “Mental Mathematics for the Numeracy Hour,” London : David Fulton, 2000
- [3] G. R. Morgan, An analysis of the nature and function of mental computation in primary mathematics curricula. Phd Thesis. Queensland University of Technology, 1999.
- [4] E. Maclellan, “Mental Calculation: its place in the development of numeracy,” Westminster Studies in Education, 24(2), 145 – 154, 2001.
- [5] I. Thompson, “Mental calculation strategies for addition and subtraction - part 2,” Mathematics in School, 29 (1), 24 - 26.1999.
- [6] R. Gusty, The Importance of Mental Calculation Skills: A Review of Literature. Master’s Project.Rochester Institute of Technology, 2002.
- [7] N. G. Haring, and M. D. Eaton, “Systematic instructional procedures: An instructional hierarchy,” The fourth R: Research in the classroom, 23-40, 1978.
- [8] T. S. Hasslebring, L. L. Goin & J. D. Bransford, “Developing automaticity,” Teaching Exceptional Children, 19(3) 30 – 33, 1987.
- [9] J. J. Ivarie, “Effects of proficiency rates on later performance of recall and writing behavior”, Remedial and Special Education, 7, 25 – 30, 1986.