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Mathematical Problem-Solving Skills and Career Choices in Mathematics across Gender

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ABSTRACT

This study highlights the importance of helping students discover and better comprehend their level of mathematics problems solving skill and its relationship to their mathematics career choice. Purposive sampling was used as a method for data collection. A questionnaire consisting of two different sections seeking students' background, their mathematical problem-solving skills, and career choice were given to the students. All the marks and data gathered were tabulated, summarized, and analyzed using the Statistical Package for Social Sciences (SPSS) version 18. ANOVA analysis was used to analyze the data gathered. The data analysis reveals that there is a relationship between mathematical problem-solving skills and career choices in mathematics among upper secondary school students. Secondly, there is no relationship between mathematics problem-solving skills and the student's career choice in mathematics across gender. It is recommended that future research employs bigger sampling for generalization purposes.

Keywords: Mathematics Problem Solving, Career Choice.

1. BACKGROUND OF THE STUDY

Malaysia will move on to a highly advanced country in coming years. Former Prime Minister, Tun Dr Mahathir bin Mohamad had set a goal in order to become a high technology country in 2020. By 2020, the target focused is on the industrial segment as the core development of Malaysia (Farizah, 2008). In order to do so, Malaysia is changing the level of qualification requirement needed in workers. The availability of workers that are highly motivated, trained and educated affect the competitiveness and productivity of the industry.

Therefore, the preparations towards the career choices must be considered from the primary school in order to achieve the standard qualification of the workers. Career selection is one of many important choices the students will have to go through in determining their future. According to Jasbir (1976), a higher level of education is often associated with employment, income and a better social position. Mathematics may be a deciding factor in education that influences students' career choice. It is because according to Shoffner and Vacc (1999), 75% of the jobs in the future will require the use of computers which will involve mathematical competency. Osafehinti (1990) also mentioned that learning mathematics in schools is a basic preparation for adult life and a gateway to a vast array of career choices. If the students lack the required mathematical knowledge to pursue these technical careers, their career selections are going to be limited in the future.

In recent years, research has shown that the performance of mathematics in secondary school level is weak. According to the Ministry of Education (Syuhada, 2001), there are still many

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students who do not get satisfactory results in mathematics. This is due to the low skill level to solve the mathematics problem. Masmuda (1980) in his research found that students usually find subjects such as science, mathematics, and additional mathematics as difficult subjects and need to be studied with persistence. For secondary school students, learning mathematics is often regarded as a difficult and tedious learning process that takes place in a traditional classroom structure, memorizing mathematical formulas and doing exercises that require strong skills in answering the question (Koh Lee Ling *et al*, 2008). For these reasons, students' confidence level of mathematics will result in confused thinking, incompetence, low level of interest, and non-participation in class. This will also affect the level of mathematics problem-solving skill among the students.

Research by Scarpello (2005) indicates several factors that may influence a student's career decision in mathematics. Some factors could have more influence than others in the career selection process: especially social and economic factors (Hackett, 1994), gender (Stake, 1986), influences from parents (Otto, 2000) and peers (Harrison, 1987). However, very little study has been conducted on how mathematics problem-solving skill is affecting career choice in mathematics for the secondary school student. Thus, the focus of this study is to investigate the effect of mathematics problem-solving skill of secondary school student across gender, age and race in mathematics to the career choices in mathematics.

2. RESEARCH OBJECTIVE

The purpose of this study is to investigate the correlations of choosing math career based on mathematical problem-solving abilities, among the students in five selected secondary school. The objective of this research is as follows:

i. To identify the relations between students' gender with mathematical problems solving ability and how it influences their mathematics career choices.

This research will provide a better understanding of the education issues concerning secondary school students and their career choice in mathematics.

3. RESEARCH QUESTION

3.1 Research question 1

Is there any significant difference between mathematics problem-solving skills and career choices across gender?

4. SIGNIFICANT OF THE STUDY

This research was done to evaluate the mathematics career choice of students in five selected secondary school. The results of this study will be helpful for students, parents, guidance counsellors, teachers, and school administrators in helping them discover and better comprehend the level of mathematical problem-solving skill that affects the career choices of students in mathematics.

The teachers can help these students in assisting them towards a better understanding of mathematics knowledge. Teachers provide a significant impact on the success of the students in their class. Sanders (1997) stated that teacher is the most significant factor affecting student learning and that teacher who do not use effective instructional practices, will find their

students falling behind in their mathematics lessons compared to students who have been taught with effective instructional practices. The teachers have to be aware of the students' performance level in mathematics so that effective teaching strategies can be employed to increase student learning. The school must also take action to overcome the weaknesses of students' mathematics performance and increase their interest in mathematics. Finally, this study is important in order to observe the impact of gender differences in mathematics performance and their future career selection.

5. MATHEMATICAL PROBLEM-SOLVING SKILL ACROSS GENDER

Mathematics performance affected by the level of mathematical problem-solving skill differences by gender has been studied by many researchers. Jamil Ahmat *et al*. (2001) study has shown that girls have better achievement than boys in math performance in the Penilaian Menengah Rendah (PMR) and the Sijil Pelajaran Malaysia (SPM). In addition, the performance of boys also decreased each year. The same finding was stated by Wahid Hashim (2005), in the article of Utusan Malaysia entitled "Mathematics - strange scenario in Malaysia," said the girls are better than the boys in modern mathematics and additional mathematics. Rosliza Mohd Taha in Utusan Malaysia supports the finding by showing examination results from 1996 to 2007. It showed that female students have an overall better performance than male students in almost all subjects for Ujian Pencapaian Sekolah Rendah (UPSR) and PMR. While for SPM, the girls have surpassed boys in most of the subjects such as Malay (BM), English, Mathematics and Science.

While many researchers said that female students are better than male students in term of Math performance, Zheng (2007) has reported vice versa. He reported that male students perform better than female students in terms of mathematics problem-solving skills, but this result was limited to high ability students on standardized mathematics tests. Abu Bakar *et al*. (2009) supported Zheng findings by proving that the achievement of male students' outperformed female students with a mean score of 59.33. In her study entitled "Pencapaian Dan Penguasaan Konsep Dalam Matematik Peringkat SPM", she has shown that the boys showed better performance in skills such as a single fraction, simultaneous equations, angles and geometry.

According to Cobelan and Nebraska (2006), the level of mathematics problem-solving skill is often associated with self-efficacy that allowed gender separation. The females are less likely to seek challenges compared to male and have higher doubt about their own capabilities than men do (Niederle and Yestrumskas, 2008). Pajares and Graham (1999) have also supported the findings in their research by stating that the boys tend to be more overconfident compared to girls who are more under-confident when it comes to the prediction on how they will do in maths.

Meanwhile, Tartre and Fennema (1991) found that the females that have seen mathematics as a sole domain will contribute to lower mathematics achievement. In single-gender school, females who did not see mathematics as a male domain will tend to have higher mathematics achievement.

Fennema and Sherman (1977, 1978) studied the gender-related difference in participation and achievement. They found that gender differences in the selection of higher level mathematics courses. They have made such hypothesis that if the female students participate in the higher level of mathematics classes at the same rate as the male students did, the gender differences would disappear. Stanley and Benbow (1980) refused Fennama and Sherman hypothesis and argued that the gender differences in mathematics were genetic. This claim has been widely attacked and disproved, but whose publication had unfortunate repercussions (Jacobs and Eccles, 1985).

6. CAREER CHOICE IN MATHEMATICS ACROSS GENDER

There are many factors that contribute to career choice. One of them is gender identification. Simpkins and Davis-Kean (2006) reported about gender differences in self-concepts and career aspirations. Females were described having a high science ability self-concept. They were less likely than males to aspire career related to mathematics and physical science, and more interested in a career related to health and biology. For men, mathematics efficacy is seen as fulfilling masculine sex role expectation. The career choice somehow is in connection with the subjects they were taking in schools.

Students should study subjects that are related to their ambition. Studying subjects with much interest will help the students to understand the subject better. Research by Tobias (1981) showed that the avoidance of mathematics in adolescent and women appears to be rooted in sex-role socialization. According to Shamsulbahriah (1989), in the educational process, girls will tend to choose subjects that are more towards "femininity" such as English and History while the boys are more towards "manly" subject that can challenge themselves such as Mathematics. Singer and Stake (1986) said that success in mathematics has a different meaning for both women and men.

Research by Tobias (1981) indicates that about one percent of female and male in any large state university will major in mathematics. However, the percentage of women taking mathematics subject in small institutions is only 30 percent out of the 100 percent from the large university. Anderman (1998) said that gender influences mathematics achievement among students. Thus, it will also affect their career choices. Females usually have a less positive view of their mathematics ability and have less educational and career choice than males.

7. RESEARCH DESIGN

The survey research design was used to collect data for this study. According to Creswell (2002), survey designs are used to understand the attitudes, opinions, behaviours, or characteristics of the population by conducting a survey to a sample or to the entire population. The instrument used for data collection was a set of a questionnaire consisting of two different parts; students' demographic background, and a students' mathematics problem-solving skills and career choice. A pilot test was conducted to check the validity of the questionnaire and the data was collected by following the appropriate procedure. The method of data collection was described in details as follows.

8. POPULATION

The population of this study was taken from Form 4 and Form 5 from upper secondary school students in the district of Alor Setar, Kedah. Since this study is only a descriptive study, 5 schools were conveniently selected to participate in this study. These five schools would be selected based on their overall performance as assessed by the Kuantan Educational Department. The five selected schools consist of 1 cluster schools which is SMK Sultanah Asma and the remaining 4 are ordinary government schools (SMK Sultanah Bahiyah, SMK Syed Omar, SMK Tengku Abdul Malik and SMK Tanah Merah) that are located around the vicinity of Kedah town.

9. RESEARCH FINDINGS

The results and findings were intended to answers the following research question:

Research Question 1: Relationship between mathematics problem-solving skills and the student's career choice in mathematics across gender.

Table 1.0 indicates respondents' significant difference between mathematics problem-solving skills and student's career choice in mathematics across gender. Based on the questionnaire collected, students' responses are illustrated in Table 1 and Table 2.

Table 1 Mean score across gender

Gender			N	Mean	SD
ccim	dimension1	Male	100	3.46	.59
		Female	100	3.35	.53
pss	dimension1	Male	100	3.34	.52
		Female	100	3.46	.44

Table 1.0 shows that males were observed to have higher mean score on the career choice in mathematics (mean = 3.46, SD = 0.59) compared to females (mean = 3.35, SD = 0.54). Meanwhile, for mathematics problem-solving skills shows that females have higher mean score (mean = 3.46, SD = 0.44) compared to male (mean = 3.34, SD = 0.53).

Table 2 Independent t-test: Mathematics problem solving skills and career choices in mathematics across gender

	Mean	SD	*df*	t	*p*
CCIM	.11582	.07992	198	1.45	.149
PSS	-.11970	.06905	198	1.73	.085

An independent t-test was computed to compare mathematics problem-solving skills and career choices in mathematics across gender. Based on Table 2, the results were interpreted using the t-test at $p < 0.05$, level of significance. Output for Levene's test for equality of variances in career choice in mathematics indicates a statistically non-significant p-value of 0.533, which is larger than 0.05. Based on the outcome, estimates from the equal variances were consulted. The results indicated that the differences between the means for males and females are statically insignificant (df =198; t = 1.45, p=0.149). It is the same with mathematics problem-solving skills. There is no significant difference in both means for male and female for mathematics problem-solving skills where t (df = 198; t = 1.73, p = 0.085).

In conclusion, when t-test was done to compare males and females across these two variables (Career Choice in mathematics and Mathematics Problem Solving Skills), there is no significant difference of mathematics problem-solving skills and career choices in mathematics across gender in this study. This indicates that there is no gender difference in mathematics problem-solving skills and career choices in mathematics.

10. CONCLUSION

The study found that there is no significant difference across gender. Thus, this finding disagrees with Jamil Ahmat *et al*. (2001) and Wahid Hashim (2005) which stated that female in

mathematics problem-solving skills performance is better than male. Meanwhile, the fact that gender differences in mathematical problem solving are not significant could be due to different factors that have biological, psychological and environmental origins, promise that education can play a great role in eliminating or reducing gender differences in mathematical problem-solving. On one hand, educators need to think about how to help all female and male students develop problem-solving abilities by using appropriate instruction. Moreover, educators need to consider critically the positive and negative impacts of classroom variables and make a conscious effort to promote gender equity in mathematics problem-solving skills.

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