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SELF-REGULATION TEST-TAKING STRATEGIES FOR MATHEMATICS

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ABSTRAK

Penelitian ini bertujuan untuk mengeksplorasi berbagai strategi pengambilan tes mandiri yang digunakan oleh siswa kelas 11 untuk tes matematika mereka yang diamati dari tiga aspek, yaitu sebelum, selama, dan setelah tes. Data dikumpulkan dari 86 siswa di sekolah swasta yang berlokasi di Malaysia. Pengaturan tujuan dan perencanaan, pencarian bantuan, mencari informasi, latihan, menghafal, meninjau, tekanan teman sebaya, pengaruh orang dewasa, konsekuensi diri, motivasi diri, dan pengaturan lingkungan adalah strategi yang digunakan untuk persiapan ujian. Garis besar rumus, mengingat dan mengidentifikasi informasi kunci, terus berusaha, dan memeriksa adalah strategi yang digunakan selama pengujian. Selain itu, koreksi dan evaluasi diri adalah strategi yang digunakan setelah ujian. Studi lebih lanjut menguji perbedaan dari berbagai strategi pengambilan tes yang digunakan di tiga kelompok kinerja, yang berprestasi tinggi, sedang, dan rendah, dan juga untuk siswa pria dan wanita. Hasil penelitian menunjukkan bahwa ada perbedaan statistik dalam penetapan tujuan dan perencanaan, pencarian bantuan, terus berusaha, memeriksa, dan memperbaiki strategi di antara orang yang berprestasi tinggi, sedang, dan rendah. Ada juga perbedaan statistik dalam penetapan tujuan dan perencanaan, latihan, motivasi diri, garis besar formula, memeriksa, dan strategi koreksi antara siswa laki-laki dan perempuan. Hasil dari penelitian ini menunjukkan bahwa kelompok yang menggunakan penetapan tujuan dan perencanaan, latihan, pencarian bantuan, mengingat dan mengidentifikasi informasi kunci, terus mencoba, memeriksa, dan strategi koreksi memiliki skor yang lebih tinggi dalam kinerja matematika daripada kelompok-kelompok yang tidak menggunakan strategi ini.

Kata kunci: prestasi tinggi, prestasi rendah, pengaturan diri, pengambilan tes

ABSTRACT

The present study aims at exploring various self-regulation test-taking strategies used by the grade 11 students for their mathematics tests which is observed from three aspects, they are before, during, and after test-taking. The data were collected from 86 students in a private school which located in Malaysia. The goal-setting and planning, help-seeking, seeking information, rehearsal, memorization, reviewing, peer pressure, adult influence, self-consequences, self-motivated, and environment setting were the strategies that is used for test preparation. Outline formulas, recall and identify key information, keep trying, and checking were the strategies used during test-taking. In addition, correction and self-evaluation were the strategies used after the test-taking. The study further examined differences of various test-taking strategies used across three performance groups, high, medium, and low achievers, and also for male and female students. The results showed that there were statistical differences in goal-setting and planning, help-seeking, keep trying, checking, and correction strategies among high, medium, and low achievers. There were also statistical differences in goal-setting and planning, rehearsal, self-motivated, outline formulas, checking, and correction strategies between male and female students. The result of this research showed that the groups of using goal-setting and planning, rehearsal, help-seeking, recall and identify key information, keep trying, checking, and correction strategies have higher scores in mathematics performance rather than those groups which do not use these strategies.

Keywords: high achievers, low achievers, self-regulation, test-taking

INTRODUCTION

Despite a great number of past studies discussed about the effort on increasing students' mathematics achievement, students' motivation in mathematics is gradually declined over the years (Ng, Liu, & Wang, 2016). To resolve this issue, self-regulation studies have gained attention in recent years because of its positive effects on students' academic achievement (Kitsantas, 2002; Ng et al., 2016; Zimmerman, 2002). Self-regulation can be defined as "self-generated thoughts, feelings, and behaviors that are oriented to attaining goals" (Zimmerman, 2002, p. 65). In general, self-regulation researchers contend that students self-regulate their motivations, behaviors, cognitive processes, or environmental variables based on their knowledge and experiences of using a variety of learning strategies (Fadlelmula, Cakiroglu, & Sungur, 2015; Zimmerman, 2002).

In view of self-regulation theory, self-regulated students appreciate poor performance as deployed deficient strategy; they exhibited greater self-satisfaction, and thus, adapt better to the situation (Bandura, 1991; Pintrich, 2004; Zimmerman, 2002). This group of students generally are highly motivated and efficacious; they tended to set learning goals, monitor their work progress, evaluate their learning outcomes, and persistent in challenging difficulties (Zimmerman, 1989; 2002). Instead of doubting personal capabilities, self-regulated students tend to seek help from others (Zumbrunn, Tadlock, & Roberts, 2011). They also apply appropriate strategies to facilitate their learning, ultimately leads to better academic performance (Boekaerts & Corno, 2005; Zumbrunn et al., 2011).

Though numerous research evident that self-regulation enhanced students' mathematics achievement through use of effective learning strategies (e.g., Azar, Lavasani, Malahmadi, & Amani, 2010; Fadlelmula et al., 2015), little research has examined types of self-regulation strategies used by students for mathematics test-taking and to what extent of these self-regulation strategies are related to their test performance (Kitsantas, 2002). While tests are common tool for instructional assessments of students' learning outcomes, particular for primary and secondary schools, it is critical to examine significance of self-regulation strategies for

mathematics tests so that effective and efficient strategies can be imposed for instructional design. In the literature, self-regulated learning is pivotal for lifelong learning. While self-regulation is not only helps to establish students' learning habits, but also regulating their self-regulation skills for better learning outcomes (Zumbrunn et al., 2011).

Nevertheless, some self-regulation strategies are beneficial to learning, but some strategies used by high and low achievers may lead to poor performance (Hong, Sas, & Sas, 2006). Therefore, it is essential to examine which strategies are beneficial for students, especially for low attainment students. These findings can be useful for educators or teachers to seize actions to enhance mathematics achievement (Ismail, 2009). In addition, Hong et al. (2006) stated most of the test-taking strategies researchers have focused on tertiary education students. Thus, it is important to expand the focus of test-taking strategies in mathematics studies for secondary school students.

PURPOSE OF THE STUDY

This study sought to identify the possible contributing self-regulation test-taking strategies used by the students that may enhance their mathematics achievement. As we discussed, self-regulated students tend to apply a set of volitional learning strategies to facilitate their learning. Students who apply maladaptive strategies tend to undermine their learning. Therefore, the present study assesses the possible contributing self-regulation test-taking strategies so that appropriate intervention can be designed for student learning. This is especially important for low attainment students. Low attainment students may be motivated if they are improving by using more effective strategies. Thus, self-regulation test-taking strategies serve as a facilitator role in student learning. In order to have more ideas about the differences of using various self-regulation test-taking strategies among the high school students, the present study also assesses the possible contributing strategies used by gender group and performance group.

Hence, this present study aims at exploring the possible self-regulation strategies used for mathematics test before test-taking, during test-taking, and

after test-taking among grade 11 students. The study also intends to identify self-regulation strategies used by high achievers, medium achievers, and low achievers, also by male students and female students. Then, the study aims at examining significance of differences of self-regulation strategies between gender and performance groups. Lastly, the study aims at exploring effects of these self-regulation strategies on mathematics performance. Thereby, this study was designed to address the following research questions:

(1) What are the self-regulation strategies used by the 11th grade students for mathematics test before test-taking, during test-taking, and after test-taking?

(2) Is there any significant differences of self-regulation strategies used by grade 11 students for mathematics test before test-taking, during test-taking, and after test-taking for performance group?

(3) Is there any significant differences of self-regulation strategies used by grade 11 students for mathematics test before test-taking, during test-taking, and after test-taking for gender group?

(4) What are the effects of self-regulation strategies used by grade 11 students on their mathematics performance?

RESEARCH METHOD

Participants

Because of the accessibility constraint to the classrooms and students, the current study used convenience sampling. The participants in this study were 86 eleventh-grade students (34 males and 52 females) that selected from 225 eleventh-grade students from a private school which located in Klang, Malaysia. The students are placed in mixed ability classes. The study used 85 valid cases for data analysis after omitting an influential case.

Instruments

Self-regulation test-taking strategies questionnaire. Because this study intends to identify as many as possible the self-regulation test-taking strategies used by students, thus, the study used 8 unstructured questions

to classify the strategies. The questionnaire aims at assessing students' self-regulation test-taking strategies used from three aspects: before, during, and after test-taking. To understand how the student prepares for the test, the following questions were asked:

(1) When teacher announce the date of mathematics test, when will you start to prepare for the test? How much time will you assign for the preparation?

(2) Do you have any specific method of preparing for a mathematics test? What do you do if you face difficulties during test preparation?

(3) Do you have any specific method to motivate yourself for mathematics test preparation?

(4) Do you have any specific environment setting to study for a mathematics test?

To understand how the student retrieves the information and their attitude during the test-taking, the following questions were asked:

(5) During the test-taking, do you have any specific method to retrieve the knowledge of the content?

(6) What will you do if you face a problem during test-taking? Do you have any specific method to solve the challenging problem?

(7) When you complete a mathematics test, do you have any specific method to validate the answer?

To understand what the students do after the mathematics test, the following questions were asked:

(8) What will you do after getting back your mathematics test paper? Do you have any specific method to deal with that?

The present study identified 17 different self-regulation test-taking strategies for mathematics tests. More specifically, the study identified 11 self-regulation test preparation strategies included: (a) goal-setting and planning (e.g., "I start for test preparation at least 4 days before exams, and I start by doing the exercises, review the textbook."); (b) rehearsal (e.g., "I practice the mathematics problem in the textbook."); (c)

memorization (e.g., "I memorize the formulas."); (d) reviews (e.g., "I read textbook or notes."); (e) help-seeking (e.g., "I ask a friend when I do not know how to solve the problem."); (f) self-consequences (e.g., "I treat myself with a bar of chocolate or playing the game or watching a movie for doing well in a test."); (g) self-motivated (e.g., "I want to score well in the test."); (h) peer pressures (e.g., "I bet with my peer for a reward."); (i) adult influences (e.g., "I do not want to disappoint my teacher."); (j) seeking information (e.g., "Besides exercises from the textbook, I practice problems from the reference book or search over the Internet."); and (k) environment setting (e.g., "I study in a quiet room to avoid any distraction."). The study also identified four during test-taking strategies: (a) outline mathematics formulas (e.g., "I outline the formulasbefore I answer for the test."); (b) recall and identify key information (e.g., "I recall example given by teacher or page number or color of the page of the particular content in the textbook when I faced the problem."); (c) keep trying (e.g., "I keep thinking and trying for the unsolved problem until time-up when I take the test."); and (d) checking (e.g., "I check the answer by redoing the questions or substitute to the questions for verification if multiple choice question."). Besides, two after test-taking strategies were identified: (a) self-evaluation (e.g., "I check mistakes of the test."); and (b) correction (e.g., "I correct the mistakes."). If the participant used the specific test-taking strategy for mathematics test, then he/she yielded 1 point for the specific strategy used, otherwise 0 for not using it. Finally, the study summed up the total number of self-regulation test-taking strategies used before, during, and after test-taking for each student.

Test performance. Test performance is calculated by averaging eight formative tests scores taken by students within an academic year (out of 100 marks). Three performance groups, high, medium, and low achievers were categorized based on 30% cut-off point of test performance. One influential case was omitted from the data, and thus, 27 students were categorized as low achievers (Mean: M = 51.09, Standard Deviation: *S.D.*=

1.85), 30 students were categorized as medium achievers (M = 72.63, *S.D.* = .92), and 28 students were categorized as high achievers (M = 88.16, *S.D.* = .79).

Mathematics performance. Mathematics performance is measured by averaging the school mid-term and year-end examination scores (out of 100 marks).

Procedure

At the beginning of the academic year, participants' first test scores were measured and considered as their prior ability of mathematics. The Kolmogorov-Smirnov test was used to determine whether the data follow a normal distribution. The null hypothesis of Kolmogorov-Smirnov test is defined as the data follow a normal distribution, whereas alternative hypothesis is defined as the data do not follow a normal distribution. The current research showed that the participants' prior ability of mathematics is followed a normal distribution (i.e., Kolmogorov-Smirnov test = .089, *df* = 85, *p-value* = .096>.05). An independent *t*-test analysis was conducted to determine whether students' prior ability were different from both classes before the study was conducted. Result showed that both classes exhibited no statistical difference on their prior ability (M = 66.6, *S.D.*= 23.0; M = 67.3, *S.D.*= 19.8). Students in the study were required to sit for a formative test after each chapter is taught. Both classes were taught under the same teacher and they took the same formative tests throughout the entire academic year.

At the end of last semester, participants were briefed clearly about the purpose of the study. They were asked to answer a self-regulation test-taking strategies questionnaire and urged to answer the questions with as much detail as possible. The questionnaire was conducted within the classroom. To make the answer more concrete, example was given to students so that they have better idea on the questions. For example, the researcher said, "For question 1, you may describe the answer like I started the revision two weeks before the test. Each day I allocate an hour for revision. I started by re-read the textbook or notes given by the teacher. Then I re-do all the exercises. I ask friend when I have difficulties. Or,

I started on a day before the test and I just read over the textbook for about two hours."

Data analysis

First, the study examined multivariate outlier issues by calculating the Mahalanobis' distance (Mahalanobis, 1936) of 17 self-regulation strategies. Results showed that one of the cases yielded a maximum Mahalanobis' distance of 44.53 (i.e., greater than critical chi-square value of 40.79 for *df* = 17 at significance level of .001). Thus, this subject was dropped from the data. The remaining 85 cases had a maximum Mahalanobis' distance of 39.38, indicating that the data do not contaminated by multivariate outliers. The present study applied descriptive statistics to identify various self-regulation test-taking strategies used by grade 11 students for mathematics test. The descriptive statistics also exhibited for various self-regulation strategies used across different performance and gender groups. Because 17 self-regulation test-taking strategies were measured as binary data (i.e., 1 represents used it, 0 represents not used it), thus, the study applied chi-square contingency test to analyze differences of various self-regulation strategies across three performance groups (i.e., low, medium, and high achievers) and two gender groups (i.e., male and female students). To examine the significance of differences of self-regulation test-taking strategies on mathematics performance, the study applied non-parametric Mann-Whitney U (Mann & Whitney, 1947) test due to data were not normally distributed.

RESULTS

Self-Regulation Test-Taking Strategies Used by Grade 11 Students

Table 1 shows the frequency distribution of number of self-regulation test-taking strategies used by the students. Overall, the students reported they used 2 to 12 strategies out of total 17 strategies. More than half of the students (i.e., 54%) reported use of at least 8 self-regulation test-taking strategies. Concerning number of self-regulation strategies used by students for test preparation, more than half of the students (i.e., 58.5%) reported they used 5 to 7 of the strategies out of 11

strategies. Of these, the majority of the students (i.e., 42.4%) reported they used 5 of them. With regard of number of strategies used during test-taking, 64.7% of the students reported they used at least 2 out of 4 strategies. However, there were 8.2% of the students exhibited used zero strategies during test-taking and 10.6% of the students reported neither do correction nor self-evaluation after test-taking. Despite that, students engaged in self-evaluation and correction activities after test-taking were considered high (i.e., 89.4%).

Table 1. Number of Self-Regulation Test-Taking Strategies Used by Students

Number of Self-Regulation Strategies Used	Number of Students	Percent
Before Test-Taking		
1	2	2.4
2	6	7.1
3	16	18.8
4	11	12.9
5	36	42.4
6	11	12.9
7	3	3.5
During Test-Taking		
0	7	8.2
1	23	27.1
2	26	30.6
3	26	30.6
4	3	3.5
After Test-Taking		
0	9	10.6
1	39	45.9
2	37	43.5
Overall		
2	1	1.2
3	3	3.5
4	4	4.7
5	5	5.9
6	16	18.8
7	10	11.8
8	14	16.5
9	9	10.6
10	13	15.3
11	6	7.1
12	4	4.7

Table 2 presents the mean and standard deviation of 17 self-regulation test-taking strategies used by the students. Since self-regulation test-taking strategies for mathematics test were measured using a dichotomous code, 1 point for used it and 0 point for not used it; therefore, the average score is categorized as 0 to 0.33 for low level, 0.34 to 0.67 for medium level, and 0.68 to 1.00 for high

level. Results showed that students in this study moderately applied a set of self-regulation test-taking strategies for their mathematics tests, regardless before, during, or after test-taking. However, the study found that the students highly applied rehearsal (*M* = .87, *S.D.* = .35), help-seeking (*M* = .88, *S.D.* = .32), and environment setting (*M* = .70, *S.D.* = .46) strategies when they prepared for the tests. While doing the tests, they tended to keep trying (*M* = .74, *S.D.* = .44) in solving the questions. With regard to actions after the test-taking, they highly engaged in self-evaluation strategy to self-judge their learning outcomes (*M* = .86, *S.D.* = .35). In this study, students generally did not seek for extra information and regulate self-consequences behavior (i.e., punish or rewards one for failure or success) when prepared for their mathematics tests. Their social pressures also did not influence them for test preparation. In addition, they also revealed as having weak practices on outline the relevant formulas, recall and identify the key information when they faced problem during test-taking.

Table 2. Mean, Level of Measurement, and Standard Deviation of Self-Regulation Test-Taking Strategies

Self-Regulation Strategies	Mean	*S.D.*	Level
Before Test-Taking	.40	.12	M
Goal Setting and Planning	.27	.45	L
Rehearsal	.87	.34	H
Memorization	.35	.48	M
Reviews	.61	.49	M
Seeking Information	.08	.28	L
Help-Seeking	.89	.31	H
Self-Consequences	.08	.28	L
Self-Motivated	.45	.50	M
Peer Pressure	.02	.15	L
Adult Influence	.06	.24	L
Environment Setting	.69	.46	H
During Test-Taking	.49	.26	M
Outline Formulas	.32	.47	L
Recall and Identify	.29	.46	L
Keep Trying	.74	.44	H
Checking	.59	.50	M
After Test-Taking	.66	.33	M
Correction	.47	.50	M
Self-Evaluation	.86	.35	H

Self-Regulation Test-Taking Strategies Used by High Achievers, Medium Achievers, and Low Achievers

Table 3 shows the mean and standard deviation of self-regulation test-taking strategies used by three performance groups: low, medium, and high achievers. Results showed that all performance groups possessed moderate degree of level in using various self-regulation strategies before test (Low Achievers: *M* = .34; Medium Achievers: *M* = .40; High Achievers: *M* = .45) and during test-taking (Low Achievers: *M* = .37; Medium Achievers: *M* = .48; High Achievers: *M* = .61). However, high achievers possessed high degree of level in using self-regulation strategies after test-taking compared to low and medium achievers (Low Achievers: *M* = .56; Medium Achievers: *M* = .67; High-Achievers: *M* = .77). Despite that, results indicated that the mean scores of using various self-regulation strategies have increased across three performance groups in all aspects, before, during, and after test-taking. High achievers are more prone to use various self-regulation test-taking strategies to facilitate their learning.

Table 3. Mean, Level of Measurement, and Standard Deviation of Self-Regulation Test-Taking Strategies among Low, Medium, and High Achievers

	Low-Achievers			Medium-Achievers			High-Achievers		
Self-Regulation Strategies	M	*SD*	Level	M	*SD*	Level	M	*SD*	Level
Before Test-Taking	.34	.13	M	.40	.10	M	.45	.11	M
Goal Setting and Planning	.07	.27	L	.27	.45	L	.46	.51	M
Rehearsal	.78	.42	H	.87	.35	H	.96	.19	H
Memorization	.48	.51	M	.23	.43	L	.36	.49	M
Reviews	.59	.50	M	.53	.51	M	.71	.46	H
Seeking Information	.04	.19	L	.13	.35	L	.07	.26	L
Help-Seeking	.74	.45	H	1.00	.00	H	.93	.26	H
Self-Consequences	.11	.32	L	.03	.18	L	.11	.31	L
Self-Motivated	.30	.47	L	.50	.51	M	.54	.51	M
Peer Pressure	.04	.19	L	.03	.18	L	.00	.00	L
Adult Influence	.07	.27	L	.07	.25	L	.04	.19	L
Environment Setting	.56	.51	M	.70	.47	H	.82	.39	H
During Test-Taking	.37	.22	M	.48	.26	M	.61	.24	M
Outline Formulas	.37	.49	M	.27	.45	L	.32	.48	L
Recall and Identify	.19	.40	L	.30	.47	L	.39	.50	M
Keep Trying	.52	.51	M	.80	.41	H	.89	.31	H
Checking	.41	.50	M	.53	.51	M	.82	.39	H
After Test-Taking	.56	.32	M	.67	.33	M	.77	.32	H
Correction	.30	.47	L	.47	.51	M	.64	.49	M
Self-Evaluation	.81	.40	H	.87	.35	H	.89	.31	H

Specifically, high achievers highly engaged in rehearsal, reviews, help-seeking, environment setting, keep trying, checking, and self-evaluation for their test-taking. Analogous to high achievers, medium achievers also highly engaged in these self-regulation test-taking strategies, except for reviews and checking strategies. Medium achievers revealed as having moderate degree of level in reviewing before sit for the test and checking for answers during test-taking. Low achievers only showed highly engaged in three self-regulation test-taking strategies: rehearsal, help-seeking, and self-evaluation. In general, low achievers possessed low degree of level in using most of the strategies (i.e., 8 out of 17), included goal-setting and planning, seeking information, self-consequences, self-motivated, peer pressure, adult influence, recall and identify key information, and correction. However, medium achievers also revealed as having low degree of level in using 8 out of 17 strategies, included goal-setting and planning, memorization, seeking information, self-consequences, peer pressure, adult influence, outline formulas, and recall and identify key information. Medium achievers were found moderately self-motivated to score well for their tests and engaged in correction after test-taking than low achievers.

Table 4 shows the chi-square test of various self-regulation test-taking strategies across three performance groups. For zero cells that have expected count less than 5, the present study used Pearson chi-square test to verify the test of association; otherwise, the present study used likelihood ratio chi-square test (also known as G-test). Results showed that there were significant differences in using two self-regulation strategies for test preparation (i.e., goal-setting and planning, and help-seeking) across three performance groups. The majority of the high achievers stated that they will allocate enough time to revise and prepare for their test, where the test preparation time is at least 4 days before the test is conducted compared to medium and low achievers (Low Achievers: M = .07; Medium Achievers: M = .27; High Achievers: M = .46). Though all performance groups revealed as having high degree of level in seeking help before the test, however, almost all medium and high achievers showed greater association in seeking help for test preparation compared to low achievers (Low Achievers: M = .74; Medium Achievers: M = 1.00; High Achievers: M = .93).

With regard of self-regulation strategies used during test-taking, results showed that the performance groups had significant differences in regulating keep trying and checking strategies while taking for a test. The medium and high achievers possessed high degree of level in keep trying for the unsolved questions, while low achievers possessed medium degree of level (Low Achievers: *M* = .52; Medium Achievers: *M* = .80; High Achievers: *M* = .89). Besides, the high achievers revealed as having high degree of level in checking for their test answers when they are taking for a test compared to medium degree of level held by medium and low achievers (Low Achievers: *M* = .41; Medium Achievers: *M* = .53; High Achievers: *M* = .82). Concerning self-regulation strategies used after the test-taking, high and medium achievers revealed significant differences in practicing correction for the mistakes compared to low achievers (Low Achievers: *M* = .30; Medium Achievers: *M* = .47; High Achievers: *M* = .64).

Table 4. Chi-Square Test of Self-Regulation Test-Taking Strategies and Three Performance Groups

Self-Regulation Strategies	Pearson Chi-Square Value	*df*	*p* Value	Likelihood Ratio Chi-Square Value	*df*	*p* Value
Before Test-Taking						
Goal Setting and Planning	10.608	2	.005			
Rehearsal				4.703	2	.095
Memorization	3.835	2	.147			
Reviews	2.058	2	.357			
Seeking Information				1.837	2	.399
Help-Seeking				12.116	2	.002
Self-Consequences				1.688	2	.430
Self-Motivated	3.713	2	.156			
Peer Pressure				1.628	2	.443
Adult Influence				.449	2	.799
Environment Setting	4.584	2	.101			
During Test-Taking						
Outline Formulas	.708	2	.702			
Recall and Identify	2.863	2	.239			
Keep Trying	10.877	2	.004			
Checking	10.305	2	.006			
After Test-Taking						
Correction	6.629	2	.036			
Self-Evaluation				.702	2	.704

Self-Regulation Test-Taking Strategies Used by Male Students and Female Students

Table 5 shows the mean and standard deviation of self-regulation test-taking strategies used by two gender groups: male and female students. Results showed that male and female students possessed moderate degree of level in using various self-regulation strategies before test (Male: M = .35; Female: M = .43) and during test-taking (Male: M = .39; Female: M = .55). However, female students possessed high degree of level in using self-regulation strategies after test-taking compared to male students (Male: M = .56; Female: M = .73). Evidently, mean scores of female students in using various self-regulation strategies were higher than male students in all aspects, before, during, and after test-taking. Female students are more prone to use various self-regulation test-taking strategies to facilitating their learning in this study.

Table 5. Mean, Level of Measurement, and Standard Deviation of Self-Regulation Test-Taking Strategies among Male and Female Students

	Male			Female		
Self-Regulation Strategies	Mean	*S.D.*	Level	Mean	*S.D.*	Level
Before Test-Taking	.35	.13	M	.43	.11	M
Goal Setting and Planning	.12	.33	L	.37	.49	M
Rehearsal	.76	.44	H	.94	.24	H
Memorization	.45	.51	M	.29	.46	L
Reviews	.61	.50	M	.62	.49	M
Seeking Information	.03	.17	L	.12	.32	L
Help-Seeking	.85	.36	H	.92	.27	H
Self-Consequences	.09	.29	L	.08	.27	L
Self-Motivated	.27	.45	L	.56	.50	M
Peer Pressure	.03	.17	L	.02	.14	L
Adult Influence	.06	.24	L	.06	.24	L
Environment Setting	.61	.50	M	.75	.44	H
During Test-Taking	.39	.25	M	.55	.24	M
Outline Formulas	.18	.39	L	.40	.50	M
Recall and Identify	.27	.45	L	.31	.47	L
Keep Trying	.67	.48	M	.79	.41	H
Checking	.42	.50	M	.69	.47	H
After Test-Taking	.56	.35	M	.73	.30	H
Correction	.33	.48	L	.56	.50	M
Self-Evaluation	.79	.42	H	.90	.30	H

Table 6 shows the chi-square test of various self-regulation test-taking strategies between male and female students. For zero cells that have expected count less than 5, the present study used Pearson chi-square test to verify the test

of association; otherwise, the present study used Fisher exact test (two-tailed test). Results showed that there were significant differences in goal setting and planning, rehearsal, and self-motivated among male and female students for test preparation. Female students revealed as having medium degree of level in goal-setting and planning while male students possessed low degree of level (Male: *M* = .12; Female: *M* = .37). Though the majority of the students possessed high degree of level in practicing rehearsal before the test, however, almost all female students revealed that they practiced and solve problems for test preparation than male students (Male: *M* = .76; Female: *M* = .94). Besides, female students revealed that they were more self-motivated to score well in the test compared to male students (Male: *M* = .27; Female: *M* = .56).

Table 6. Chi-Square Test of Self-Regulation Test-Taking Strategies and Gender Group

Self-Regulation Strategies	Pearson Chi-Square Value	*df*	*p* Value	*p* Value of 2 Sided Fisher Exact Test
Before Test-Taking				
Goal Setting and Planning	6.098	1	.014	
Rehearsal				.020
Memorization	2.438	1	.118	
Reviews	.007	1	.931	
Seeking Information				.240
Help-Seeking				.300
Self-Consequences				1.000
Self-Motivated	6.632	1	.010	
Peer Pressure				1.000
Adult Influence				1.000
Environment Setting	1.970	1	.160	
During Test-Taking				
Outline Formulas	4.592	1	.032	
Recall and Identify	.119	1	.730	
Keep Trying	1.561	1	.212	
Checking	5.989	1	.014	
After Test-Taking				
Correction	4.079	1	.043	
Self-Evaluation				.201

With regard of self-regulation strategies used during test-taking, results showed that male and female groups had significant differences in outline the formulas and regulate checking strategies when solving for a test. Results showed that female students were more favor in outline the relevant formulas that needed

to solve for a mathematical problems than male students (Male: M = .18; Female: M = .40). Besides, female students also showed that they were more prone to use checking strategies to check their test answers (Male: M = .42; Female: M = .69). Concerning self-regulation strategies used after the test-taking, female students revealed as having high degree of level in correction for mistakes, while male students possessed low degree of level in correction (Male: M = .33; Female: M = .56).

Effects of Self-Regulation Test-Taking Strategies on Mathematics Performance

Table 7. Mann-Whitney U Test of Self-Regulation Test-Taking Strategies on Mathematics Performance

Self-Regulation Strategies	Used It		Not Used It		Mann-Whitney U Test Value	*p* Value (Two-Tailed)
	Mean Rank	N	Mean Rank	N		
Before Test-Taking						
Goal Setting and Planning	57.48	23	37.63	62	380.0	.001
Rehearsal	45.08	74	29.00	11	253.0	.044
Memorization	39.38	30	44.97	55	716.5	.318
Reviews	42.69	52	43.48	33	842.0	.885
Seeking Information	53.93	7	42.02	78	196.5	.221
Help-Seeking	45.32	76	23.44	9	166.0	.012
Self-Consequences	42.14	7	43.08	78	267.0	.924
Self-Motivated	46.79	38	39.94	47	749.0	.203
Peer Pressure	29.75	2	43.32	83	56.5	.471
Adult Influence	39.00	5	43.25	80	180.0	.724
Environment Setting	45.78	59	36.69	26	603.0	.118
During Test-Taking						
Outline Formulas	39.13	27	44.80	58	678.5	.324
Recall and Identify	51.32	25	39.53	50	542.0	.045
Keep Trying	48.15	63	28.25	22	368.5	.001
Checking	49.90	50	33.14	35	530.0	.002
After Test-Taking						
Correction	48.84	40	37.81	45	666.5	.040
Self-Evaluation	44.24	73	35.46	12	347.5	.253

Table 7 shows the Mann-Whitney U test of various self-regulation test-taking strategies on mathematics performance. Results showed that mathematics performance in groups of using goal-setting and planning (U = 380, p< .005), rehearsal (U = 253, p< .05), help-seeking (U = 166, p< .05), recall and identify key information (U = 542, p< .05), keep trying (U = 368.5, p< .005), checking (U

= 530, $p < .005$), and correction ($U = 666.5$, $p < .05$) strategies were higher than the groups of not using these strategies for test-taking.

DISCUSSIONS

The current study examined the hypothesized connection between self-regulation test-taking strategies and mathematics achievement as numerous studies have contended that fostering self-regulation strategies may enhance students' achievement. Specifically, the findings of the study demonstrate the students use various self-regulation test-taking strategies such as goal-setting and planning, rehearsal, memorization, reviews, seeking information, help-seeking, self-consequences, self-motivated, peer pressure, adult influence, environment setting, outline formulas, recall and identify key information, keep trying, and checking, correction and self-evaluation in facilitating their mathematics tests.

A focus of the present study was to assess the effects of self-regulation test-taking strategies on students' mathematics achievement and how these strategies differed between gender and performance groups. The findings of this study reveal that for those students who exhibit use of goal setting and planning, rehearsal, help-seeking, recall and identify key contents, keep trying, checking, and correction strategies statistically performed better in mathematics achievement. Regarding goal-setting and planning for a test, successful examinees are more likely to set learning goals and engage in strategic planning compared to less successful counterparts. This can be evident from levels of goal-setting and planning for high achiever is higher than other two performance groups. This finding is consistent with previous studies showing that students who plan and set learning goals exhibit higher levels of performance as goals are importance for students to keep motivated and goals act as a standard for individuals to self-evaluate their performance (Bandura, 1991; Fadlelmula et al., 2015; Kitsantas, 2002; Zimmerman, 2002). The findings of the study also indicate that male students are weak in planning and set process goals for learning. This might explained why female students are more in favor in mathematics performance than male students in some of the empirical studies (e.g., Tajudin & Chinnappan, 2016). Besides, according to Kitsantas (2002), students will seek for assistance

from social and/or social sources if they set process goals and having intrinsic interest in the assigned task. Of this reason, students who put the efforts in rehearsing their texts or notes and seeking help from friends or teachers during test preparation are more likely to perform better in the test compared to their counterparts. Analogous to planning and goal-setting, the present study noted that high achiever and female groups showing higher scores in using rehearsal and help-seeking strategies. Thus, the findings suggest that planning and goal-setting, rehearsal, and help-seeking strategies during test preparation may positively affect students' test performance.

In the literature, self-regulation theorists believe use of cognitive strategies such as elaboration strategy, critical thinking skills, organization and transformation strategy may help in retrieving information (Fadlelmula et al., 2015; Pintrich & de Groot, 1990). The current findings demonstrate that high achievers having better ability to recall and identify key contents than medium and low performance groups. One of the possible explanations is the high achievers are more likely to apply deep learning strategies in facilitating their learning rather than applying surface learning strategies such as memorization technique. The study shows that low attainment students are more likely to exhibit higher level of using memorization strategies. This finding is consistent to Kitsantas's (2002) findings who reported that low test scorers used more memorization strategies. She elicits that low achievers tended to engage in rote memorization teachnique than using elaborative or organizational strategies which resulted in deeper understanding of the material. Thus, the study suggests that the ability to recall and identify key contents during test-taking may positively enhance students' test performance. To improve this, students should learn and use more of deep learning strategies to facilitate their mathematics learning.

In addition, the present study is consistent to previous studies that high achievers are more likely to review and revise their test responses than low achievers (e.g., Kitsantas, 2002). The findings of this study indicate that high achievers exhibit higher levels of using keep trying and checking strategies compared to their counterparts. There were also a statistical difference of using keep trying strategy during test-taking for gender group. The results showed that

female students tended to check their test responses more often than did male students. This may due to female students are more motivated to score well in the test as the finding reveals female students having higher levels of self-motivation. Moreover, female students are more likely to use outline formulas strategy during test-taking than male students. Based on the self-regulation theory, self-regulated students are said more persistent in accomplishing a task (Bandura, 1991; Pintrich & de Groot, 1990; Zimmerman, 2002). Thus, for those who are persistent in accomplishing a task tended to keep trying in solving complex and difficult problems. Though the present study found that there were statistically difference in using keep trying strategy during test-taking between three different performance groups, however, this result is not consistent with Kitsantas's (2002) finding who reported that process of elimination (i.e., a way of checking) had no significant difference between high and low achievers. The inconsistency of the findings may due to different contextual factors. For example, Kitsantas's (2002) focused on university students while this study focused on high school students. Thus, this study suggests keep trying and checking for test answers may positively affect students' mathematics achievement.

On the other hand, according to Ramdass and Zimmerman (2008), students generally do not initiated self-correction in nature. The present study agreed with them as the present finding shows that students possessed low to moderate degree of level in correcting their test outcomes, especially for low achievers. The finding reveals that high achievers are more likely to correct their test answers after the test than their counterparts. There was also a statistical difference of using correction strategy between male and female students. Female students generally show higher levels of correction than did male students after test-taking. Despite that, the present study is consistent with previous studies that self-evaluation strategy reveals as having no significant effect on students' mathematics achievement. Thus, the study suggests that students who use correction strategy may positively affect their achievement. In short, high achievers use more self-regulation test-taking strategies than low achievers as previous studies predicted (e.g., Hong et al., 2006; Kitsantas, 2002; Pintrich & de Groot, 1990; Zimmerman, 2002).

CONCLUSION

Due to the motivation and interest on mathematics have been gradually decreased over the years, educators are fostering self-regulation strategies for student learning. The present study examined the possible self-regulation test-taking strategies and their effects on mathematics achievement. The current research concluded groups of students who are using goal-setting and planning, rehearsal, help-seeking, recall and identify key information, keep trying, checking, and correction strategies have higher scores in mathematics performance. Because relatively less studies have examined the connection of self-regulation strategies on mathematics achievement for gender and performance groups, this study not only concluded that there are statistical differences in goal-setting and planning, help-seeking, keep trying, checking, and correction strategies between high, medium, and low achievers, but also in goal-setting and planning, rehearsal, self-motivated, outline formulas, checking, and correction strategies between male and female students. The study suggest that teachers should foster these self-regulation strategies to facilitate student learning (e.g., Fadlelmula et al., 2015; Pintrich & de Groot, 1990; Ramdass & Zimmerman, 2008; Tee, Leong, & Abdul Rahim, 2018).

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