Test-taking skills of secondary students: the relationship with motivation, attitudes, anxiety and attitudes towards tests

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Test-taking skills are cognitive skills that enable students to undergo any test-taking situation in an appropriate manner. This study is aimed at assessing the relationship between students' test-taking skills and each of the following variables: motivation to learn mathematics; mathematics anxiety; attitudes towards mathematics; and attitudes towards tests. The study was conducted on a random sample of 626 (372 males and 254 females) secondary school students. The following instruments were used in the data collection: the Test-taking Skills Scale (TSS); the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ); the Mathematics Anxiety Scale-Revised (MAS-R); the Mathematics Attitude Inventory (MAI); and the Attitude towards Tests Scale (ATS). A positive and significant relationship was reported between students' test-taking skills and each student's motivation to learn mathematics, attitudes towards mathematics, and attitudes towards tests; while mathematics anxiety was shown to have a significant negative relationship with test-taking skills. Test-taking skills account for more than 30% of the variation in motivation to learn mathematics, 25% in attitudes towards mathematics, 17% in mathematics anxiety, and more than 40% in attitude toward tests. The study concluded the improvement of secondary students' testing skills to be significantly correlated with variables that play a substantial role in a student's level of achievement in mathematics.

Keywords: attitudes toward mathematics; attitudes toward tests; mathematics anxiety; motivation to learn mathematics; test-taking skills

Introduction
Test-taking skills are cognitive skills that allow students to undertake any test-taking situation in an appropriate manner, and to know what to do before, during, and after the test (Dodeen, 2009). These skills help students to translate their knowledge from classroom learning to answering and responding to questions when taking tests. Test-taking skills positively affect students' test-taking competency and hence impact upon their academic achievement. Test-taking skills are transferable skills (Sefcik, Bice & Prerost, 2013), where once acquired, students may be enabled to use these skills across a variety of subjects and within different settings and conditions. Moreover, most test-taking skills are useful in a students' practical life, where they may benefit their effective use of time, ability to set priorities, ability to work both fast and accurately, and to make sure ideas become directly evident.

Research shows that the motivation to learn (O'Neil & Drillings, 1994; Pajares & Kranzler, 1995); anxiety (Cates & Rhymer, 2003; Ryan & Ryan, 2005); as well as attitudes towards subject matter (Chang, 1990; Dwyer, 1993), play a major role in students' achievement. Additionally, studies have shown that attitudes towards tests in general affect student achievement (Eggleston, 1988; Perney & Ravid, 1990). The effects of these variables (motivation, attitudes towards mathematics, and attitudes towards tests) on achievement have been clearly established in the related literature. The important question in this instance pertains to the way in which these variables might be re-organised so as to improve student achievement. One solution to this question is to improve students' test-taking skills. Test-taking skills are related to the motivation to learn and to the attitudes students may hold with regards to specific subjects (Dodeen, 2009; Peng, 2005; Steele & Arth, 1998). Additionally, test-taking skills can be effectively used to help examinees eliminate any feelings of tension and anxiety that may interfere with their ability to communicate what they know in a test situation (Austin, Partridge, Bitner & Wadlington, 1995). Therefore, improving students' testing skills is likely to indirectly improve student achievement.

Learning mathematics is cumulative in nature, where each step depends on another, and progress is made from simple tasks to more complex ones. At the national level, mathematics achievement is often associated with the economic future of the country, and is considered as one of the school subjects that the students perceived to be the most challenging, difficult, complex, and abstract (Schwartz, 2000). "The desire to understand and identify factors that may have meaningful and consistent relationships with mathematics achievement has been commonly shared among national leaders, policy makers, and educators around the world" (Phan, Sentovich, Kromrey, Dedrick & Ferron, 2010:2). In the Kingdom of Saudi Arabia (KSA), there have been concerns amongst researchers and educators regarding the low performances of Saudi students in internationally collected mathematical assessments. For example, in the Trends in International Mathematics and Science Study (TIMSS) of 2003, the five lowest performing countries were the Philippines, Botswana, Saudi Arabia, Ghana, and South Africa. In TIMSS 2011, the same situation could be found, where the performance of Saudi Arabia was among the world's lowest, with a rank of 37 out of 45. In addition, TIMSS reports showing that Saudi Arabia, South Africa and Egypt are among those developing countries where students struggled to attempt mathematical problems independently, and to achieve success (Jurdak, 2009). The performance of South African students in mathematics was also poor, as revealed in another international study, the Second Southern Africa Consortium for Monitoring Educational Quality (SACMEQ II) (Moloi & Strauss, 2005). Therefore, test-taking skills and other variables would be of interest to most researchers and teachers, and might be seen as a means to improving grades; and might be further foreseen to fulfill the desire of educators to both identify and understand factors related to mathematics achievement specially in developing economies.

This study examines the relationship between students' test-taking skills and each of the following variables: motivation to learn mathematics; mathematics anxiety; attitudes towards mathematics; and attitude towards tests. Conclusions from the study will add insight to the learning and teaching of mathematics, as well as to a more nuanced understanding of the context of the classroom setting.

Literature Review

Currently, tests are employed as a universal tool for decision-making in most societies, and individuals are evaluated according to their achievement on these tests. As a result, a major concern for students and teachers worldwide is the ability to perform better on tests (Al Fraidan & Al-Khalaf, 2012). Studies indicate that students with test-taking skills improved attitudes towards tests, demonstrated lower levels of anxiety, and achieved better results (Peng, 2005; Perney & Ravid, 1990; Steele & Arth, 1998). Even students familiar with the subject matter may do poorly in tests due to poor test-taking skills (Sweetnam, 2002). Some researchers argue that test-taking skills are as important as having the knowledge or information to answer the test questions (Langerquist, 1982). However, this does not mean that these skills can replace knowledge of the materials or the preparation for the test, but rather, it means that having such skills helps students improve their scores and performance.

Apart from ability, students' performance on tests is also affected by psychological, cognitive, and personal factors, which may include: motivation to learn a specific subject; level of related anxiety; attitudes towards a specific subject; attitudes towards tests; and test-taking skills (Hambleton, Swaminathan & Rogers, 1991). Research about the effect of these variables on achievement in mathematics is briefly discussed in the following paragraphs.

Motivation to Learn Mathematics

Motivation refers to "the reasons for directing behaviour towards a particular goal, engaging in a certain activity, or increasing energy and effort to achieve the goal" (Liu & Lin, 2010:222). It also refers to the intensity, initiation, and persistence of human behaviour (Kleinginna & Kleinginna, 1981). Student motivation plays an essential role in learning (O'Neil & Drillings, 1994; Pajares & Kranzler, 1995). Agar and Knopfmacher (1995) reported the most significant problematic components of learning in the affective domain in South Africa to have been motivation and anxiety. In Taiwan, Liu and Lin (2010) studied the motivation to learn mathematics and learning strategies of Taiwanese students from Grades 10 to 12. The results showed that students display a low motivation in learning mathematics, but that male students showed a higher motivation in learning mathematics than females. Motivation was found to correlate significantly with undergraduate performance in intermediate Algebra (Belcheir, 2002). MacNamara and Penner (2005) also reported that mathematics abilities among first year college students were positively correlated with their motivation level.

Mathematics Anxiety

Many students suffer from mathematics anxiety (Armstrong, 1985). This anxiety causes students to perform poorly in maths courses, and to show difficulty in situations that involve mathematical processes (Wigfield & Meece, 1988). It also causes students to lose confidence when in mathematical situations, and has an impact on their future success (Chinn, 2009). While a reasonable level of anxiety is useful to motivate a student, a high level of anxiety may interfere with the way in which students perform (Strand, 2003), and this may negatively affect his/her concentration and organisation of ideas and thoughts. In a test, highly anxious students generally spend much more time on irrelevant thoughts, rather than on vital tasks, and usually have poor study habits as well (Culler & Holahan, 1980). Additionally, individuals with mathematics anxiety try to avoid careers and environments that require mathematical skills (Ashcraft, 2002). Among the several methods of reducing mathematics anxiety is the development of appropriate test-taking skills (Buxton, 1981; Steele & Arth, 1998).

Attitudes towards Mathematics

Generally, attitudes towards subject matter have a positive relationship with achievement and success in that subject (Schofield, 1982; Wilson, 1983). When it comes to mathematics, this can be defined in terms of either a positive or negative emotional disposition towards mathematics (Zan & Martino, 2007). Successful experience of a student in mathematics tests and tasks can make him/her develop positive attitudes towards learning it (Akinsola & Olowojaiye, 2008). Alrwais (2000) examined the correlation between student attitude towards learning mathematics, students' mathematical creativity and grades, and the way in which these factors have an effect on achievement. This study showed student attitude towards learning mathematics to be the best predictor of success. Wang (2008) reported that the student valuation of mathematics has a significant effect on performance in mathematics in South Africa. Other researchers found that there are differences in attitudes with regards to student gender (Leder & Forgasz, 1994; Murphy & Ross, 1990). According to research, bachelor degrees granted in Mathematics fell by 19% between 1990 and 2000 in American universities. Attitude towards mathematics was found to be one of the factors affecting undergraduate enrolment in mathematics in the United States of America (USA) (Lutzer, Maxwell & Rodi, 2002). However, the reported findings that showed a relationship between attitudes and achievement should not be considered to be definite. There are other researchers who have reported a weak relationship between components of attitudes and mathematics achievement (Atnafu, 2010).

Attitudes towards Tests

Several studies have been conducted on attitudes towards tests and related variables. For example, Birenbaum and Feldman (1998) studied student attitudes towards both open-ended and multiple choice test formats, and learning and test-taking skills. Their results indicated that students with good test-taking skills prefer the open-ended format

over that of multiple choice. In addition, highly anxious students tended to prefer the multiple choice format over the constructed-response format. Eggleston (1988) studied the relationship between students' attitudes towards tests and their achievement and found that attitudes towards tests may cause underachievement. Additionally, Perney and Ravid (1990) investigated the relationship between achievement and students' attitudes towards tests. Their results indicated that there is a moderate positive correlation between attitudes towards tests and achievement. Mwamwenda (1994) showed a statistically significant difference in academic achievement related to the level of test anxiety amongst students; while Dodeen and Abdelmabood (2005) examined the effect of teaching test-taking skills on students' achievement and attitudes towards tests, where students were taught specific test-taking skills for multiple-choice items in English over a period of six weeks. The results showed that students' attitudes towards tests were improved.

Objectives
This study aimed to achieve the following goals, with respect to secondary school students in mathematics in Saudi Arabia:
1. Determine levels of students' test taking skills; their motivation to learn mathematics; their mathematics anxiety; their attitudes towards mathematics; and their attitudes towards tests; as well as to compare male and female students on each of these variables.
2. Assess the relationship between student test-taking skills and each of the following variables: motivation to learn mathematics; mathematics anxiety; attitudes towards mathematics; and attitudes towards tests, respectively.
3. Assess the contribution of test-taking skills to the prediction of each of the following variables: motivation to learn mathematics, mathematics anxiety, attitudes towards mathematics, and attitudes towards tests.

Methodology
Population and Sample
The study was conducted on secondary school students from Grades 10, 11, and 12, in the KSA. A random sample of 626 students was selected to participate in this study. The students were asked to respond to all instruments used to collect the data. Data were collected in the classroom setting with the help of school teachers. Participating students were told about the goals of the study; while informed about the way in which they were selected, and that their participation was not mandatory. They were also informed that all information and data collected in the study would be kept confidential, used only for the purposes of research.

Instruments
The following instruments were used in the data collection process in this study:

Test-taking Skills Scale (TSS)
Students' test-taking skills were assessed using the Test-taking Skills Scale (TSS) developed by Dodeen (2008). The scale consists of 31 items distributed into four subscales: Before-Test; Time Management; During-Test; and After-Test. Examples of the scale items include: "I estimate how much time I have to answer each question"; "If I do not know the answer, I make an intelligent guess"; and "I determine the reasons that effectively reduce my scores on the test". A high score on the TSS indicates the student to have appropriate test-taking skills. The TSS scale was developed on undergraduate students of the United Arab Emirates University (UAEU).

Motivation to Learn Mathematics
Motivation to learn maths was assessed using a motivation scale modified from MMSLQ. The MMSLQ was developed at the National Center for Research in order to improve postsecondary teaching and learning at the University of Michigan (Pintrich, Smith, Garcia & McKeachie, 1991). The questionnaire was designed to assess college students' motivational orientations and their use of different learning strategies. The Motivation to Learn Mathematics (MLM) scale consists of 14 items in three domains, namely: Intrinsic Goal Orientation (4 items); Extrinsic Goal Orientation (5 items); and Task Value (5 items). Intrinsic goal orientation focuses on the internal reasons that motivate a given student to participate in specific mathematical tasks, such as satisfaction and curiosity, for example: "I would like to have curiosity-initials materials in maths class even though they are quite difficult". Extrinsic goal orientation focuses on the external reasons for a given student's interest in mathematics, such as achieving good grades, or receiving praise from others, for example: "my main aim is to get the best grades in maths class". Task value refers to a given student's awareness of the usefulness and importance of mathematics, and were worded, for example: "What I learn in the maths class can be applied in my daily life". All the items in this scale use the five-point Likert scale as follows: strongly disagree (1); disagree (2); neutral (3); agree (4); and strongly agree (5). A high score on MLM indicates a high level of motivation to learn mathematics.

Mathematics Anxiety
Students' math anxiety was measured using the MAS-R developed by Bai, Wang, Pan & Frey (2009). MAS-R was developed using a sample of undergraduate students from different disciplines enrolled in entry-level mathematics courses. The scale is intended to be a bi-dimensional measure that would capture both the positive and negative effects of mathematics anxiety. MAS-R consists of 14 items that assess student feelings towards mathematics. Examples of MAS-R are "I worry about my ability to solve math problems", "Mathematics makes me feel nervous", and "Mathematics is one of my favorite subjects". All the items in this scale use the five-point Likert scale to indicate: strongly disagree (1); disagree (2); neutral (3); agree (4); and strongly agree (5). The scores of all the positively stated items were to be reversed before being calculated. A high score on MAS-R suggests a high level of mathematics anxiety.

Attitudes towards Mathematics
Students' attitudes towards maths were assessed using the MAI developed by Ahmad (1986). This inventory consists of 15 items measuring students' attitudes towards mathematics. MAI was developed and validated on samples of secondary students in Qatar. Examples of this inventory are: "Mathematics is a very worthwhile and necessary subject"; "I hate Mathematics because it makes me nervous"; "Mathematics helps me in developing accurate methods of thinking"; and "Mathematics is a necessary subject for daily life issues". Respondents were rated on a 5-point Likert-type scale, ranged from "strongly disagree" to "strongly agree". A high score on the MAI indicates positive attitudes towards mathematics.

Attitudes towards Tests
Student attitudes towards tests were assessed using the ATS developed by Dodeen (2008). ATS was developed with participation from undergraduate college students at UAEU. Examples from the instrument are: "Tests motivate me to study hard"; "For me, taking tests is a painful experience"; and "I learn many skills during tests". Respondents were rated on a 5-point scale, Likert-type ranged from "strongly disagree" to "strongly agree". A high score on ATS suggests positive attitudes towards tests.

Results
Prior to the statistical analyses, all variables in the collected data set were screened for outliers or extreme values, where none were identified. The data were also screened for missing values. Most of the scales' variables had very few missing cases, which did not affect the results. Additionally, all items written in the negative direction on each scale were reversed to further analysis. This resulted in reversing the following items in the corresponding scale:
1. In the TSS, 10 items were reversed so the high score in this scale implies that the student uses appropriate skills in tests.
2. All items in the Mathematics Motivation Scale were written in the same positive direction, thus no item was reversed in this scale.
3. In the MAS-R, seven items were stated in the positive direction; thus, they were reversed, so that the high score in this scale means a high level of mathematics anxiety.
4. Six items were reversed in the MAI, where the high score means positive attitudes towards mathematics.
5. Finally, four items were reversed in the ATS such that the high score can be interpreted as a reflection of positive attitudes towards tests.

Participants
A random sample of 626 secondary students from KSA secondary school students participated in this study. Table 1 describes the demographics of the participating students. Around 60% of students were males. The three secondary classes (the 10th, 11th and 12th grades) saw near equal representation in the sample.

Table 1 Participating students' demographic profile

		Number	%*
Gender	Males	372	59.4
	Females	254	40.6
Grade	10th	175	28.0
	11th	219	35.0
	12th	231	36.9

* Note: added together the percentages do not total 100,
due to missing values.

Reliability Analysis

To assess the reliability of the five scales used in the study, Cronbach's alpha coefficient for internal consistency was calculated for each scale. Table 2 summarizes the reliability coefficient of each scale, along with the number of items. These results indicate that each scale had an acceptable internal consistency level. The only exception is the TSS subscale. The overall reliability of the TSS is (.74) which is acceptable value (the minimum advisable level is .70) (Nunnally, 1994); although it may be reduced to .60 in exploratory research (Hair, Anderson, Tatham & Black, 1995). However, two subscales of TSS (Before-Test Skills and During-Test Skills) showed lower reliability values.

Table 2 Internal consistency reliability (Cronbach's Alpha) for each scale

Scale/Subscale		No. of Items	α
TSS		31	.74
TSS Subscales	Before-Test Skills	8	.48
	Time Management	7	.63
	During-Test Skills	11	.52
	After-Test Skills	5	.75
MLM		14	.82
MAS-R		14	.91
MAI		15	.92
ATS		17	.81

Descriptive statistics were calculated to answer the first research question, which seeks to determine student test taking skills, their motivation to learn mathematics, their mathematics anxiety, their attitudes towards mathematics, and their attitudes towards tests. In addition, to comparison between male and female students on each of these variables, the *t* test was applied for each subscale.

Test-Taking Skills

Students responded to the TSS, which consisted of the following four subscales: Before-Test Skills (8 items); Time Management (7 items); During-Test Skills (11 items); and After-Test Skills (5 items). Students indicated the way in which each item might match their actual skills or behavior when taking tests. The means and standard deviations of the students' responses on each of the four subscales were calculated and are indicated in Table 3.

Table 3 Students' test-taking skills for the whole sample and for each gender

Subscale	No. of Items	Mean (All Sample)	Mean (Males)	Mean (Females)	t	p
Before-Test skills	8	2.89 (0.60)*	2.88 (0.61)	2.91 (0.59)	-0.460	.646
Time management	7	2.54 (0.67)	2.53 (0.69)	2.55 (0.65)	-0.306	.759
During Test skills	11	2.38 (0.49)	2.40 (0.50)	2.36 (0.48)	1.106	.269
After-Test skills	5	2.29 (0.84)	2.23 (0.87)	2.39 (0.78)	-2.335	.020
Whole scale	31	2.53	2.51 (0.42)	2.54 (0.39)	-.518	.605

* Note: Standard deviation in parentheses

As can be observed from Table 3, student test-taking skills are below the midpoint average on the four subscales. This means that participant students do not have the appropriate test-taking skills as measured by these subscales. The highest average was found to be in the Before-Test subscale, while the lowest average was found to be in the After-Test subscale.

Table 3 summarizes the mean average of male and female student responses, respectively. Similar results were observed for both males and females, especially in the Before-Test Skills and in the Time Management subscale. These small, non-practical differences between males and females' responses were statistically evaluated by conducting independent *t* tests on each subscale. As expected, the *t* test results were not significant (at .05 level); except on the After-Test subscale, in which females showed slightly better results than their male counterparts. Nevertheless, one can conclude from these results that both boys and girls lack the necessary testing skills.

Motivation to Learn Mathematics

The results indicated that overall motivation level to learn mathematics was less than the average ($M = 2.38$, $SD = 0.64$). Although the overall mean is low, individual items like "In math class, I would like to have some challenging materials" ($M = 3.52$, $SD = 1.30$), and "I like every topics and contents in math class" ($M = 3.24$, $SD = 1.23$),

achieved higher rank. On the other hand, items like "My most wanting is to get best grades in math class" ($M = 1.15$, $SD = 0.52$), and "I hope I can get higher grade in math than any other classmates" ($M = 1.46$, $SD = 0.84$), ranked very low. It seems that students, are, in general, motivated more by specific topics and materials in mathematics than they are by achieving good grades. Using an independent t test, no significant difference in motivation to learn mathematics between males and females was observed (t (560) = 0.874, p = .383).

Mathematics Anxiety

The mean of student responses on the MAS-R was less than the average ($M = 2.97$, $SD = 0.93$). When comparing male and female responses, a significant difference was observed. The mean of males on the MAS-R was 2.86 ($SD = 0.95$), while the mean of females was 3.12 ($SD = 0.89$). This indicates that female students are more anxious about mathematics than their male counterparts. This difference was supported by the significant result obtained from conducting an independent t test (t (556) = -3.27, $p < .001$).

Attitudes towards Mathematics

The overall mean of all responses on the MAI was 2.63, ($SD = 0.89$). The highest mean was for the items "I enjoy learning math and I feel happy in math class" ($M = 3.44$, $SD = 1.29$) and "Mathematics is one of my favourite subjects" ($M = 3.12$, $SD = 1.36$). On the other hand, the items "Mathematics is useless" ($M = 2.23$, $SD = 1.30$), and "Mathematics enhances scientific thinking" ($M = 2.25$, $SD = 1.20$), received the lowest mean averages. When comparing males and females responses, the mean of male students on the MAI scale was 2.68 ($SD = 0.92$), while the mean of female students was 2.54 ($SD = 0.82$). This can be interpreted to mean that both genders are likely to have similar attitudes towards mathematics, where the difference between these two groups was not found to be significant (t (532) = 1.80, p = .07).

Attitude towards Tests

The overall mean of students' responses to ATS was 2.47 ($SD = 0.61$). The highest two means were for items "I think taking a test is a useful experience" ($M = 3.67$, $SD = 1.22$) and "I prefer subjects with many tests" ($M = 3.24$, $SD = 1.31$). The lowest two means were for items "Test helps me concentrate on important points" ($M = 2.03$, $SD = 1.10$), and "Tests help determine my achievement level" ($M = 2.11$, $SD = 1.15$). A significant difference was observed between male and female responses. The mean of male responses was 2.48 ($SD = 0.63$) while the mean of females was 2.45 ($SD = 0.58$). The difference was not significant (t (526) = 0.57, p = .57).

Relationships between Test-taking Skills and the other Variables

The second research question assessed the relationships between students' test-taking skills and each of the following variables: motivation to learn mathematics; attitudes

towards mathematics; mathematics anxiety; and attitudes towards tests. Zero-order Pearson correlations were used to assess the magnitude and the direction of these relationships. The correlation coefficients and their corresponding significance levels are listed in Table 4.

Table 4 Pearson correlation coefficients between testing skills and the other variables

	Test-taking Skills	Math Motivation	Math Anxiety	Attitude towards Math	Attitude towards Tests
Test-taking Skills	1				
Math Motivation	.42**	1			
Math Anxiety	-.30**	-.50**	1		
Attitude towards Math	.41**	.62**	-.86**	1	
Attitude towards Tests	.59**	.56**	-.51**	.56**	1

** Note: Significant at .001

The relationship between students' test-taking skills and their motivation to learn mathematics was positive and statistically significant ($r = .42$). Similar results were obtained for the relationship between test-taking skills and attitudes towards mathematics. As for attitudes towards tests, the relationship with test-taking skills was also positive and statistically significant; but it is even stronger than the relationships with other variables. The relationship between test-taking skills and math anxiety was negative and significant ($r = -.30$). This can be interpreted to mean that students who do not have test-taking skills are likely to have higher levels of anxiety towards tests.

The third research question aimed to predict each of the four variables in the study by test-taking skills. Specifically, the four test-taking skills subscales (Before-Test, Time Management, During-Test, and After-Test) were used to predict student motivation to learn mathematics; attitudes towards mathematics; mathematics anxiety; and attitudes towards tests, in separate models.

The results of the multiple regressions are summarized in Table 5. It appears that test-taking skills in Dependent 1 were able to account for more than 30% of the variation in motivation to learn mathematics. Except for the Before Test subscale, the other subscales were statistically significant. In Dependent 2, the students' attitudes towards mathematics were predicted from the four test-taking skills subscales. It was possible to use predictors to interpret 25% of the variability in attitudes towards mathematics. In this case, only the Time Management subscale was not a significant predictor ($t = 0.99, p = .32$). In Dependent 3, Test-taking skills were able to account for 17% of the variability in mathematics anxiety. The negative beta values confirm the expected negative relationship between test-taking skills and anxiety in mathematics. Once again, Time Management was the only non-significant predictor in this model ($t = -0.45, p = .65$). Finally, in Dependent 4, the best prediction values could be found in predicting attitudes towards tests. In this case, all test-taking skills variables proved

Table 5 Multiple regressions results

Predicted (Dependent)	Multiple R	R Square	Predictor (Independent)	Coefficient (Beta)	*t*	*p*
Motivation to learn Math (Dependent 1)	.56	.31	Before-Test Skills	.01	-0.01	.990
			Time Management Skills	.16	3.54	.001
			During-Test Skills	.24	3.85	.001
			After-Test Skills	.25	7.05	.001
Attitudes toward Math (Dependent 2)	.50	.25	Before-Test Skills	.38	6.30	.001
			Time Management Skills	.07	0.99	.320
			During-Test Skills	.44	4.92	.001
			After-Test Skills	.17	3.29	.001
Math Anxiety (Dependent 3)	.42	.17	Before-Test Skills	-.45	-6.86	.001
			Time Management Skills	-.03	-0.45	.650
			During-Test Skills	-.36	-3.71	.001
			After-Test Skills	-.11	-1.96	.050
Attitudes toward tests (Dependent 4)	.65	.42	Before-Test Skills	.17	4.44	.001
			Time Management Skills	.09	2.29	.020
			During-Test Skills	.40	7.30	.001
			After-Test Skills	.22	7.39	.001

to be significant predictors, and used together were able to account for more than 40% of variability.

Discussion

Educational models that work well for a developed country may not apply to the circumstances in a developing country (Phan et al., 2010). Therefore, models attempt to identify factors related to achievement and connected variables could be used to help evaluate and improve the effectiveness of mathematics education on similar educational systems in developing countries. Additionally, there is lack of international studies related to student achievement in developing countries. Phan et al. (2010:2) have observed that "low income countries as well as those that performed poorly in international achievement studies such as South Africa, Chile, and Egypt, were rarely included in international research studies."

The results of this study indicated that participating students (both males and females) do not have the appropriate test-taking skills they need to ensure acceptable levels of achievement. The results also indicated that overall motivation levels to learn mathematics, their attitudes towards mathematics, and their attitude towards tests, proved to be less than average. Connecting these findings to existing literature, research shows that these three variables play significant roles in students' achievement in mathematics (Agar & Knopfmacher 1995; Chang, 1990; Dodeen & Abdelmabood, 2005; Eggleston, 1988; Mwamwenda 1994; O'Neil & Drillings, 1994; Pajares & Kranzler, 1995; Perney & Ravid, 1990). Additionally, results indicated that there is a positive and significant relationship between student test-taking skills and motivation to learn mathematics, attitudes towards mathematics, and attitudes towards tests. More specifically, test-taking skills accounted for more than 30% of the variation in motivation to learn mathematics; 25% of the variability in attitudes towards mathematics; and more than a 40% variation in attitudes towards tests. Therefore, it can be deduced that improving the specific skills required when taking tests will improve student motivation and attitudes.

Mathematics anxiety can meanwhile be seen to have negative effects on student performance in mathematics (Cates & Rhymer, 2003; Culler & Holahan, 1980; Ryan & Ryan, 2005; Wigfield & Meece, 1988). In this study, the relationship between test-taking skills and mathematics anxiety was found to be both negative and significant. This suggests that reducing students' mathematics anxiety may also be achieved through improving their skills when it comes to how to deal with tests and examinations.

Test-taking skills can be developed and achieved by teaching students in a systematic manner, similar to that applied in the acquisition of any other set of skills. The effects of teaching test-taking skills on student performance and achievement have been investigated by several studies. For example, Dolly and Williams (1986) and Sweetnam (2002) have reported on how teaching test-taking skills resulted in improving student scores on examinations. Vattanapath and Jaiprayoon (1999) investigated

the effectiveness of teaching test-taking skills on achieving higher scores in English tests. It was found that the participating students achieved higher scores and developed positive attitudes toward the learning of test-taking skills. Carraway (1987) reported that teaching test-taking skills decreased test anxiety and increased test scores. Similarly, Dodeen and Abdelmabood (2005) reported that teaching test-taking skills improved students' attitudes toward tests and decreased their anxiety.

A limitation of the current study can be found in the fact that it does not assess the direct relationship between testing skills and mathematics achievement. A recommendation for future studies is to utilise other data resources, such as classroom observations, interviews, and teacher reports. More investigations could be conducted to test the relationships between attitudes, motivation, test-taking skills, and school performance in mathematics within different school levels. The results of this study have implications for teachers and educators to help them better understand the importance of test-taking skills on student motivation and attitudes. This understanding may help educators to make better decisions about educational opportunities and curriculum development. In addition, teacher preparation programmes should pay more attention to the variety of instructional approaches that pre-service teachers can use to enhance student testing skills, as well as on their motivation to learn mathematics and to reduce their own anxiety in the process of assessment.

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