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Effects of Instructional Materials in General Mathematics and High School Statistics on the Attitude, Self-Efficacy Beliefs, and Performance of High School Students

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ABSTRACT

Instructional materials (IMs) hold some constitutive edge that make them peculiar in teaching. For one thing, they give the teacher with interesting and satisfying platforms for providing information since they motivate students to want to learn more and more. With this, an investigation was conducted to determine the effectiveness of the materials developed in General Mathematics and High School Statistics. A pretest-posttest research design was implemented in all classes in Grade 7 General Mathematics and third year High School Statistics. Results revealed that the respondents had low performance in General Mathematics and High School Statistics before the conduct of the study.

However, their performances increased to average after the treatment period. The students had varying levels of attitude before and after the conduct of the investigation. Their attitude ranged from moderately positive to positive. The t-test for difference resulted a significant increase in the performance of students before and after the use of IMs for all levels. There were significant differences in the students' attitudes and self-efficacy beliefs before and after the treatment. The utilization of instructional materials had shown potential effectiveness to enhance students' performance and to strengthen positive attitudes and high self-efficacy beliefs among high school students.

Keywords: Mathematics education, attitude, self-efficacy beliefs, performance, instructional materials

INTRODUCTION

Many studies have indicated the poor state of science and mathematics education in our country (Nebres & Mendoza, 2009). The poor state of science and mathematics education in our country was evident in the results of Trends in International Mathematics and Science Study (TIMSS) (2003) which shows that the Philippines rank lower that the international average in science and mathematics among the 25 countries that joined the said study. Talisayon (2009) found out that school resources, instructional materials (IMs)/equipment, computer use, class size, teacher qualification, and language of test are some of the factors that affected Philippine achievement in TIMSS 2003. She added that in IMs/equipment, students who had textbooks, computers, internet access, and calculators had significantly better scores than those who did not have both in science and mathematics, both for Grade four and high school.

Serious attempts have been done in the past to improve the state of science and mathematics education in the Philippines but a lot of problems arise along the way like challenges of teachers, teacher training, textbooks, lack of classrooms and other basic needs. Nebres (2009) conducted a study entitled "Improving Math Education Through Lesson Guides", and established that of all the problems that the government is facing, the lack of textbooks and self-contained reference materials can be addressed first to improve the state of mathematics education in the country. He added that writing a totally new textbook will take at least a couple of years because of the bidding process, the writing and the final approval and printing. However, researchers have long documented that IMs

matter (Zeringue et al., 2008). They affect what teachers teach, and consequently what students learn.

Knowing the influence of IMs in the classroom and the need to better understand the selection process, the researchers are in the midst of a study investigating curricular decision-making, with particular attention to the development of General Mathematics and High School Statistcis IMs. The researchers made their own IMs to be used in the classroom and investigated the effectiveness of these IMs in improving student performance, attitudes and self-efficacy beliefs.

FRAMEWORK

Instructional Materials

Many authors have written on the use and effectiveness of instructional materials or teaching aids to enhance teaching for expected social and behavioral change.

Instructional materials (IMs) hold some constitutive edge that make them peculiar in teaching. For one thing, they give the teacher with interesting and satisfying platforms for providing information since they motivate students to want to learn more and more. Also, by providing wide range of opportunities for private study and reference, the students' interest and curiosity are increasingly stimulated. Further, the teacher is assisted in overcoming physical difficulties that could have hindered his effective presentation of a given topic. They generally make teaching and learning easier and less stressful. They are equally indispensable catalysts of social and intellectual development of the learners.

Mathematics Attitudes

Ma and Kishor, as cited by Nicoladou and Philippou (2003), define mathematics attitudes as "an aggregated measurement of a liking or disliking of Mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at Mathematics, and a belief that Mathematics is useful or useless". Attitudes towards Mathematics then, may be either positive or negative.

Attitude towards Mathematics has played a crucial role in the teaching and learning processes of Mathematics (Farooq & Shah, 2008). A positive attitude towards Mathematics greatly helps in motivating a student to do Mathematics. Their beliefs and attitudes have the potential to either facilitate or inhibit learning. Without interest and personal effort in learning Mathematics, students

can hardly perform well in the subject (Yara, 2009). In addition, Robson, as cited by Farooq & Shah (2008), said that "having a positive attitude towards Mathematics generally means enjoying working with school Mathematics and having confidence in one's own ability to do it, but it does not mean that a student will display this positive attitude towards the whole area of Mathematics all the time." There will be questions that are difficult to solve and will affect the students' perception of Mathematics.

In Mindanao, Prado (1995) identified a positive relationship between mathematics attitudes and performance. Students from high schools of state universities and colleges have more positive attitudes towards Mathematics than their counterparts in the national high schools. The former also have better mathematics performance than the latter. In the same study, the students with less positive attitudes towards Mathematics tend to view Mathematics as a more difficult subject than those with more positive attitudes.

Mathematics Anxiety

Mathematics anxiety is a component of the students' attitudes towards Mathematics. It is a state of distress and/or physiological arousal in reaction to present stimuli including novel situations and the potential for undesirable outcomes (Brooks & Schweitzer, 2011). It is a discrete emotion characterized by high arousal, negative valence, uncertainty, and a low sense of control (Brooks, 2012). It includes fear, frustration, stress, tension, worry, apprehension, and nervousness.

Mathematics anxiety has been studied since the middle of the 20th century. It was first noticed in the late 1950s when undergraduate students were observed to react emotionally to arithmetic and mathematics. Dreger and Aiken, as cited by Scarpello (2005), labeled this as number anxiety. Schoenfeld, as cited by Yeo (2004), declared that mathematics anxiety is a component of mathematics attitudes.

Yeo, as cited by Duque (2012), described three antecedents that interacted to possibly produce an anxious reaction with its physiological manifestations such as perspiring and increased heartbeat. These antecedents are as follows: (1) environmental antecedents – negative mathematics experiences and lack of parental encouragement, (2) dispositional antecedents – negative attitudes and lack of confidence, and (3) situational antecedents – classroom factors and instructional format.

Richardson and Suinn, as cited by Yeo (2004), declared that "mathematics

anxiety may also involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematics problems in a wide variety of the ordinary life and academic situations". It is not only inside the classroom that students experience mathematics anxiety.

Yeo (2004) added that such anxiety usually arises from lack of self-confidence. Students may perceive their inability to handle mathematics problems as somewhat "threatening", giving rise to feelings of self-doubt, fear of failure and loss of regard by others. Fennema and Sherman, as cited by Yeo (2004), defined mathematics anxiety as "feelings of anxiety, dread, nervousness, and associated bodily symptoms that are related to doing Mathematics". These bodily symptoms are treated as physical pain by the brains of the students. Even anticipating a stressful event, such as a math test, can cause actual pain (Lyons & Beilock, 2012). Fennema and Sherman divided anxiety into 4 categories: Thinking about Math, Taking Math Test, Learning Math Lesson, and Solving Math Problems. Students may have varied mathematics anxiety levels in each category. For example, a student may have low anxiety levels in Thinking about Math, such as budgeting weekly allowance, yet have high anxiety levels in Taking Math Test, especially surprise quizzes. Mathematics anxiety often occurs as a result of instrumental learning because an understanding of the material is not obtained – only memorization (Kidd, 2003).

Students' Self-efficacy Beliefs

According to Bandura (1997), who first described the construct, "perceived self-efficacy refers to beliefs in one's capacities to possibly organize and execute the courses of action required to manage prospective situations (tasks) and to produce desired outcomes". It is a belief that a person can do something to produce a specific outcome, and second, it is "a person's estimate that a given behavior will lead to certain outcomes" (Navaja, 2005). He elucidated that self-efficacy beliefs govern the objectives individuals established for themselves, how much determination they will spend, how long they will continue, and how robust they will be in the face of disaster and impediments. Self-efficacy is concerned, not with the level of skill possessed by a person, but with the judgment about what can be done with whatever level of skill exists (Navaja, 2005). Self-efficacy as a self-referent thought is a significant determinant of performance that operates partially independent of underlying skills (Bandura, 1986).

Social cognitive theory and self-efficacy of Bandura (1986) view human functioning as something that accords a central role to the cognitive, vicarious,

self-regulatory and self-reflective processes in human adaptation and change. People are viewed as self-organizing, proactive, self-reflecting and self-regulating rather than reactive organisms shaped and shepherded by environmental forces or driven by concealed inner impulses. From this theoretical perspective, human functioning is viewed as the product of a dynamic interplay of personal, behavioral, and environmental influences.

Performance

As cited by Honor (2007), Flores opined that there are many factors that contribute to low performance in mathematics among basic education students. Moreover, she also cited that positive classroom environments improve the achievement of low-performing students.

Also, Marcia (2007) cited the works of Kauchak and Eggen which emphasized that there are non-mathematical factors that are significantly related to achievement in Mathematics. These include intelligence, language, socio-economic status, parental involvement, teacher factor, vocabulary level, sex, and communication skills. As an action towards this, educators must use learning-enhancement strategies in complementing their instruction management.

OBJECTIVES OF THE STUDY

The study attempted to determine the effectiveness of the materials developed in Mathematics and High School Statistics. Specifically, the investigation intended to: (1) ascertain the level of performance of students in General Mathematics and High School Statistics before and after the use of the IMs; (2) describe the students' attitudes, mathematics anxiety, and self-efficacy beliefs in General Mathematics, and High School Statistics before and after the use of the IMs; (3) compare the performance of students before and after the use of IMs; and (4) differentiate the students' attitudes, mathematics anxiety and self-efficacy beliefs in General Mathematics, and High School Statistics before and after the use of IMs.

METHODS

The study employed a pretest-posttest research design. The students took the pretest at the beginning of the school year. College students took the test at the beginning of the semester. Before the school year (for high school) or semester

(for college students) ends, the completion or posttest was given to evaluate the performance of the students after the conduct of the study.

Descriptive method was also used in collecting data to test the hypothesis or to answer questions concerning the current status of the participants under study. This procedure follows a logical process from data collection, quantification, statistical treatment, analysis, and interpretation.

Descriptive statistics such as the mean and standard deviation were used to establish the parameters of the study. T-tests for difference were utilized to determine if there are significant differences in the performance, attitudes and self-efficacy beliefs of the respondents after the conduct of the study.

RESULTS AND DISCUSSION

This section presents the data analysis, and interpretation of results. For logical purposes, the sequence of the statement of the problems of this study is the basis of presentation.

Students' Performance

Table 1

Performance of the Students Before and After Using Instructional Materials

Subjects Enrolled by Students	Pre test	SD	Post test	SD	Gain Score
General Mathematics	74.53	6.358	84.96	5.413	10.43
High School Statistics	35.31	5.163	42.31	6.580	7.00

Table 1 presents the performance of students before and after using the instructional materials. As shown in the table, students using IM in General Mathematics obtain 74.53 pretests mean score of 74.53 with a standard deviation of 6.358. While Third Year students get a pretest mean score of 35.31 with a standard deviation of 5.163. These indicate that before the investigation, students in the different levels greatly vary in their prior knowledge about the topics at hand.

The posttest mean scores of the students as reflected in the table are: Grade 7 students mean of 84.96 with SD=5.413 and third year students mean of 42.31 with SD=6.580. These data show that those enrolled in Elementary Statistics gain lower scores compared to others. These reveal the varying degree of difficulty

of the topics of each subject which can be ranked as General Mathematics and High School Statistics from difficult to easy one.

Moreover, among the three IMs, students using High School Statistics have the lowest gain score than others. Though other respondents get a little bit higher gain score, it does not imply mastery. The below mastery level of the mean scores of students does not necessary mean that majority of the respondents do not learn anything. Due to high dispersion of scores as reflected by the standard deviation, high scores of students are pulled down by those with extremely low scores.

High School Students' Attitudes, and Beliefs in Mathematics

Table 2

Grade 7 Students Attitude Towards Mathematics

Indications	Pretest	Adjectival Rating	Posttest	Adjectival Rating
1. I like Mathematics.	3.22	Moderately Positive	3.72	Positive
2. I'd be proud to be the outstanding Mathematics student.	3.51	Positive	3.82	Positive
3. I am happy to get a good grades in Mathematics.	3.51	Positive	3.78	Positive
4. It would be great to win a prize in Mathematics.	3.60	Positive	4.50	Highly Positive
5. Being first in the math competition would make me happy.	3.85	Positive	3.78	Positive
6. Being thought of as smart in Math would be great thing.	3.79	Positive	4.11	Positive
7. Winning a prize in math would make me feel embarrassed.*	3.19	Moderately Positive	3.93	Positive
8. Other kids will think I'm weird if I get good grades in Math.*	3.30	Moderately Positive	3.72	Positive
9. If I get good grades in Math, I would try to hide it.*	3.08	Moderately Positive	3.46	Moderately Positive
10. If I got the highest grades in Math, I would try to hide it.*	3.66	Positive	3.73	Positive
11. It would make kids like me less if I were a really good math student.*	3.51	Positive	3.22	Moderately Positive
12. I don't like people to think I'm smart in Math.*	3.90	Positive	3.67	Positive
Overall Mean	***3.51***	***Positive***	***3.79***	***Positive***

Table 2 presents the Grade 7 students attitude towards Mathematics. Among the twelve statements, participants answered "I don't like people to think I'm smart in Math" with the highest mean of 3.91 in the pretest. But in the posttest, the statement "It would be great to win a prize in Mathematics" has the highest mean of 4.5. On the other hand, the statement "If I get good grades in Math, I would try to hide it" has the lowest mean in the pretest having a mean of 3.08 when reversely scored. While in the posttest, the statement "It would make

kids like me less if I were a really good math student: with a mean of 3.22. These statements imply that students have positive attitude towards success in Mathematics. They think winning a prize in Math is great and that they like people to think that they are good at Math.

The over-all mean score of the participants' attitude towards success in mathematics are 3.51 and 3.79 for pretest and posttest, respectively. There is a slight increase of the over-all mean score, however, this does not guarantee change in their attitude.

Table 3

Grade 7 Students' Mathematics Anxiety

Indications	Pretest	Adjectival Rating	Posttest	Adjectival Rating
1. Math does not scare me at all.	2.63	Moderately Positive	3.80	Positive
2. It wouldn't bother me at all to take more math courses.	3.14	Moderately Positive	4.13	Positive
3. I don't usually worry about being able to solve math problems.	2.83	Moderately Positive	3.40	Moderately Positive
4. I almost never get nervous during a math test.	2.66	Moderately Positive	3.40	Moderately Positive
5. I am usually calm during math tests.	3.37	Moderately Positive	3.60	Positive
6. I am usually calm in math class.	3.03	Moderately Positive	3.45	Moderately Positive
7. Math usually makes me feel uncomfortable and nervous.*	3.22	Moderately Positive	3.78	Positive
8. Math makes me feel uncomfortable, restless, irritable, and impatient.*	3.31	Moderately Positive	3.77	Positive
9. I get a sick feeling when I think of trying to do math problems.	3.54	Positive	3.96	Positive
10. My mind goes blank and I am unable to think clearly when working math problems.*	3.31	Moderately Positive	3.96	Positive
11. A math test would scare me.*	3.17	Moderately Positive	3.85	Positive
12. Math makes me feel uneasy, confused, and nervous.*	3.17	Moderately Positive	3.60	Positive
Overall Mean	***3.12***	Moderately Positive	***3.73***	Positive

Table 3 reveals the students mathematics anxiety. The statements with highest mean during the pretest and posttest are "I get a sick feeling when I think of trying to do math problems" (mean of 3.54) and "It wouldn't bother me at all to take more math courses" (mean of 4.13), respectively. On the other hand, the statement "Math does not scare me at all" has the lowest mean in the pretest having a mean of 2.63 but in the posttest, the statement "I don't usually worry about being able to solve math problems and I almost never get nervous during a math test" with a mean of 3.40. These show that students do not have high anxiety levels in Mathematics. The over-all mean score of the respondents' anxiety level increases from 3.12 in the pretest to 3.73 in the posttest. These indicate that

Grade 7 students are less anxious in Mathematics. The findings of this study contradict the claim of Yeo (2004) that high ability high school students do experience mathematics anxiety.

Table 4

Third Year Students Attitude (Attitude Towards Success in Mathematics)

Statements	Pretest	Adjectival Rating	Posttest	Adjectival Rating
1. I like Mathematics.	3.18	Moderately Positive	4.08	Positive
2. I'd be proud to be the outstanding Mathematics student.	3.56	Positive	4.00	Positive
3. I am happy to get a good grades in Mathematics.	3.98	Positive	4.46	Positive
4. It would be great to win a prize in Mathematics.	3.79	Positive	4.13	Positive
5. Being first in the math competition	3.81	Positive	4.41	Positive
6. Being thought of as smart in Math would be great thing.	3.70	Positive	3.93	Positive
7. Winning a prize in math would make me feel embarrassed.*	3.66	Positive	3.79	Positive
8. Other kids will think I'm weird if I get good grades in Math.*	3.59	Positive	3.63	Positive
9. If I get good grades in Math, I would try to hide it.*	3.54	Positive	3.88	Positive
10. If I got the highest grades in Math, I would try to hide it.*	3.95	Positive	3.91	Positive
11. It would make kids like me less if I were a really good math student.*	3.68	Positive	3.71	Positive
12. I don't like people to think I'm smart in Math.*	3.44	Moderately Positive	3.33	Moderately Positive
Overall Mean	3.65	Positive	3.9	Positive

Table 4 presents the third year students attitude towards Mathematics. Among the twelve statements, the respondents have highest mean score in the pretest and posttest on the statement, "I am happy to get a good grades in Mathematics", with mean of 3.98 and 4.46, respectively. On the other hand, the statement "I like Mathematics." has the lowest mean in the pretest having a mean of 3.18 but in the posttest, the statement "I don't like people to think I'm smart in Math" with a mean of 3.33. These statements and the students' responses in each of them exemplify that they possess positive attitude towards the subject. In general, students have positive attitude towards Mathematics with mean of 3.65 and 3.93, respectively.

Table 5

Third Year Students' Mathematics Anxiety

Indications	Pretest	Adjectival Rating	Posttest	Adjectival Rating
1. Math does not scare me at all.	2.79	Moderately Position	2.95	Moderately Positive
2. It wouldn't bother me at all to take more math courses	3.20	Moderately Positive	2.94	Moderately Positive
3. I don't usually worry about being able to solve math problems	2.95	Moderately Positive	3.13	Moderately Positive
4. I almost never get nervous during a math test.	2.98	Moderately Positive	3.05	Moderately Positive
5. I am usually calm during math tests.	3.21	Moderately Positive	3.46	Moderately Positive
6. I am usually calm in math class.	3.15	Moderately Positive	3.36	Moderately Positive
7. Math usually makes me feel uncomfortable and nervous.*	3.20	Moderately Positive	3.06	Moderately Positive
8. Math makes me feel uncomfortable, restless, irritable, and impatient.*	3.25	Moderately Positive	3.29	Moderately Positive
9. I get a sick feeling when I think of trying to do math problems.	3.64	Positive	3.54	Positive
10. My mind goes blank and I am unable to think clearly when working math problems.*	3.29	Moderately Positive	3.31	Moderately Positive
11. A math test would scare me.*	3.16	Moderately Positive	3.33	Moderately Positive
12. Math makes me feel uneasy, confused, and nervous.*	3.05	Moderately Positive	3.06	Moderately Positive
Overall Mean	3.15	Moderately Positive	3.21	Moderately Positive

Table 5 presents the students Mathematics anxiety. The participants answered "I get a sick feeling when I think of trying to do math problems" with the highest mean of 3.64 and 3.54 in the pretest and posttest, respectively. On the other hand, the statement "Math does not scare me at all" has the lowest mean in the pretest having a mean of 2.79 but in the posttest, the statement "It wouldn't bother me at all to take more math courses." with a mean of 2.94. These data show that students have low anxiety level in Mathematics.

As a whole, the participants are moderately anxious in the posttest (3.21) than in the pretest (3.15). Students in CMULHS are considered of high ability since admission to this high school is selective. The findings support the claim of Yeo (2004) that high ability students do experience mathematics anxiety.

Table 6

Students' Self-efficacy Beliefs

Statements	Grade 7		Third Year	
	Pretest	Posttest	Pretest	Posttest
1. I enjoy solving mathematical problems	3.24	3.30	3.56	3.54
2. When I meet an interesting mathematical problem, I cannot calm down until I have solved it.	3.33	3.11	3.64	3.44
3. I am not at all interested in Mathematics.*	3.67	2.43	3.68	2.45
4. I am always ready to solve mathematical problems.	3.44	2.98	3.58	3.31
5. Solving mathematical problems can be pleasant and interesting.	3.63	3.46	3.83	3.83
6. I do not usually give up solving a mathematical problems until I have found its solution	3.47	3.18	3.64	3.48
7. I am made for mathematics.	2.69	2.58	2.96	2.75
8. These days, learning mathematics is a complete waste of time.*	4.06	1.94	4.15	1.75
9. I simply cannot do mathematics.*	3.83	2.41	3.86	2.29
10. Sometimes it seems I can spend all my life solving mathematical problems.*	2.95	2.66	3.16	2.80
11. Without a good knowledge of mathematics I will find it hard to enroll in the college I wish.	3.66	3.96	4.16	4.16
12. A knowledge of mathematics gives a base of sound thinking in everyday life.	3.70	3.83	4.00	4.04
13. A solid mathematical knowledge opens more possibilities when selecting a future profession.	3.67	3.88	4.24	4.20
14. I am more successful than most students of my age at solving mathematical problems.	2.72	2.65	2.68	2.83
15. A mathematical way of thinking impoverishes human life.	2.62	3.40	2.39	3.80
16. Sometimes, even after class, I think about mathematical problem that I could not solve in it.	3.33	3.13	3.62	3.41
17. I do not try to solve a task if it appears too difficult.*	3.43	3.00	3.47	2.59
18. When I begin solving a mathematical problem, I suspect in advance that I will not finish it successfully.*	2.96	2.81	3.19	2.60
19. You cannot deal with anything seriously today without good mathematical knowledge.*	3.51	3.20	3.90	3.59
20. No matter how much I try, I cannot essentially influence my success in mathematics.*	3.29	2.70	3.22	2.54
21. I get upset when I cannot solve a mathematical problem.*	2.51	3.35	2.58	3.51
22. If I cannot solve a mathematical problems in 10-15 minutes I cannot solve it at all.*	3.22	2.84	3.39	2.51
23. I admire people who know mathematics well.	4.13	4.34	4.43	4.50
24. Success in mathematics depends on good or bad luck to a great extent.*	3.66	2.44	3.42	2.40
25. Good mathematicians are highly esteemed in society.	3.66	3.44	3.78	3.75
26. I feel proud when I solve a harder mathematical problem.	4.13	4.01	4.34	4.39
27. Success in mathematics can only be achieved by regular study and practice.	4.01	3.55	4.18	3.89
28. The mark in mathematics mostly depend on the teacher's good or bad mood.*	3.27	2.74	3.55	2.80
29. For success in life today, it is sufficient to know four basic arithmetic operation.	2.19	3.69	1.93	3.99
Overall Mean	***3.36***	***3.14***	***3.14***	***3.28***

Table 6 presents the students' self-efficacy beliefs. Among the twenty-nine statements, "I admire people who know Mathematics well and I feel proud when I solve a harder mathematical problem" has the highest mean of 4.13 in the pretest but in the posttest, the statement "I admire people who know Mathematics well." has the highest mean of 4.34. On the other hand, the statement "I get upset when I cannot solve a mathematical problem" has the lowest mean in the pretest having a mean of 2.51 but in the posttest, the statement "Learning mathematics

is a complete waste of time" with a mean of 1.94. In general, the participants have high self-efficacy beliefs towards mathematics learning with mean of 3.36 and 3.14, respectively.

In the same table, third year students' self-efficacy beliefs is shown. Participants answered "I admire people who know Mathematics well." with the highest mean of 4.43 in the pretest and in the posttest with mean score of 4.50. On the other hand, the statement "I get upset when I cannot solve a mathematical problem" has the lowest mean in the pretest having a mean of 2.58 but in the posttest, the statement "These days, learning mathematics is a complete waste of time." with a mean of 1.75. These show that students tend to have low self-efficacy beliefs when they can not solve a mathematical problem.

The participants had moderate self-efficacy belief towards mathematics with mean of 3.14 and 3.28, respectively. This suggests that students' judgment on their ability to perform mathematical tasks is somewhat uncertain (neutral) but is increasing positively. This is in consonance with the study of Anderson and Betz (2001) when they posited that development of beliefs of students can be traced back to their past performance, emotional arousal, and social persuasion which are direct learning experience.

Table 7

T-test for Difference: Performance of Students Before and After the Intervention

Variables	Grade/Level	Mean	SD	T	p-value
Pretest	Grade 7	74.53	6.358	***-5.434****	***0.000***
Posttest		81.96	5.413		
Pretest	Third Year	54.61	9.374	***-9.027****	***0.000***
Posttest		69.93	***7.589***		

*α =0.01 level of significance

Table 7 reveals the t-test for difference in the performance of students before and after the use of instructional materials. The data shows that for the grade 7 students, the mean score in the pretest is 74.53 and in the posttest is 81.96. This indicates that there is an increase of mean score or performance of the students after using the IMs. There was a significant increase in the performance of the students. For the third year students, the mean score in the pretest was 54.61 and in the posttest is 69.93. T-test revealed that there was a significant increase in the performance of the students.

The significant increase of students' performance from pretest to posttest reveals the effectiveness of the IMs used in enhancing learning among students.

During informal interviews, students claimed that they found IMs to be useful especially that topics in the course syllabi are already well-arranged and presented. These findings are supported by the National Mathematics Advisory Panel (NMAP, 2008) when it espoused that research-based IMs foster success in Algebra and beyond.

Table 8

T-test of Difference: Attitude, Motivation, and Self-efficacy Belief Before and After the Investigation

Variables	Pretest	Posttest	t	p-value
Self-efficacy Beliefs	***3.26***	***3.32***	***5.56***	***0.000***
Attitude				
A. Towards Mathematics	3.51	3.79	4.64	0.000
B. Mathematics Anxiety	3.12	3.73	15.54	0.000

Table 8 shows the t-test for difference in the students' attitudes, motivation, and self-efficacy beliefs in Mathematics. The table shows that participants have a mean score equal to 3.51 and 3.79, in the pretest and posttest, respectively. This implies that students have positive attitude towards Mathematics. There is a significant increase in the attitude of the students. This means that there is a positive and significant change of students' attitude after using the IMs. This supports the claim of Ballantine as cited by Honor (2007) that students with positive attitude are motivated to perform better.

For students' self-efficacy beliefs, their mean score in the pretest is 3.26 while 3.32 in the posttest. This indicates that participants have moderate beliefs of their capacity before and after the investigation. There is a significant increase in the self-efficacy beliefs of the students. This indicates that IM has affect a significant change in the beliefs of the participants.

During casual conversation with high performing respondents, they said that the availability of IMs makes them motivated to read the topics in Mathematics and even answer the exercises in advance. They claimed that IMs are very useful especially in the preparation for periodical examinations. This is in consonance with Nicolaidou and Philippou's (2003) research results when they found out that engagement and avoidance of mathematical activities can be measured by the students' beliefs if one is good or bad in Mathematics, or one students' attitude and beliefs on his ability to perform tasks.

CONCLUSIONS

Based on the findings of the study, the researchers conclude that the participants have low performance in General Mathematics and High School Statistics before the conduct of the study. However, their performances increase to average after the treatment period. The students have varying levels of attitude before and after the conduct of the investigation. Their attitude ranges from moderately positive to positive. There is a significant increase of the performance of students before and after the use of IMs for all levels. There are significant differences in the students' attitudes, motivation, and self-efficacy beliefs before and after the treatment.

RECOMMENDATIONS

Based on the above-mentioned conclusion, the following recommendations were made:

1. Faculty members are encouraged to develop their instructional materials and utilize varied instructional aids to enhance student learning;

2. Authors of IMs are reminded to continually revise their developed IMs to suit the learning style and preferences of the students;

3. Teachers are invigorated to utilize different methods, strategies and techniques of teaching including the use of IMs, equipment, technology and others to facilitate effective teaching and develop positive attitude towards mathematics among students;

4. Teachers' initiatives and promotion of successful mathematical experiences among students be provided to strengthen self-efficacy beliefs; and

5. Varied learning activities be prepared by teachers to help students with negative attitude and low self-efficacy beliefs be able to revert them to a more favorable attitude and beliefs.

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