



MATHEMATICS TEACHING SKILLS AND STUDENTS' LEVEL OF PERFORMANCE: INPUT TO A PARADIGM SHIFT MODEL

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Abstract: This study aimed to determine the relationships between Mathematics Teaching Skills such as 1) Employing Mathematics Enhanced Activities, 2) Innovation in Teaching Mathematics, 3) Caring Attitude Towards Mathematics, 4) Teachers' Creativity, and 5) Teachers' Motivation and the Students' Performance measured by: 1) Grade Point Average in Grade 10, 2) Attitude Towards Math and 3) Involvement in Mathematics Activities in order to propose a plan of action which will serve as an input to a paradigm shift model for an improved learning environment in Mathematics education.

The respondents of this study were the Math teachers and Grade 10 students of the four selected schools namely: Philippine School Doha, Philippine International School Doha, Valenzuela City School of Math and Science and Malinta National High School. The subjects of this study were the 17 teachers selected from Qatar Schools and 13 teachers from the Philippines. The total population of the Grade 10 students of the four selected schools was 368 which comprised of 200 students from Qatar and 168 students from the Philippines.

The statistical tools employed in this study were frequency counts and percentages to describe the profile of the respondents, means and standard deviations to describe the level of Math teaching skills and students' performance, Pearson's r to determine the significant relationships and the one-way analysis of variance (ANOVA) to determine significant differences among the variables mentioned.

The findings of this study revealed that: 1) There is no significant relationship between Math teaching skills and students' performance. 2) Teachers' motivational skills differed significantly when grouped according to gender. 3) Enjoying Mathematics enhanced activities and caring attitude towards Math are two skills which significantly differed when teachers are grouped according to their students' Math performance. 4) Schools differ significantly according to students' performance. 5) Proposed paradigm shifts from teacher-effective system to learner-effective system were designed to create a culture of high expectation, collaboration and excellence.

Based on the findings, the following conclusions were drawn: 1) None of the Mathematics teaching skills were correlated with any of the students' performance. 2) Male teachers motivate students better than the female teachers. 3) Employing Mathematics enhanced activities affect the students' performance. 4) Mathematics teaching skills of Philippines and Qatar schools differed significantly except in teaching innovations. 5) Students' performance differed significantly in each school. 6) Mathematics teaching skills consisting of employing Mathematics enhanced activities and caring attitude are two of the many skills for which the teachers should study to create a paradigm shift in Mathematics education. 7) Schools have their own set of criteria in measuring success considering that students' performance in terms of grade-point average, attitude towards Math and involvement in Math activities differed significantly.

Index Terms – Teaching Skills, Enhanced Activities, Innovation in Teaching Math, Caring Attitude, Teacher's Creativity, Paradigm Shift

I. INTRODUCTION

Mathematics is useful, important and interesting as what mathematician John Allen Paulo's writes, it is useful because mathematical problems abound in our daily lives, it is essential in the field of science, engineering and research. It is important because the mathematically inclined persons will make better economic and political decisions about risk, policy and resource allocation. It is interesting because it possesses not only truth, but supreme beauty (Bertrand Russell) and should be studied in its own right.

In an era of standards-based reform in education, many believe that improved learning environment can best be achieved by improved teaching (Birman, Desimone, Porter & Garet, 2000). The issue of professional development of teachers that supports school Mathematics reform as addressed by Borasi and Fonzi (2002) identified five factors that must be present to meet the needs of teachers of Mathematics These are (1) sustained and intensive training and development, (2) be informed of what people know about how people learn best, (3) center around the critical activities of teaching and learning rather than focus primarily on abstractions and generalities; (4) foster collaboration) and (5) offer a rich set of diverse experiences.

Over the past century, several reforms have been tried as attempts to change the paradigm to which Mathematics is viewed as a disembodied set of objective truths to be communicated to students most of whom would then struggle to internalize them. (Ellis & Berry, 2005). Research in Mathematics classroom during the latter years of the twentieth century found that in the United States, teachers were still the center of authority, first disseminating rote skills and procedural knowledge to their students who then worked individually on sets of problems in order to internalize this knowledge (p.10).

With these criticisms on the efforts to impact a curricular change in Mathematics education and with the advent of the full implementation of K-12 basic education curriculum in the Philippines, one may ask, “has there been a significant change in Mathematics education over the past years?”

3.1 Population and Sample

The subjects of this study were the 17 teachers selected from Qatar schools and 13 teachers from the Philippines. Comprising the total population of Mathematics teachers of four schools selected. The Mathematics students in Grade 10 of these schools who have completed the Junior High School served as the student-respondents. A total population of 200 students from Qatar and 168 students from the Philippines representing the whole population of Grade 10 students from these schools served as respondents in this study.

REVIEW OF RELATED LITERATURES AND STUDIES

1.1. Gender

Study shows that the gender of the teachers affects the performance of the students. Gender matters when it comes to learning, the study of Thomas Dee(2007), about “Teachers and the Gender Gaps in Student Achievement “, resulted to having a female teacher instead of a male teacher raised the achievement of girls and lowered that of boys in Science, Social Studies and English. Dee also contends that gender influences attitudes. This is supported by his findings that with a female teacher, boys were more likely to be seen as disruptive. Girls were less likely to be considered inattentive or disorderly.

Martin, A.& Marsh, H. (2005), found in their study that according to the gender-stereotypic model, boys fare better academically in classes taught by males and girls fare better in classes taught by females. The gender-invariant model suggests that the academic motivation and engagement of boys and girls is the same for men and women teachers.

Studies have shown that teachers’ gender has its role on the effectiveness of teachers. According to Norlander – Case, Regan and Case (1999) women tend to perform better in teaching than their male counterparts. This is supported by the findings from TIMSS 2003 data for Israel which revealed that students taught by female teachers achieve more—about a third of a group standard deviation—than those students taught by male teachers.

1.2. Age

When it comes to the relation of the teachers’ age and academic performance of the students, few studies exist. This is supported by Sloan & Kelly (2003) as cited by Alufohai & Ifhafidon (2015) as they mentioned that most developed countries such as America do not care about the age of a teacher. A study on the Effect of Teacher Age and Gender on Student Perception carried out in Columbia by Martin and Smith (1990), where teachers’ age was grouped into three levels – young age, middle age and old age, revealed that middle aged teachers were perceived by learners to be more effective in classroom organization, motivation, communication and competence. Another study by Goebel and Cashew (1979) as cited by Alufohai & Ifhafidon (2015) revealed that old teachers were rated lower on teaching skills than young or middle aged teachers.

1.3. Civil Status

Studies about marital status have shown that unmarried and married teachers had higher scores than those separated and divorced in the dimensions of job engagement, especially in the dimension of vigor and dedication to duty, Kong (2005). Kong also mentioned that single teachers who do not have any family issues are more dedicated and committed to their jobs.

This was supported by the study of Sangman as cited by Joson (2012), stated that single teachers had higher level of performance than married ones.

In the study of Bautista as cited by Carlos E. (2015), civil status play significant roles in job performance. It point out that being married or single affects teacher's performance. She further implied that married teachers tend to have greater understanding and anticipation of time management.

1.4. Educational Attainment

Cruz as cited by Carlos E. (2015) stressed that teachers' educational attainment helped the institution achieve its goals and training and education of teachers reflect the teaching competencies which likewise improve students' achievement.

This was further explained by the study of Goldhaber, D. & Brewer, J. (1997) on "Evaluating the Effect of Teacher Degree Level on Educational Performance" revealed that a teacher with a BA in Mathematics, or an MA in Mathematics, has a statistically significant positive impact on students' achievement relative to teachers with no advanced degrees or degrees in Non-Mathematics subjects.

1.5. Math Teaching Experience

The findings from TIMSS 2003 data for Israel about "Teachers' Qualifications and their Impact on students achievement as written by Zuzovsky(2003), revealed that students studying in groups taught by Mathematics teachers with more than 15 years of experience achieve more—by about a half of a group standard deviation—than those students studying in groups taught by Mathematics teachers with less experience (five years or fewer).

The reasons for the paradigm shift can be supported by the following:

2.1. Employing Mathematics Enhanced Activities

Mathematics Lessons have been found to be difficult, boring and lacking in effective teaching/learning materials. The challenge is how to make Mathematics more "alive", more "real" and more "accessible. The Strengthening of Mathematics and Science in Secondary Education (SMASSE) project in 1998 has shown that consistent failure and negative attitude by students, towards Mathematics, continues to characterize the classroom. Based on this same research, teachers have been found to present lessons that are too much teacher-centered with the teacher as the main actor and sometimes the only actor in the classroom as students remain passive recipients. It is, therefore, strongly felt that students' involvement during lessons must be enhanced to increase motivation, effective teaching/learning materials used and lessons should be made more interesting.

Bahru, 2005 realized that a student-centered lesson should be enhanced from two complimentary elements; (i) placing more responsibility in the hands of students, and (ii) requiring the teacher to serve as a mentor and facilitator in presenting knowledge especially to students and fellow teachers in the teaching /learning process.

2.2. Innovations in Teaching Mathematics

Berkun, (2013) defined innovation as significant positive change. It's a result. It's an outcome. It's something you work towards achieving on a project.

Innovations in teaching of Mathematics can be diversified in terms of learning strategy, methods, and pedagogic resources.

2.3. Caring Attitude towards Mathematics

Noddings (2003), describes caring not as an attribute of personality but as a relation. Caring is not something you are, but something you engage in, something you do with every interaction that provides an opportunity to enter into a caring or uncaring relation. She claims that each caring encounter is an interaction between a person giving care and a person or object receiving care; as she describes it, the "one-caring" and the one or object "cared-for." The "one-caring" responds to the "cared-for" with full attention and receptivity to who or what the "cared-for" is and needs. Her concept exceeds empathy and describes a state of "feeling with" characterized not by projection but by reception, receiving the other into oneself, thereby seeing and feeling with the other.

Meyers (2009) found out that when instructor-student rapport increases, those increases are associated with greater student enjoyment of the class, improved attendance and attention, more study time devoted to the class, and more courses taken in that discipline. Another study documented that a professor's positive attitude toward students accounted for 58 percent of the variability in the students' motivation, 42 percent of the variability in course appreciation, and 60 percent of students' attitude about the instructor. (p. 206).

Deiro (1996), as cited by Miller (2008) stated that, the research had not yet identified how teachers could exhibit caring behaviors so that students would work harder and achieve more. Deiro also mentioned that caring requires teachers to be equipped with principles and practical skills for building close and trusting relationships.

2.4. Creativity in Teaching Mathematics

The success of teaching Math lies with the creativity of the teachers. Creativity can be seen as the ability of man to establish new relationships to change reality (Eid, 2000, cited by Fayez, Mina 2008). Teachers have a vital role in motivating students, establishing a creative environment and a guide to know their limitations.

According to Fayez, Mina (2008), the two essential inputs to mathematical creativity are; adopting developments in Science and paradigm shifts in education, Mathematics and Mathematics education.

2.5. Motivation in Teaching Mathematics

In the usual class settings, students need to be motivated to give their best. Janelle Cox, the contributing writer of TeachHub.com enumerates the following as few strategies that use extrinsic as well as intrinsic motivation to inspire young minds to love Math.

a. Build on Skills Students Have Mastered

An effective technique is to structure learning based on what students have already mastered. When you build on skills students feel comfortable with, it will give them a sense of accompaniment. You'll also be learning how to motivate students to want more.

b. Demonstrate the Usefulness for Math in the Real World

A critical element to switching students on to Math is to show them how it is used in their lives. Many children do not understand that the tools they use every day (Twitter, Instagram, and texting) come from an engineer. When you help students make this connection, it can in turn motivate them, and they will be able to appreciate how Mathematics can translate into a career.

c. Set Achievable Goals

Help students set a goal to work towards it. Start small, and once they achieve their first goal, move to a higher one. Once students get a taste of achieving their aims on a regular basis, it will motivate them to strive for even more.

d. Present a Reasonable Challenge

Present your students with a challenge that is both within their reach and can peak their excitement. After all, it's difficult to motivate a love for Math if there's no enthusiasm behind it. Children love a challenge and this can very well be the key factor to get your students hooked on the subject.

e. Incorporate Technology into Lessons

Children love technology and any time that you can incorporate it into your lessons, the better. There are numerous Math apps on the market that provide students with challenging games or at the very least, a different vantage point to approach the problems. Teachers can use them generously.

f. Be Enthusiastic While Presenting Math

Another powerful trigger to cultivating a love for Math is your own enthusiasm while teaching. Children tend to attach a value to each subject, and when they see their teacher (or parent) values Mathematics, and then they too will understand its importance.

g. Entice Students with a Magical Math Problem

Magic is something that mystifies people, and sometimes all it takes to motivate a student to love Math is to give them one bewildering problem that can get them hooked. For example, the **birthday problem** is a famous Math problem based on the premise that at least two students in a classroom will have the same birthday.

h. Play Games

Make Math interesting by using recreational Mathematics to motivate students, such as puzzles, board games, and manipulative. Chess can teach students to strategize and calculate, while other games can teach math-related skills to help keep their minds sharp.

PARADIGM**What is the meaning of paradigm?**

Do paradigm, really matters in our lives? What really a paradigm is? Everything that is being thought and done can be explained by the paradigms we have developed and been born into. According to Joel Barker, famous business consultant and all around nice fellow, a paradigm is a problem solving system. They are the way we see the world.

PARADIGM SHIFT

What is a paradigm Shift?

Thomas Kuhn (1962), defined *paradigm shift* as not just a small change in Science or the modification of a theory. It is a scientific revolution and completely changes the way in which Science looks at the world.

Paradigm shift in Mathematics is from seeing Mathematics as the study of formal systems to seeing Mathematics as a living body (Fayez, 2008).

On May 2013, the Department of Education (DepEd) launched a training program entitled Learning Effectively through Enhanced Pedagogies (LEEP) to improve the delivery of education for Filipino learners.

According to DepEd Secretary Br. Armin A. Luistro (2013), LEEP aims to train teachers and principals on a direct learner-centered educational system, in line with the paradigm shift of K to12 educational reform for a more proactive approach in the classroom. Dr. Oscar M. Lopez, Chairman of the KCFI Board of Trustees said. "The goal of the K to 12, with programs like LEEP to complement its goals, is to shift the perspective of our educational system from a teacher-effective system to a more learner-effective structure in our classrooms.

3.3 Conceptual framework

The framework shown in Figure 1 was based on the Mathematics Teaching Skills of the secondary mathematics teachers and students performance which will be an input to a paradigm shift model for an improved learning environment. The independent variables in this study were the teachers' and students' demographic information. The researcher will also explore the teachers' Mathematics teaching skills in terms of employing enhanced Mathematics activities, innovations in teaching Mathematics, caring attitude towards teaching Mathematics, creativity in teaching Mathematics and motivation in teaching Mathematics.

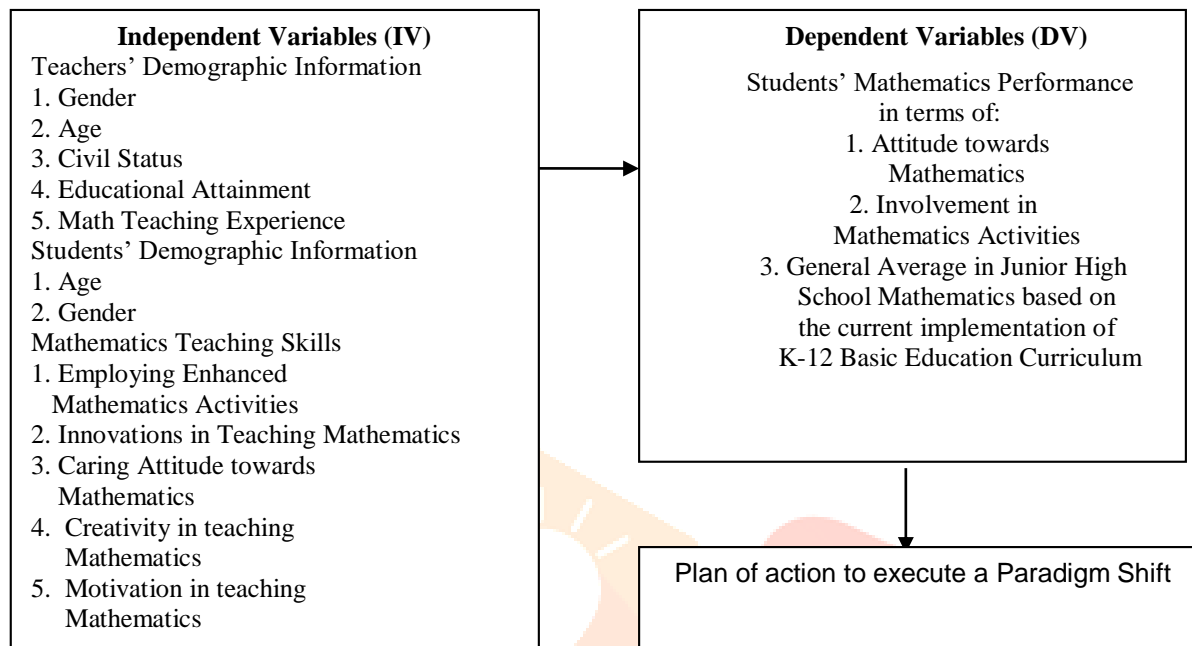


FIGURE 1. The representation of the relationship among variables within the conceptual framework

The dependent variable in this study were the students' Mathematics performance in terms of attitude towards Mathematics, involvement in Mathematics activities and general average in Junior High School Mathematics based on the current implementation of K-12 Basic Education Curriculum.

A plan of action to execute a paradigm shift will be the tail end of this study.

RESEARCH METHODOLOGY

Research Design

The present study is descriptive in nature. It involves the description and interpretation of conditions that exist within the independent variables as well as their relationship to the level of students' Mathematics performance in terms of their attitude towards Mathematics, involvement in Mathematics activities and general average in Junior High School Mathematics based on the current implementation of K-12 Basic Education Curriculum.

3.4 Statistical Tools

The statistical tools employed in this study were: frequency counts and percentages to describe the profile of the respondents, means and standard deviations to describe the level of Math teaching skills and students' performance, Pearsons' r to determine the significant relationships and the one-way analysis of variance (ANOVA) to determine significant differences among the variables mentioned. All statistical computations were computer-processed through the Statistical Package for Social Sciences (SPSS) software, all set at 0.05 level of significance.

IV. RESULTS AND DISCUSSION

Table 5 shows the correlation matrix of the teacher-respondents characteristics and Math teaching skills with their students' performance.

The table reveals that Mathematics teaching skills have no significant relationships with the Mathematics performance, attitude towards Math and involvement in Math activities.

The table indicates the following insignificant correlations at 95% confidence level.

A. Employing Mathematics Enhanced Activities VS

- 1.) Math Grade Point Average Performance : $r = 0.12$
- 2.) Attitude towards Mathematics : $r = -0.06$
- 3.) Involvement in Math Activities : $r = -0.14$

The hypothesis of no significant relationships is therefore accepted at 95% level of confidence.

B. Innovations in Teaching Mathematics VS

- 1.) Math Grade Point Average Performance : $r = -0.04$
- 2.) Attitude Towards Mathematics : $r = -0.11$
- 3.) Involvement in Math Activities : $r = -0.16$

This Mathematics teaching skill has no significant relationships with the students Mathematics performance.

C. Caring Attitude Towards Mathematics VS

1. Math Grade Point Average Performance : $r = -0.09$
2. Attitude Towards Mathematics : $r = -0.18$
3. Involvement in Math Activities : $r = -0.27$

With the computed correlation coefficients and significant tests at 0.05 level, the claim of no significant relationships is therefore accepted.

D. Teachers' Creativity VS

1. Math Grade Point Average Performance : $r = -0.07$
2. Attitude Towards Mathematics : $r = -0.16$
3. Involvement in Math Activities : $r = -0.23$

Again, teachers' creativity has no significant relationships with any of the students' performance. The claim of no significant difference is therefore accepted at 0.05 level of significance.

E. Teachers' Motivation

1. Math Grade Point Average Performance : $r = -0.16$
2. Attitude towards Mathematics : $r = -0.21$
3. Involvement in Math Activities : $r = -0.26$

The above Math skills of teachers' motivation were not correlated with the students' performance. The null hypothesis of no significant relationships is therefore accepted at 95% confidence level.

Table 5. Correlation Matrix of Teacher-Respondents Characteristics and Math Teaching Skills with their Students' Performance

Variables	Skill A Enhanced Activities	Skill B Innovation	Skill C Caring Attitude	Skill D Creativity	Skill E Motivation	Students' Performance	Students' Attitude	Students' Involvement
Gender	-0.14	-0.18	-0.12	-0.30	0.39*	-0.23	-0.181	-0.15
Age	-0.24	-0.29	-0.20	-0.26	0.02	0.13	0.26	0.24
Civil St.	0.08	0.00	0.10	-0.02	-0.04	-0.22	-0.19	-0.18
Education	0.32	0.19	0.37*	0.25	0.30	0.04	0.05	-0.06
Experience	0.07	0.08	0.07	0.05	0.18	0.08	0.07	-0.00
Skill A	1.00	0.64**	0.61**	0.70	0.34	0.12	-0.06	-0.14
Skill B	0.64**	1.00	0.67**	0.87**	0.65	-0.04	-0.11	-0.16
Skill C	0.61**	0.67**	1.00	0.75	0.60**	-0.09	-0.18	-0.24
Skill D	0.70**	0.87**	0.75**	1.00	0.71**	-0.07	-0.16	-0.23
Skill E	0.34	0.65**	0.60**	0.07**	1.00	-0.16	-0.21	-0.26

*Correlation is significant at the 0.05 level (2 tailed)

**Correlation is significant at the 0.01 level (2-tailed)

In summary, we can say with certainty at 95% confidence that each of the Math teaching skills has no significant relationships with the students' performance. It means that the Mathematics teaching skills which comprised of employing Mathematics enhanced activities, innovations in teaching Mathematics, caring attitude towards Mathematics, teachers' creativity and teachers' motivation are independent of the students' performance as defined by the grade point average, attitude towards Math and involvement in Math activities.

Table 6. Significantly Differed Variables with Mathematics Teaching Skills Based on ANOVA Test

1. GENDER	ANOVA			
	Groups	df	F-value	Significance (p<.05)
1. Skill A. Employing Math Enhanced Activities Descriptive: Mean (SD) Male : : 4.17 (0.45) Female: : 4.03 (0.52)	Between Groups Within Groups Total	1 28 29	0.59	.45
2. Skill B. Innovations in Teaching Math Descriptive: Mean (SD) Male : : 3.83 (0.59) Female: : 3.67 (0.35)	Between Groups Within Groups Total	1 28 29	0.89	.35
3. Skill C: Caring Attitude Towards Math Descriptive: Mean (SD) Male : : 4.48 (0.39) Female: : 4.37 (0.52)	Between Groups Within Groups Total	1 28 29	0.44	.51
4. Skill D. Creativity Descriptive: Mean (SD) Male : : 4.34 (0.69) Female: : 3.99 (0.49)	Between Groups Within Groups Total	1 28 29	2.72	.11
5. Skill E. Motivation Descriptive: Mean (SD) Male : : 4.33 (0.65) Female: : 3.82 (0.56)	Between Groups Within Groups Total	1 28 29	4.98	.03
2. Students' Math Grade Performance				
	ANOVA			
	Groups	df	F-value	Significance (p<.05)
1. Skill A. Employing Math Enhanced Activities Descriptive: Mean (SD) >81 : 4.28 (0.57) 84 ≥ 87: 4.22 (0.32) 81 ≥ 84: 3.65 (0.43) < 87 : 4.24 (0.29)	Between Groups Within Groups Total	3 26 29	3.77	.02
2. Skill B. Innovations in Teaching Math Descriptive: Mean (SD) >81 : 3.86(0.29) 84 ≥ 87: 3.85(0.29) 81 ≥ 84: 3.52(0.61) < 87 : 3.68(0.63)	Between Groups Within Groups Total	3 26 29	0.96	.43
3. Skill C: Caring Attitude Towards Math Descriptive: Mean (SD) >81 : 4.58(0.36) 84 ≥ 87 : 4.66 (0.35) 81 ≥ 84: 4.08 (0.51) < 87 : 4.24 (0.46)	Between Groups Within Groups Total	3 26 29	3.52	.03
4. Skill D. Creativity Descriptive: Mean (SD) >81 : 4.33 (0.47) 84 ≥ 87 : 4.36 (0.43) 81 ≥ 84 : 3.76 (0.68) < 87 : 3.98 (0.67)	Between Groups Within Groups Total	3 26 29	2.13	.12
5. Skill E. Motivation Descriptive: Mean (SD) >81 : 4.24 (0.30) 84 ≥ 87; 4.21 (0.81) 81 ≥ 84: 3.76 (0.63) < 87: 3.76 (0.71)	Between Groups Within Groups Total	3 26 29	1.38	.27
3. Students' Attitude Towards Mathematics				
	ANOVA			
	Groups	df	F-value	Significance (p<.05)
1. Skill A. Employing Math Enhanced Activities Descriptive: Mean (SD) 3.60: 4.28 (0.57) 4.00: 4.22 (0.32) 3.90: 3.65 (0.43) 4.20: 4.24 (0.29)	Between Groups Within Groups Total	3 26 29	3.77	.02
2. Skill B. Innovations in Teaching Math Descriptive: Mean (SD) 3.60: 3.86 (0.29) 4.00: 3.85 (0.29) 3.90: 3.52 (0.61) 4.20: 3.68 (0.63)	Between Groups Within Groups Total	3 26 29	0.96	.43
3. Skill C: Caring Attitude Towards Math Descriptive: Mean (SD) 3.60: 4.59 (0.36) 4.00: 4.66 (0.35) 3.90: 4.07 (0.51) 4.20: 4.24 (0.46)	Between Groups Within Groups Total	3 26 29	3.52	.03
4. Skill D. Creativity Descriptive: Mean (SD) 3.60: 4.33 (0.47) 4.00: 4.36 (0.43) 3.90: 3.76 (0.68) 4.20: 3.98 (0.67)	Between Groups Within Groups Total	3 26 29	2.13	.12

5. Skill E. Motivation Descriptive: Mean (SD) 3.60: 4.24 (0.30) 4.00: 4.21 (0.81) 3.90: 3.76 (0.63) 4.20: 3.76 (0.71)	Between Groups Within Groups Total	3 26 29	1.38	.27
4. School	ANOVA			
	Groups	df	F-value	Significance (p<.05)
1. Skill A. Employing Math Enhanced Activities Descriptive: Mean (SD) Philippine : 3.88 (0.47) Qatar : 4.25 (0.45)	Between Groups Within Groups Total	1 28 29	4.89	.04
2. Skill B. Innovations in Teaching Math Descriptive: Mean (SD) Philippine : 3.58 (0.60) Qatar : 3.85 (0.28)	Between Groups Within Groups Total	1 28 29	2.68	.11
3. Skill C: Caring Attitude Towards Math Descriptive: Mean (SD) Philippine : 4.14 (0.48) Qatar : 4.62 (0.35)	Between Groups Within Groups Total	1 28 29	10.46	.00
4. Skill D. Creativity Descriptive: Mean (SD) Philippine : 3.85 (0.66) Qatar : 4.35 (0.44)	Between Groups Within Groups Total	1 28 29	6.25	.02
5. Skill E. Motivation Descriptive: Mean (SD) Philippine : 3.76 (0.64) Qatar : 4.23 (0.58)	Between Groups Within Groups Total	1 28 29	4.44	.04
6. Performance Descriptive: Mean (SD) Philippine : 84.48 (2.48) Qatar : 82.81 (1.54)	Between Groups Within Groups Total	1 28 29	5.15	.03
7. Attitude Descriptive: Mean (SD) Philippine : 4.01 (0.15) Qatar : 3.79 (0.21)	Between Groups Within Groups Total	1 28 29	11.15	.00
8. Involvement Descriptive: Mean (SD) Philippine : 3.57 (0.10) Qatar : 3.34 (0.15)	Between Groups Within Groups Total	1 28 29	22.73	.00

The table reveals that the teachers' mathematics teaching skills which comprise of A.) Employing mathematics enhanced activities, B.) Innovation in teaching mathematics, C.) Caring attitude towards mathematics, D.) Teachers' Creativity and E.) Teachers' motivation were found to differ significantly in some aspects with the following variables: gender, students math grade performance, attitude towards math and when grouped according to schools.

A closer look at the table will show that the teachers' motivational skills differed significantly with gender with an F-value of 4.99 and a probability of .03, which is below the critical value of 0.05 for rejection. Hence, the null hypothesis of no significant difference is therefore rejected at 95% confidence level.

The table also reveals that male teachers obtained higher mean score compared with female teachers. It means that male teachers motivate their students better than their counterpart. Male teachers obtained a mean score of 4.33 and standard deviation of 0.65 against the mean of 3.82 and standard deviation of 0.56 of the female teachers.

Particularly, among the five teaching skills, the employment of enhanced math activities and the teachers' caring attitude towards Mathematics varies significantly when grouped according to students' grade performance as shown by F-values of 3.77 and 3.52 respectively with probabilities obtained below the critical value of .05. ($p = .02$ and $.03$ respectively). In these cases, the null hypotheses of no significant differences were rejected at 5% level of significance.

It can be claimed therefore, with 95% confidence that students' performance will vary when teachers employ enhanced math activities in the classroom and shows a caring attitude towards mathematics. This findings corroborates the study of Shann, (1999) and Bahru (2005) on the aspect of utilizing manipulative, hand-on materials, games and the like which tend to enhance students' math performance and similarly, showing concerns and nurturing a caring environment boost the learning capabilities of the students.

Moreover, the Math teaching skills tend to vary when grouped according to schools; Philippines and Qatar. Significant differences were also noted on the students' performance.

Based on the ANOVA table, when the mathematics teaching skills were grouped according to Qatar and Philippine schools, the F-values obtained were 5.15, 11.15 and 22.73 respectively for math grade performance, attitude towards math and involvement in math activities. These obtained probabilities of less than the critical value of .05. Hence, the hypothesis of no significant difference is rejected.

It can be surmised that students in the Philippines performed better compared with their counterparts in Qatar as shown by the mean values of 84.48 obtained by the students in the Philippines and 82.81 by Qatar students in terms of Grade point average. A closer look at the table will also show that in terms of attitude towards Mathematics and involvement in Math activities, students from the Philippines performed higher.

It is also worth to note that only the Math teaching skill on innovations in teaching turned out of having no significant difference. It means that Philippine and Qatar schools did not have any significant difference on the innovations made in teaching mathematics. Perhaps, this can be explained that all these schools follow the same curriculum approaches as prescribed by the Department of Education.

It can also be deduced that Philippine and Qatar Schools differed significantly in terms of Mathematics teaching skills. The descriptive statistics shown in the table reveals higher means of Qatar schools.

Proposed plan of action to execute a paradigm shift in Mathematics education.

With a backdrop of the K-12 Basic Education curriculum, particularly on the Mathematics program, this action plan is being proposed based on the collated major findings of this present study which includes:

- Mathematics Teaching Skills consisting of employing Mathematics enhanced activities and caring attitude differed significantly when grouped according to students' performance measured by grade point average and attitude towards Mathematics.
- Mathematics teaching skills consisting of employing Mathematics enhanced activities, caring attitude, teachers' creativity and motivation differed significantly when grouped by schools.
- Students' performance in terms of grade point average, attitude towards Math and involvement in Math activities differed significantly when grouped according to schools.

The above findings confirm that the teacher remains to be the catalyst to ignite an effective learning atmosphere in the classroom. A more proactive approach in the classroom necessitates a paradigm shift in our educational system particularly in Mathematics program from a **teacher-effective system to a learner-effective system** in which the K-12 educational reform aims to achieve.

The ACTION PLAN

Figure 13. Proposed Action Plan to execute the Paradigm Shift in Mathematics Education



Figure 13 displays the proposed action plan to execute a paradigm shift in Mathematics Education. The action plan shows the three factors that stood out from this research study to guide the implementation of this paradigm shift. Three cultures were included in the paradigm. The action plan proposed to create a Culture of High Expectation which lies in the center of the concentric circle, to create a Culture of Collaboration can be found in the middle circle and the outer most circle aimed to create a Culture of Excellence.

The three cultures were further discussed below:

1.) Create a Culture of High Expectation

Teachers should believe that raising the bar will increase student achievement. The teachers in the classroom must be willing to increase the rigor of instruction employing Mathematics enhanced activities. School managers should be willing to support these efforts. The teachers should communicate their high expectations to the students on a daily basis. Teachers do this by *raising the standards* for all students in the classroom and show care to help the students succeed. Raising the standard without additional support is setting up the students for failure. School managers support the culture of high expectations by providing staff development resources and support for the efforts extended by the teachers.

In order to support the students, this research study came up with the idea of developing **Math HELP** (Helping Everyone Like to Pass Math) Program. In this program, the math department can open a Math Clinic to accommodate students who need help in their assignments and provide tutoring for students who needs extra guidance in their lessons. The teacher together with the math club officers must spend time to offer before and after class math tutoring.

The Math Clinic will be a venue for the students to appreciate, understand and love Mathematics. The clinic will also offers games and puzzles and some motivating videos that will remove the math anxiety of the students. This program will be possible with the help of the Math teachers and Math Club officers.

Teachers should have high expectations for themselves as well. This means that teachers should be willing to learn and try new instructional strategies and be available to provide additional support to ensure students' success. This can be done by attending seminars.

2.) Create a Culture of Collaboration

Teacher collaboration creates a culture of high student expectations, promotes sharing of best practices, and cultivates a sense of belonging.

To begin the process, the school should organize a *core team*. The core team will include the teachers and administrators who share the same desires to improve student achievement. This core team will be responsible for developing the implementation plan for the campus.

The next step is to build the collaborative team members. These team members should be compatible and willing to work together. All members must understand that they will be expected to fully participate in the collaborative team. Once established, individual roles norms and team must be defined.

The principals should promote collaborative opportunities for teachers by allowing a specific time for the teachers to meet together. Collaboration of teachers in a school is expected to draw plans and strategies to implement activities that geared towards the development of using Mathematics enhanced activities, caring attitude towards Mathematics and creativity. Development of these skills will rebound to the benefit of the students.

The core team members are the best individuals in the Math HELP Program. Aside from providing extra help for the students in Math, they can also develop activities which will geared in the application of Mathematics Teachers Skills mentioned in this study. Some proposed activities are the following:

1. Math Fun Day
2. Math Dance
3. Math Quiz Bee
4. Math Pie Day
5. Geometric Lantern
6. Bb. at G. Sipnayan
7. Mathletics
8. Math Bulletin Board Making Contest
9. Math Artwork
10. Inter School MATHirang MATHibay Contest
11. Math HELP Seminar
12. Math HELP Program Activities (Peer Tutoring, Assignment Assistance etc.)

Collaboration can be done among teachers in a school or between or among schools in the area and with parents. Schools cannot sit back and wait for parents to come to them. Parents should be invited onto campus and involved in decision making when appropriate. Parents who feel welcome are more likely to become involved.

Parents can be invited to be the speaker in the Math HELP seminar. Sharing their expertise will be a big leap in creating culture of collaboration.

Communication between school and family should be consistent and it should involve school administrators as well as teachers.

3.) Create a Culture of Excellence

Schools aspiring to improve instruction and help students develop a positive attitude towards their studies particularly of Mathematics should embrace these characteristics. It is the role of campus leaders to determine how these characteristics look on your campus.

Professional development is the key to achieve excellence. For many years professional development was presented in a “one and done” method, presented only at the beginning of the year. To positively affect student achievement, professional development should be an ongoing learning experience.

Conduct needs assessment to determine areas that need to be improved. Invite experts or resource persons to answer and guide the teachers toward the solution of problems that affects student’s progress in school. The professional development must be on-going process, to do this, teachers must attend seminars in and outside the country.

SUMMARY OF FINDINGS

The following findings revealed that:

- 1.) Most teachers were middle-aged at 25-39 years old, female and married.
- 2.) Most teachers in Qatar have the masters’ degree or have earned units leading to a doctorate degree while teachers in the Philippines majority of which earned only a Bachelors’ degree with some units in masters’ degree.
- 3.) Majority of the teacher-respondents have been teaching Math for 6-15 years.
- 4.) Student respondents were mostly female in a ratio of 3:2 with an average age of 15.7 years old.
- 5.) Mathematics teaching skills were good. Teachers were more skilled on caring attitude but needs more improvement with their innovative skills.
- 6.) Students performed well in Math with an average of 83.89. Students from the Philippines scored better with a mean of 84.65
- 7.) Students have moderately positive attitude towards Math and actively participate in Math activities.

- 8.) There is no significant relationship between Math teaching skills and students' performance. The null hypothesis of no significant relationship is accepted at 95% level of confidence.
- 9.) Teachers' motivational skills differed significantly when grouped according to gender. Male teachers motivate better than female teachers.
- 10.) Employing Mathematics enhanced activities and caring attitude towards Math are two skills which significantly differed when teachers are grouped according to their students' Math performance.
- 11.) Schools differed significantly according to students' performance.
- 12.) Proposed paradigm shifts from teacher-effective system to learner-effective system were designed to create a culture of high expectation, collaboration and excellence.

Conclusions

Based on the findings of this study, the following conclusions were drawn:

- 1.) None of the Mathematics teaching skills were correlated with any of the students' performance. The null hypothesis stating that there are no significant relationships between these teaching skills and students' performance was statistically accepted at 95% confidence.
- 2.) Male teachers motivate students better than the female teachers. The null hypothesis of no significant difference on motivational skills when grouped according to gender is therefore rejected at 95 % confidence.
- 3.) Employing Mathematics enhanced activities affect the students' performance. The null hypothesis of no significant difference is therefore rejected at 95% level of confidence.
- 4.) Mathematics teaching skills of Philippine and Qatar schools differed significantly except in teaching innovations. The null hypothesis of no significant difference is therefore rejected at 0.05 level of significance.
- 5.) Students' performance differed significantly in each school from the Philippines and Qatar. The no significant difference is therefore rejected at 5% level of significance.
- 6.) Mathematics Teaching Skills consisting of employing Mathematics enhanced activities and caring attitude are two of the many skills for which the teachers should study to create a paradigm shift in Mathematics education.
- 7.) Schools have their own set of criteria in measuring success considering that students' performance in terms of grade point average, attitude towards Math and involvement in Math activities differed significantly.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are given:

- 1.) Teachers should be given professional development training on employing enhanced Math activities and caring attitude towards Math to affect a better students' performance.
- 2.) Teachers' innovative skills should be strengthened in the faculty development training.
- 3.) Schools in the Philippines and Qatar should collaborate on best practices to improve teaching skills and students' performance.
- 4.) The action plan should be disseminated to respondent schools to effectuate changes in pedagogy and realize a paradigm shift in Mathematics education.

- 5.) The insignificant relationships of Mathematics teaching skills and student performance may be due to the lack of samples between the pairing of teachers and his/her own students' performance. A wider selection of samples from different schools may result to conclusive evidence.
- 6.) Further studies should be conducted using other variables like home factors and environment factors to be related with Mathematics teaching skills.

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