

FACTORS THAT AFFECT MATHEMATICS ACHIEVEMENTS OF STUDENTS OF PHILIPPINE NORMAL UNIVERSITY – ISABELA CAMPUS

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ABSTRACT

The study aimed to identify the factors that affect the achievements of students in Mathematics and to determine the relationship between the students' achievements and individual, instructional, classroom management and evaluation factors. The 239 Bachelor of Elementary Education (BEEd) students were the subjects of the study. The descriptive-correlational design was used. Data were subjected to statistical analyses using t-test, Pearson r and multiple regression. Findings reveal that 1) achievements of students in Math Courses (Fundamental Mathematics and Contemporary Mathematics) is poor; 2) students perform low in both subjects; 3) mathematics achievements are highly correlated to individual and instructional factors and moderately correlated to classroom management and evaluation factors; 4) individual factor and instructional factor greatly affect achievements in fundamental math; 6) instructional factor is the number one predictor of achievement in contemporary math; 7) instructional factor is the factor that affects most the achievements of students in Mathematics.

Keywords: Mathematics achievement, instruction, classroom management, evaluation, teaching effectiveness

INTRODUCTION:

Mathematics is considered the mother of all learning in both arts and sciences. It is essential in almost every field: measurement in fashion, angles in sports, technology and economics. This perspective on Mathematics has gained more attention with the rapid advances of information and communication. Mathematics is not just computation but a tool for understanding structures, relationships and patterns to produce solutions for complex real life problems. Mathematics is a necessity for people of all ages to be successful in life.

Despite the usefulness of mathematics in daily life, there are factors that adversely affect the students' ability to understand and apply mathematics concepts.

Leongson (2003) reveals that Pilipino students excel in knowledge acquisition but fare considerably low in lessons requiring higher order thinking skills. This disappointing condition is evident in the performance of students in national and international surveys on mathematics and science competencies. Performance of pre-service teachers and mathematics teachers in the Professional Board Examination reveals the same picture of poor competencies (Philippine Daily Inquirer, 1986; Ibe, 1995). The Third International Mathematical Science Study (TIMSS, 2000) examined patterns of students achievement in mathematics and found out that the school effectiveness and teachers competency impact learning and promote higher level of achievements (<http://www.research.acer.edu.au/cgi.viewcontent.cgi>). The quality of instruction and effective instructional design are necessary to alleviate problems related to teaching and learning mathematics (Dursun & Dede, 2004).

College students are not exempted from the problem in learning and mastering mathematics. Tests in Mathematics reveal low performance of students of Philippine Normal University, Isabela Campus. Aware of the importance and relevance the problem in Mathematics pose, this study is conducted.

A growing body of research finding indicates that demographic, individual, instructional; classroom management and evaluation factors have an impact on the Mathematical Achievement of the students. Identifying factors that affect Mathematics Achievement is important to effectively educate students.

CONCEPTUAL FRAMEWORK:

The potential of formal operational thought according to Piaget's theory of cognitive development (Piaget, 1932 in Leongson, 2003) develop during the middle school years. According to the theory, these potentials can be actualized by ages 14, 15 or 16 years, if proper learning experiences are encountered by the individual. These experiences consist of both the individual and social aspects of learning. As the students attain formal operational thought, they are able to apply mental operations not only to concrete objects, but to objects, situations, ideas and concepts that are not directly perceived. Apparently, learning mathematics involved operational thought. The research of Piaget shows that individuals are formal operational thinkers by ages 15 or 16, the usual ages of college freshmen in the Philippines.

Recent studies in mathematics achievement highlight the importance of the classroom, teacher and school as factors affecting performance in the subject. Most the differences in student achievement in the United States and Australia were due to compositional and organizational factors, not so much on teacher factor (Macber, 2000).

Hill and Rowe (1998) affirmed that teachers have major effect on student achievement. Teachers quality contributes a lot in the effectiveness of the school, hence quality instruction produces high achievement.

Demographic factors such as gender, parents' educational attainment and socio-economic status are also found to be factors in students achievement. But in the study of Campbell (1995; Gray, 1996; Kimbell, 1998; Beaton, 1995; Mullis, 1997) gender does not in any way affect achievement in mathematics.

Parents' educational attainment was found to be a significant factor in achievement of students in mathematics (Coleman, 2006; Campbell, 1995; Mangaliman, 2004). Parents with higher level of education could be role models for their children to perform well in mathematics. Parents with higher

income could provide more instructional resources to their children which eventually help them improve grades in mathematics. Hence, students from different economic strata manifest different attitudes and performance in mathematics.

Curriculum, instructional strategies, math teacher competency, school context, and facilities are other significant factors in teaching and learning mathematics. The mathematics curriculum contains specific subject matter and instructional design principles to enable students to develop logical and mathematical skills needed to understand fundamental mathematical concepts. Designing an instruction based on a curriculum that is in harmony with instructional design can scaffold students learning and promote their achievement in mathematics. Instructional strategies and methods are important for the achievement of the students. Learning situations ought to be selected and implemented in a way that allows students to apply higher order of operations (Lobatan, 2003; Ball, 1993; Grossman, 1998). School safety and facilities, temperature of the class, features of the school buildings and crowdedness of school were also reported to influence the achievement of students. These results point out that attention should be given to school context and facilities to improve the math achievement of students (<http://www.itdl.org/Journal/december09>).

Consequently, mathematics teachers expect college students to perform at the formal level. So, the curricula and syllabi for mathematics are designed with the goal engaging students in formal level learning activities (Tan, Oon Seng, 2000; www.cimt.playmouth.ac.uk/journal/limjap.pdf).

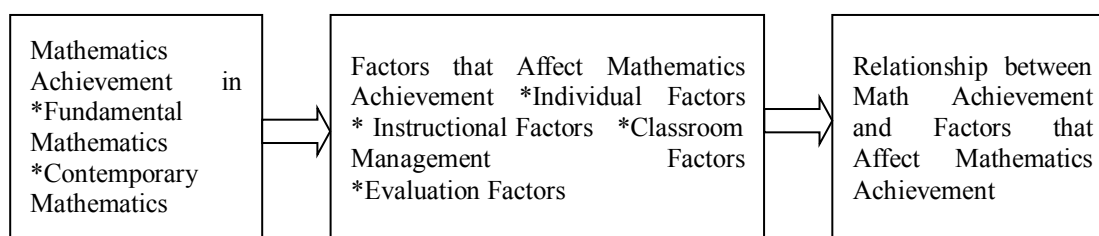


Figure 1. Conceptual Paradigm of the Study

STATEMENT OF THE PROBLEM:

This study attempted to determine the mathematics achievement of college students in fundamental mathematics and contemporary mathematics and the factors that affect their achievement.

The study specifically sought to answer the following questions:

What is the mathematics achievement of the respondents in the Fundamental Mathematics and Contemporary Mathematics?

Is there a significant difference between the performance of respondents in Fundamental Mathematics and Contemporary Mathematics?

What are the factors that affect mathematics achievement of the respondents?

Is there significant relationship between and among the mathematics achievement of respondents and the factors that affect mathematics achievement?

Which of the factors greatly affect mathematics achievement of respondents in fundamental and contemporary mathematics?

HYPOTHESIS:

There is no significant difference between the performance of the respondents in fundamental and contemporary mathematics.

There is no significant relationship between and among the mathematics achievement of respondents and the perceived factors that affect the mathematics achievement.

SIGNIFICANCE OF THE STUDY:

This study may:

1. help the students become aware of the factors that affect their performance in mathematics. Knowing such factors can help them identify their strengths and weaknesses that constantly interfere their performance in mathematics. This will, in turn inspire the students to overcome their weaknesses and hence, results to a good performance of students toward Mathematics.
2. provide teachers teaching mathematics with a better understanding of, and a deeper insight into the needs and problems of their students.
3. serve as springboard for administrators to revise the mathematics curriculum that may improve mathematics instruction.
4. provide more accurate assessment of their children's ability, and information they need in order to properly address their children's academic problems.

METHODOLOGY:

RESPONDENTS OF THE STUDY:

The respondents of the study were the second, third, and fourth year BEED (Bachelor of Elementary Education) students of PNU Isabela Campus during the first semester of school year 2012-2013. A total of 239 respondents were chosen from the population using the stratified random sampling.

INSTRUMENT USED:

Report of Rating from the Registrar's Office was used to determine the final grades of students Fundamental mathematics and contemporary mathematics during the first semester of school year 2012-2013. The final grades served as the respondents' mathematics achievement.

A Rating Scale on factors that affect Mathematics Achievement of College Students was constructed by researchers. The scale consists of 34 items divided into four factors: Individual Factors, Instructional Factors, Classroom Management Factors, Evaluation Factors. To ensure the reliability of the instruments, a try-out test was conducted to freshmen and junior BEED students of PNU. The reliability using the Cronbach alpha yielded with $r = .792$ which indicates a high reliability and adequacy of the instrument.

DATA COLLECTION PROCEDURE:

Permission to conduct the study was secured from the instructors/professors of the respondents. Upon approval, the researchers administered the instrument to the respondents during their vacant period. The test was administered from August 25-September 7, 2012.

DATA ANALYSIS:

The data gathered were analyzed using the Microsoft excel and processed using the SPSS computer software. The descriptive Statistics mean, percentage, and standard deviation; the t-test to determine the difference in the achievements of respondents in the fundamental and contemporary mathematics;. the Pearson Product Moment Correlation coefficient to determine the extent of relationships of the variables and Multiple regressions.

For the qualitative description of the final grades of the respondents in Fundamental Mathematics and Contemporary Mathematics, the range below was used:

| Range | Qualitative Description |
|--------------|--------------------------------|
| 79 and below | Poor |
| 80-86 | Satisfactory |
| 87-93 | Very Satisfactory |
| 94-100 | Outstanding |

RESULTS AND DISCUSSIONS:

1. Mathematics Achievement of the Respondents

Table 1. Mathematics Achievement of Respondents

| Respondents | Fundamental Mathematics | Description (Range) | Contemporary Mathematics | Description (Range) |
|-------------|-------------------------|---------------------|--------------------------|---------------------|
| Second Year | 77.83 | Poor | 77.42 | Poor |
| Third Year | 79.15 | Poor | 78.47 | Poor |
| Fourth Year | 78.78 | Poor | 78.57 | Poor |
| Mean | 78.59 | Poor | 78.15 | Poor |

Table 1 shows the mathematics achievement of the respondents in fundamental and contemporary mathematics. The mathematics achievement in Fundamental Mathematics reveals that the second year has a mean of 77.83, third year, 79.15, and fourth year, 78.78.

In Contemporary Mathematics, data reveals that the second year got a mean of 77.42, third year, 78.47, and fourth year, 78.57. The general mathematics achievements of the respondents in Fundamental Mathematics is 78.59 and 78.15 in Contemporary Mathematics.

The result shows that the achievement of respondents in fundamental and contemporary mathematics is poor. The result is similar to the studies of Cardona (2009); Meria (2000) and Mangaliman (2000) where respondents show poor performance in fundamental mathematics.

2. Significant Difference between the Achievement of respondents in Fundamental Mathematics and Contemporary Mathematics

Table 2. Computed-t value between Means in Fundamental and Contemporary Mathematics

| Course | N | Df | Mean | Mean Difference | t |
|--------------------------|-----|-----|-------|-----------------|-------|
| Fundamental Mathematics | 239 | 476 | 78.25 | 0.52 | 1.471 |
| Contemporary Mathematics | 239 | | 77.73 | | |

The table shows that the achievement in fundamental mathematics of the respondents got a mean of 78.25 and a mean of 77.73 in contemporary mathematics respectively with a mean difference of 0.52. The computed t-value of 1.471 yields no significant difference. This result implies that the achievement of the respondents in fundamental mathematics and contemporary mathematics is almost similar.-poor performance This result tries to show that students achievement in fundamental mathematics is as much only as the achievement in contemporary mathematics.

The significance of no difference between the students achievement in fundamental and contemporary mathematics may be attributed to student attitude (student factor) and teaching quality (teacher factor). Teachers should know their students' ability, interest and attitude towards the subjects.

3. Factors that affect Mathematics Achievement of Respondents

Table 3. Factors that affect Mathematics Achievement

| Factors | N | Mean | Std. Deviation | Rank |
|------------------------------|-----|-------|----------------|------|
| Individual Factors | 239 | 2.804 | .491 | 3 |
| Instructional Factors | 239 | 2.966 | .524 | 1 |
| Classroom Management Factors | 239 | 2.800 | .505 | 4 |
| Evaluation Factors | 239 | 2.935 | .547 | 2 |
| Valid N (list wise) | 239 | | | |

Table 3 shows the factors that affect mathematics achievement of the respondents. Data shows instructional factor affects achievement the most; followed by evaluation factors; then individual

factors, and finally, classroom management factor. The standard deviation shows that the grades of the respondents are homogeneous. The result confirms the studies of Warren and Roseberry (1996) that teachers' competency and effectiveness greatly affect performance. Tan Oon Seng (2003) pointed out that to enable students to construct their understanding and knowledge of the subject domain, teacher should provide meaningful and authentic learning activities. The instructional and evaluation factors may be attributed to over-emphasis on memorization and under-emphasis on understanding and application of mathematical concepts and facts. (Leongsan, 2003). Teachers' knowledge and beliefs about Mathematics is directly connected to their instructional choices and teaching method (Braphy, 1990; Brown, 1985; National Council of Teachers of Mathematics, 1989; Thomson, 1992; Wilson, 1990; Cardona, 2009), hence, there is a need for Math instructors to revisit their course syllabi and review content, strategies and types of evaluation.

4. Significant Relationship Between and Among Mathematics Achievement of Respondents and Factors that Affect Mathematics Achievement

Table 4. Correlation Between and Among the Factors of Fundamental and Contemporary Mathematics

| | Individual Factors | Instructional Factors | Classroom Mgt Factors | Evaluation Factors | Fundamental Mathematics | Contemporary Mathematics |
|--|--------------------|-----------------------|-----------------------|--------------------|-------------------------|--------------------------|
| Fundamental (Pearson) Mathematics Correlation Sig. (2-tailed) | .177 .071 | -.005 .940 | .003 .967 | .008 .902 | 1 | .429 .000 |
| N | 239 | 239 | 239 | 239 | 239 | 239 |
| Contemporary (Pearson) Mathematics Correlation Sig. (2-tailed) | .124 .056 | .024 .713 | .036 .583 | -.036 .580 | .429** .000 | 1 |
| N | 239 | 239 | 239 | 239 | 239 | 239 |

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

Table 4 shows the correlations between and among the factors that affect mathematics achievement in fundamental and contemporary mathematics. Data shows that there is high correlation between achievement in Fundamental Mathematics and Instructional Factors, Classroom Management, and Evaluation Factors, and moderate correlation with Individual Factors.

This result shows the mathematics achievement of respondents is highly related to Instruction and Evaluation factors. The study avers that the teachers have major effect on student's achievement.

Studies show that Individual factors including self-directed learning, arithmetic ability of students, attitude towards Mathematics, motivation or concentration of students and time spent in their Mathematics lesson were related to achievements. Excellent students have high levels of willingness to solve mathematical problems compared to weak or average students (Tapia, 2002; Saritas, 2009).

The table further shows that the achievement in Contemporary Mathematics and instructional factors have very high positive correlation; moderate correlation with classroom management, and evaluation factors. The study shows significant factors in mathematics instruction and students' achievement include curriculum, instructional strategies, method of teaching, math teacher's competency, school context and facilities (Wilson, 1995).

Data reveals a significant relationship between Fundamental and Contemporary Mathematics. Meaning, all factors should be considered when preparing a course syllabus to ensure smooth transition from one course to the other in terms of knowledge, process, and product.

These results point out that attention should be given to school context and facilities to improve the math achievement of students. (<http://www.idtl.org/Journal/december09>).

5. Factors that greatly affect mathematics achievement in fundamental and contemporary mathematics.

Table 5. Factors that affect Achievement in Fundamental Mathematics

| | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|-----------------------|-----------------------------|------------|---------------------------|--------|------|
| | B | Std. Error | Beta | | |
| 4(Constant) | 76.699 | 1.618 | | 47.399 | .000 |
| Individual Factors | 1.936 | .738 | .236 | 2.624 | .009 |
| Instructional Factors | -1.309 | .692 | -.170 | -1.890 | .060 |

Multiple R: .177 $R^2 = .028$ Adjusted R= 0.20 $F(2,236)=3.445, p=.034$

The table shows that the individual factors and instructional factors have significant influence on the achievement of the students in Fundamental Mathematics. This is shown by the multiple R value of .177 which signifies moderate positive correlation. The r-square or the coefficient of determination of .028 suggests that 2.8 percent of the variation in the Fundamental Mathematics grade is jointly accounted for by individual factors. The F-ratio, 3.445 was found to be significant at the 0.05 level of significance. It implies that the joint variation of the items in explaining the variation in the math grade is significant. The t-test results however show that only individual factor has a unique contribution on the subject.

Although the predictive power of two factors is small, individual factor has a greater influence than the instructional factor. This is shown by the p-value of .009 of individual factor against the p-value of .060 of instructional factors. Furthermore, unstandardized coefficients show that the higher the coefficient the individual factors has, the greater the grade value; while the higher the coefficient the instructional factors has the lower the grade value in the subject. However, the maximum increase the individual factor can affect is only about 8 points while the maximum decrease that the instructional factors can bring is about 5 points only.

When unique contribution is taken into account, the only predictor is individual factor. This item generated a t-value 2.264 and probability of 0.009. This means that this factor significantly affect respondents' achievement in fundamental mathematics. The beta-value of 0.236 implies that this phenomenon uniquely contributed 23.6 percent in the total variation in grades of the prospective elementary teachers. Instructional factors had no significant unique contribution on the academic grades in fundamental mathematics. It is reflected from the t-value of -1.890, $b=0.146$ and probability of 0.060. That is, the null hypothesis that $b=0$ is accepted since the p-value is greater than 0.60.

Based on the data presented it tries to imply that individual factor and instructional factor greatly affect achievement of students in fundamental mathematics. This result reaffirms that student factor and teacher factors greatly affect the achievements of students in Mathematics.

Table 6. Factors that affect Achievement in Contemporary Mathematics

| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|--------------------|-----------------------------|------------|---------------------------|--------|------|
| | B | Std. Error | Beta | | |
| 4(Constant) | 76.367 | 1.462 | | 52.233 | .000 |
| Individual Factors | 1.745 | .603 | .235 | 2.895 | .004 |
| Evaluation Factors | -1.203 | .542 | -.180 | -2.222 | .027 |

Multiple R: .189 $R^2 = .036$ Adjusted R= 0.27 $F(2,236)= 4.349, P=.014$

As reflected in the table, the regression equation is:

$$Y = 76.367 + 1.745x_1 - 1.2003x_2$$

Where:

Y= mathematics achievement (grade) in Contemporary Mathematics

x_1 = individual factor

x_2 = evaluation factor

Table 6 shows that individual and evaluation factors are predictors on the achievement of the respondents in contemporary mathematics. The equation shown appears statistically significant ($p = 0.014$) with F of 4.349. the adjusted R square of 0.27 indicated that about 2.7 percent of the variance of respondents' achievement in the Contemporary Mathematics is explained by the combination of independent variables included in the equation. The predictors have also moderately small positive correlation to achievement as shown by the multiple r value of 0.189.

When taken individually, individual factor produced the biggest variance in the grades of the respondents with beta value of 0.235, t-value of 2.895, $p = .004$. On the other hand, beta value of evaluation is significantly lower than zero, hence, it is significant. This incurred a t-value of -2.222, $p = .027$.

As to contemporary mathematics the factors that greatly affect achievement of respondents are individual factors and evaluation factors. This data tries to show that the student as well as teachers are factors that contribute to the achievement of respondents in mathematics.

Generally, the study reveals the following findings:

The mathematics achievement of the students is poor.

There is no significant difference between the achievement of respondents in fundamental and contemporary mathematics.

The factors that affect mathematics achievement, as to rank, are: 1st- instructional factors, 2nd- evaluation factors, 3rd individual factors, and 4th- classroom management factors.

There is high correlation between and among classroom management, instructional factor, and evaluation factor.

The factors that greatly affect Mathematics Achievement in Fundamental Math are individual factor (students) and instructional factor (teacher) while the factor that greatly affect performance in Contemporary Math is instructional.

The result implies that low or poor performance of students in Mathematics is due to lack of knowledge in content and pedagogy, attitude and commitment of teachers. The teacher who is at the center stage of instruction really play a major role in the learning of students. The success or failure of students in school and in life greatly lie on the hands of the teachers.

CONCLUSION:

The poor achievement of students in mathematics are caused by four factors: individual (student), instructional (teacher), classroom management and evaluation. There is a need for Math teachers of the Philippine Normal University-Isabela Campus to revisit their instructional programs and suit plans to the levels of the students.

RECOMMENDATION:

Math teachers should use effective instruction that will enable the students perform better towards mathematics subject. Revision of instructional plan is necessary to meet the needs, interests and level of performance of students.

An intervention program can be developed to assist the low achievers in Fundamental and Contemporary Mathematics.

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