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RELATIONSHIP BETWEEN KNOWLEDGE OF QUADRATIC FUNCTIONS AND PERFORMANCE IN MATHEMATICS OF FRESHMAN COMPUTER TECHNOLOGY STUDENTS: PROPOSED MEASURES FOR IMPROVEMENT

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ABSTRACT

The main purpose of this study was to find out whether there was a relationship between the knowledge of quadratic functions and the performance in mathematics of the freshman Bachelor of Science in Industrial Technology – Computer Technology (BSIT – CT) Students of the Cebu State College of Science and Technology – Fishery and Industrial College (CSCST – FIC), San Francisco, Cebu.

The study used the descriptive method using correlational research with follow – up interview after a 20-item teacher- made test was administered to the respondents. There were 61 respondents that were given the test about their knowledge of quadratic functions. The results of this test were treated and analyzed. Then it was paired with the respondent's performance in mathematics in order to determine the degree of relationship between them.

The findings revealed that there was a low positive correlation between the respondents' knowledge of quadratic functions and the performance in mathematics. Then this relationship was found out to be significant after it was statistically tested for its significance. The findings also revealed that the respondents' performance in mathematics was found out to be on the above average category, while their knowledge of quadratic function was in the poor category. Proposed measures for the improvement in the performance in mathematics of the freshman Computer Technology Students will be highly recommended so that maximum learning of the students in mathematics specifically quadratic functions would be achieved.

INTRODUCTION

It is a fact that learning mathematics is very difficult for most students. As revealed from the results of the 1999 Third International Mathematics and Science Study of 8th grade mathematics and science learning in 38 countries, the Philippines ranked in the bottom 3 countries (Educational Television, 2005). For mentors and students alike, teaching and learning mathematics need special attention.

In Cebu State College of Science and Technology-Fishery and Industrial College (CSCST-FIC), San Francisco, Cebu wherein one of its course offerings is the Bachelor of Science in Industrial Technology – Computer Technology (BSIT-CT). This researcher happens to be one of the instructors in Mathematics (which is known as one of the most difficult subjects offered in the curriculum). He has experienced that teaching mathematics at the CSCST-FIC Campus is one of the difficult tasks to accomplish in a particular day. As noticed in the classroom, mathematics students tend to divert their attention to various disturbing activities like talking aloud with their seatmates, throwing crumpled papers inside and other misbehavior that can spoil the entire class. This may be due to the fact that they do not like the subject.

One of the reasons that must be considered is the fact that students might lack the basic skills in mathematics and the following areas: memory, cognitive development, and visual-spatial ability. A study revealed and is quoted as follows: "A group of students exhibit problems in learning mathematics skills and concepts that persist across their school years and even into adulthood. Specific problems in the areas of memory, cognitive development, and visual-spatial ability contribute to difficulties in learning mathematics" (Bryant, 2006). Fortunately, researchers and educators are focusing efforts on better understanding the issues these students face as they encounter the math curriculum across the grade levels. (www.schwablearning.org/articles.asp?F1001-46K).

Mathematics instructors, sometimes experience that both the instructor and the student find it difficult for the teaching/learning process to be attained to its maximum level.

Sometimes it will mean discouragement on the part of the instructor and he/she becomes hopeless that

most students do not understand the lesson. At this point the problem arises. To avoid such problems the mathematics instructors and the administrators of the school as well should look for remedies so that learning of the students in mathematics will be attained.

This researcher in his experience for 13 years in teaching mathematics had noticed that the students encountered more difficulties in learning quadratic functions. As revealed from the study of Gonzales (1987), one of the topics that the students in College Algebra find it difficult was that of the quadratic function thereby prompting this researcher to make this study.

It is for these reasons that the researcher wants to find out the learning difficulties and misconceptions about solving quadratic functions of freshman Bachelor of Science in Industrial Technology – Computer Technology (BSIT-CT) students of Cebu State College of Science and Technology - Fishery and Industrial College (CSCST-FIC), San Francisco, Cebu.

MATERIALS AND METHODS

This research used the descriptive method particularly correlational researches with follow-up interview to gather the data about the knowledge of quadratic functions and performance of the students in mathematics.

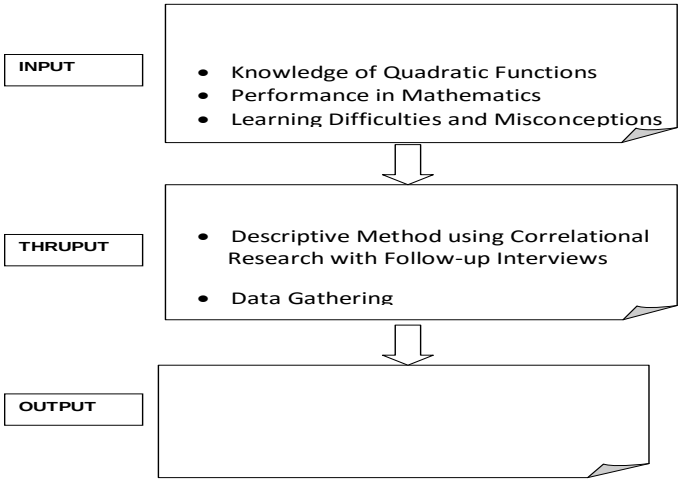

Figure 1 shows the flow of research.

Research Environment

This research was conducted at the Cebu State College of Science and Technology - Fishery and Industrial College (CSCST-FIC), San Francisco, Cebu Campus. It is located in Northern Poblacion, San Francisco, Cebu in Camotes Island. It is about 1 kilometer from the town proper going to the school campus. The location map is shown in Figure 2. The school has a total population of 466 students as of the Second Semester of the S.Y. 2007-2008. The college offers the five (5) following courses: Bachelor of Science in Industrial Engineering (BSIE); Bachelor of Science in Hotel, Restaurant Services and Technology (BSHRST); Bachelor of Science in Hotel Management (BSHM); Bachelor in Elementary Education (BEED); and Bachelor of Science in Industrial Technology major in Electronics Technology (BSIT-ET), and major in Computer Technology (BSIT-CT).

Research Respondents

The respondents of this study were the 61 freshman Bachelor of Science in Industrial Technology - Computer Technology (BSIT-CT) students. These students come from two sections. The first section is the CT-IA which has 34 students with 18 males and 16 females while the second section is the CT-IB which has 27 students in which 15 are males and 12 are females. This means that the total number of male respondents is 33 and the female respondents is 28. (Table 1)

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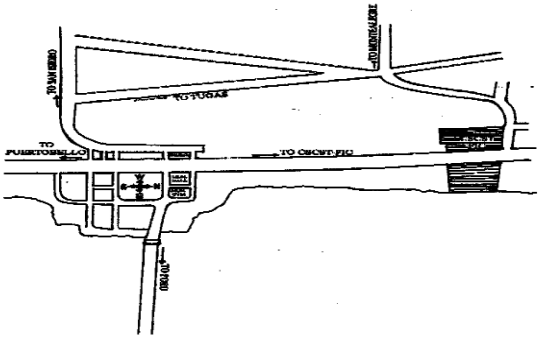

Figure 2
The Location Map of CSCST-FIC, San Francisco, Cebu

Figure 2
Figure 2. The Location Map of CSCST-FIC, San Francisco, Cebu

Table 1
Respondents of the Study

Gender	Frequency (f)	Percentage (%)
Male	33	54.00
Female	28	46.00
TOTAL	61	100.00

Research Instrument

This research study utilized a teacher-made test with a follow-up interview as the main tool for the data collection. There were twenty (20) multiple choice teacher-made questions constructed. Each item was carefully reviewed to eliminate grammatical and clerical errors. These twenty teacher made tests about quadratic functions were categorized as follows: two (2) items for finding the graph of a given quadratic function; one (1) item for determining the vertex of a given quadratic function; one (1) item for determining the zeros of a given quadratic function; three (3) items for determining the coordinates of the x-intercept; two (2) items for determining the coordinates of the y-intercept; two (2) items for determining the coordinates of the lowest point of a given quadratic function; two (2) items for determining the coordinates of the highest point of a quadratic function; two (2) items for the reduction of a given quadratic function to its vertex form; two (2) items for determining the coordinates of the focus of the given parabola; one (1) item for determining the equation of the directrix of a given parabola; and finally two (2) items for determining the length of the latus rectum of a given parabola. (See Appendix B, Research Instrument). Below is the table of specifications for the 20-item teacher-made test:

Table 2 Table of Specifications for the 20-item teacher-made test

LEVEL OF OBJECTIVE	OBJECTIVE	ITEM NUMBER	NO.	%
1. Knowledge	• Identify the graph of a quadratic function.	1,5	2	10
	• State the coordinates of the lowest point of a parabola	6,11	2	10
	• State the coordinates of the highest point of a parabola	12,13	2	10

	• State the coordinates of the focus of a parabola	16,17	2	10
2. Comprehension	• Express the given quadratic function to its vertex form	14,15	2	10
3. Application	• Determine the zeros of a quadratic function	2	1	5
	• Determine the vertex of a parabola	3	1	5
	• Determine the coordinates of the y-intercepts of a parabola	7,8	2	10
	• Determine the coordinates of the x-intercepts of a parabola	4,9,10	3	15
4. Analysis	• Deduce the equation of the directrix from a given equation of a parabola	18	1	5
5. Synthesis	• Construct the length of the latus rectum of a given parabola	19,20	2	10
		TOTAL	20	100

These twenty (20) teacher-made tests were administered to another group of freshman Computer Technology students in CSCST – Main Campus in Cebu City for the validity and reliability of this test. The result of this test underwent an item analysis to determine which items are very difficult, difficult, moderately difficult, and very easy.

The results of the item analysis helped to revise items that were too difficult, too easy and retain those that were very good items. Then, the actual administering of the test was done on the Second Semester of the School Year 2007-2008.Appendices F and G show the results of the item analysis and the difficulty and discrimination indices.

Gathering of Data. The researcher asked permission from the Campus Director of the CSCST-FIC to conduct this study in the school. Then the researcher asked the College Registrar for the final grades of the respondents in College Algebra during the first semester of the School Year 2007-2008. The twenty (20) items of the teacher-made test was administered to the 61 Freshman Computer Technology Students of CSCST – FIC.

Treatment of Data. The gathered data were treated according to the most appropriate statistical treatment for the study. These included the frequency distributions, means, the standard deviations, the simple percentage, Pearson Product Moment Correlation, and the t-test for the significance of the relationship.

RESULTS AND DISCUSSION

Knowledge of Quadratic Functions

The knowledge of quadratic functions refers to the scores of the respondents in the 20-item teacher-made exams about quadratic functions. The profile of the respondent's knowledge of quadratic functions is shown in Table 2.The grades are categorized as follows: Superior, 90 and above; Above Average, 84-89; Average, 78-83; Below Average, 72-77 and Poor, 71 and below.

Table 3
Profile of the Respondent's Knowledge of Quadratic Functions

Grades	Interpretation	Frequency (f)	Percentage (%)

90 and above	Superior	0	0.00%
84 – 89	Above Average	0	0.00%
78 – 83	Average	2	3.28%
72 – 77	Below Average	19	31.15%
71 and below	Poor	40	65.57%
Total		61	100%

Mean = 71.16 SD = 2.954

As revealed in Table 3, no students fall under Superior and Above Average category on their knowledge of quadratic functions. Average students have a frequency of 2 and 3.28% of the total, while the Below Average accounted to a frequency of 19 at 31.15% of the total population. Poor students have a frequency of 40 and 65.57% of the population. Majority of the respondents are poor with regards to their knowledge about quadratic functions.

This agrees with the findings of Gonzales (1987) in his study that quadratic functions were one of the topics in College Algebra that the students encountered learning difficulties. The mean of the respondent's knowledge of quadratic functions is 71.16 and the standard deviation is 2.954.

Performance in Mathematics

The profile of the respondent's performance in mathematics which refers to student's final grade in College Algebra is shown in Table 4. The grades are also categorized similar to that of the profile of the respondent's knowledge of quadratic functions. It is seen in Table 4 that all of the 61 respondents got a grade of 78 and above with no student in the Below Average and Poor category. Thirty seven (37) students are on the Above Average or 60.66% which clustered in the 84-89 bracket. Majority (60.66%) of the students are Above Average in their performance in mathematics.

Table 4. Profile of the Respondent's Performance in Mathematics

Grades	Interpretation	Frequency (f)	Percentage (%)
90 and above	Superior	4	6.56%
84 – 89	Above Average	37	60.66%
78 – 83	Average	20	32.78%
72 – 77	Below Average	0	0.00%
71 and below	Poor	0	0.00%
Total		61	100.00%

Mean = 85.00 SD = 3.203

The mean of the respondents in their performance in mathematics was 85 and a standard deviation of 3.203. As revealed in Table 4 the frequency of the group who got the highest grade of 90 and above (Superior) was 4 for a percentage of 6.56%. Average students have a frequency of 20 or 32.78 %.

Learning Difficulties and Misconceptions of the respondent's Knowledge of Quadratic Function

After administering the 20-item teacher-made test given to the 61 respondents about their knowledge of quadratic functions, the results revealed that the percentages of the correct responses for each item were very low. It was in item no. 10 which was to find out the coordinates of the x-intercepts of a parabola that registered the lowest correct responses from the respondents at 9.84%. In item no. 16 which was for finding the coordinates of the focus of a parabola also registered the lowest at 9.84%.

Only in item no. 17 which was also similar to item no. 16 for finding the coordinates of the focus of a parabola where the respondents got the highest percentage of 57.38% correct responses. The rest of the topics involving the respondent's knowledge of quadratic function were seen to be poor. They got 50% below.

As revealed from the study, it can be deduced that the respondents have learning difficulties in quadratic functions as shown in APPENDIX H which shows the respondent's responses for the 20-item teacher-made test about their knowledge of quadratic function.

The following are the areas in quadratic function in which the respondent's encountered learning difficulties.

Determining the coordinates of the x-intercepts of a parabola
Determining the coordinates of the focus of a parabola
Determining the length of the latus rectum of a parabola
Determining the vertex of a parabola
Reduction of a given quadratic function to its vertex form
Determining the coordinates of the highest point of a parabola
Graphing a quadratic function
Determining the coordinates of the x-intercepts of a parabola
Determining the equation of the directrix
Determining the zeros of a quadratic function
Determining the coordinates of the lowest point a parabola
Determining the coordinates of the y-intercepts of a parabola

This researcher interviewed the respondents after administering the 20-item teacher-made test and found out that their misconceptions about quadratic functions are the following:

They were unaware that the graph of a quadratic function is a parabola.

- They cannot tell whether the curve opens up or down.
- Most of the students were not aware that when a quadratic function is equated to zero, it will become a quadratic equation which can be solved by factoring, completing the square or by quadratic formula.
- The students also were not able to tell that the vertex and the focus of the parabola lies along the line of symmetry of a particular parabola.
- The students thought that the quadratic function, which is a second degree function can be solved directly by transposing the x^2 and x terms to the left as in the case of a linear function.
- The students did not understand that the highest and the lowest point of a parabola is its vertex.
- The students are also unaware that the length of the latus rectum passes through the focus of a parabola.

It was also found out that the student's learning difficulties and misconceptions about quadratic function was due to student's lack of the readiness to face this new lesson about quadratic function which is somewhat new to them. These agrees with Thorndike's theory that the teaching/learning process results to an effective outcome if a student is ready to face a new lesson, otherwise it results to annoyance. In this study, the result is annoying because of the student's lack of readiness.

The students also have deficiency in manipulating mathematical equations, because they are poor in their knowledge of the basic skills in mathematics which contributed much to the respondent's learning difficulties in quadratic functions. This conforms with the suggestion of Vergara (2000) that the students should master the basic skills in mathematics because these serve as springboard in worded problem solving mathematics.

Table 5
Range of Values for the Interpretation of the Degree of Relationship Between Knowledge of Quadratic Functions (Y) and the Performance in Mathematics (X)

0.90 to 1.00 (0.90 to -1.00)	Very High Positive (Negative) Correlation
.70 to 0.89 (-0.70 to – 0.89)	High Positive (Negative) Correlation
0.50 to 0.69 (-0.50 to -0.69)	Moderate Positive (Negative) Correlation
0.30 to 0.49 (-0.30 to -0.49)	Low Positive (Negative) Correlation
0.00 to 0.29 (0.00 to -0.29)	Little, if any correlation

The value of r is 0.2996 and is nearly equal to 0.30. The degree of relationship between the knowledge of quadratic function and the performance in mathematics is interpreted as low positive correlation as referred to table 5.

Significance of Relationship Between Knowledge of Quadratic Functions and Performance in Mathematics

The significance of relationship between the knowledge of quadratic functions and performance in mathematics was computed using the t-test formula, Using the value of r = 0.2996, the computed t value was 2.412.

Table 6
Significance of Relationship Between Knowledge of Quadratic Functions and Performance in Mathematics

Variable	Mean	Standard Deviation	Pearson r	Interpretation	Computed t	Critical t	Significance
Knowledge of Quadratic Functions (Y)	71.16	2.954	0.2996	Low Positive Correlation	2.412	2.0009	significant
Performance in Mathematics (X)	85.00	3.203					
df = 59	α = 0.05						

As shown in Table 6, the Pearson r value was 0.2996 and interpreted as low positive correlation as referred to the range of values for the interpretation of the degree of relationship between X and Y. From the Table of Critical Values of t, with df=59, we obtained the critical value of t=2.0009 by interpolation at 0.05 level of significance. Since the computed t of 2.412 is greater than the critical value of 2.0009, the degree of relationship between the knowledge of quadratic functions and the performance in mathematics is interpreted as significant.

CONCLUSION

Based on the findings of the study, it is concluded that there is a significant relationship between the knowledge of quadratic functions and performance in mathematics of the students, thus the need to enhance the knowledge of quadratic functions.

RECOMMENDATIONS

Based on the findings revealed from this study and conclusions drawn, the following specific recommendations are hereby offered:

1. The Cebu State College of Science and Technology – System (CSCST – System) should review the Algebra syllabus on strategies and methodology in order to provide an adequate number of hours required for the desired learning competencies of a mathematics class.

2. The School Administrators should provide enough reading materials and school facilities in relation to mathematics instructions so that the students will be provided with enough resources, hence, learning mathematics for them will become easier.

3. The students must be properly motivated by their parents, Instructors, as well as self-motivation by the students themselves so that their love in mathematics will enhance maximum learning. This will be done by having a math contest in the class or in the entire school and give a proper recognition for those students who top the said contest.
4. The school should conduct seminar / symposium and lectures about the importance and the benefit of students' success in mathematics in order to motivate the students to study harder thereby making their performance especially in quadratic functions to be more satisfying.

5. Mathematics instructors should conduct remedial classes and imbedded tutorials during vacant time or during Saturdays and Sundays for those students who have low performance in mathematics so that they can eliminate their learning difficulties and misconceptions pertaining to the topics in quadratic functions encountered during the classroom discussion.

6. There should be another test given to these students to make sure that they have already acquired knowledge during their remedial classes. If the performance is still unsatisfactory they will undergo another reteach/retest process until learning becomes successful.

7. In order for the students to unlock their learning difficulties with regards to the 20-item teacher-made exam given to test their knowledge about quadratic functions. The following items which they have encountered difficulties are solved and to be given to the students by the teacher.

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