

Mathematics Difficulties among Grade 11 Students of Ramon Magsaysay Technological University

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Abstract—The study presented the level of Mathematics Difficulties of the Grade 11 Students of Ramon Magsaysay Technological University – Iba Campus. Results served as the basis for improving instruction in the institution. Student's scores in formative test was used to measure the Mathematics difficulties of the respondents. Based from the findings, it showed that the respondents' level of academic performances from first quarter to fourth quarter were all proficient but the results revealed that the Mathematics difficulties of the students in Patterns and Algebra was Moderately Difficult showing that there was a slight difficulty in understanding this strand unlike in Geometry and Trigonometry, Probability, and Statistics were all Difficult to the respondents. This results implied that there were problems encountered in the new Mathematics Curriculum. The general recommendations were made to make the new Mathematics curriculum more effective, coordination of the curriculum, instructional materials, assessment, instruction, professional development, and school organization around the development of Mathematics difficulties should drive school improvements efforts; the integrated and balanced development of all four strands of the new Mathematics curriculum in the K to 12 should guide the teaching and learning of school Mathematics; textbooks and other instructional materials should develop the core content of the four strands in a focused way, in depth, and with continuity in and across grades; and practice should be used with feedback to support all strands of Mathematics and not just procedural fluency.

Key Words - K to 12 Mathematics Curriculum, Mathematics Difficulties, Spiral Progression Approach, Academic Performance

1 INTRODUCTION

Education has always been dynamic. Everything that is dynamic certainly echoes possible problems. To keep in pace with global competitiveness, Philippines has finally implemented the K to 12 basic education curriculum starting June of school year 2012. Indeed, education constantly grows with the growth of humanity. The curriculum in the educational system of the Philippines has been altering for the changing times of generation. Unlike other countries that have 12-year basic education, the Philippine Basic Education has the least number of curricular years, six years elementary and four years secondary. This recent decade, the country's educational system has been suffering from various feedbacks, specifically when it failed to cater to the needs of the Filipino students [1].

In this new curriculum, spiral progression approach was used in teaching Science and Mathematics. Spiral Progression approach in curriculum is derived from Bruner's Spiral curriculum model [2]. Bruner stressed that teaching should always lead boosting cognitive development. Student will not understand the concept if teachers plan to teach it using only the teacher's level of understanding. Curriculum should be organized in spiral manner so that the student continually builds upon what they have already learned. The idea in spiral progression approach is to expose the learners into a wide variety of concepts/topics and disciplines, until they mastered it by studying it over and over again but with different deepening of complexity. In relation to secondary Mathematics curriculum, Sanchez [3] explained that Mathematics is composed of four areas, namely Elementary Algebra, Intermediate Algebra, Geometry, and Advanced Algebra & Trigonometry. In old curriculum, Elementary Algebra was taught in first year, second year was Intermediate Algebra, third year was Geometry and Fourth year was Advanced Algebra & Trigonometry.

However, in new secondary mathematics curriculum implemented last 2012, the concept of those four major areas are being taught all at the same time. Each year students are exposed to spiral progression approach, wherein the four areas are being taught per grading period.

The Spiral progression approach has advantages and disadvantages [4]. Spiral progression approach avoids disjunctions between stages of schooling, it allows learners to learn topics and skills appropriate to their developmental/cognitive stages, and it strengthens retention & mastery of topics & skills as they are revisited & consolidated. The problem, however with the spiral design is that the rate for introducing new concepts is often either too fast or too slow. All concepts are allotted the same amount of time whether they are easy or difficult to master. Units are approximately the same length, and each topic within a unit is 1 day's lesson. On some days there will not be enough time to introduce. The fact that an entire class period must be devoted to a single concept makes it difficult to sequence instruction to ensure that students acquire necessary pre-skills before introducing a difficult skill.

In line with this, a study of Capate and Lapinid [5] indicated that most of the Grade 8 students of Don Bosco Technical Institute – Makati (DBTI) during the first conduct of the new K to 12 Mathematics curriculum were in the Beginning level of achievement only. Moreover, half of the tested contents were least-mastered. Incorrectly applying the formulas, properties, theorems, and/or laws and incompletely solving the problem despite correctly doing the initial procedure are their common difficulties.

Hence, it is imperative that there is a need to conduct a study regarding the Mathematics difficulties of Grade 11 students in the implementation of the new K to 12 Mathematics

ics curriculum in the Philippines.

2 METHODOLOGY

2.1 Research Design

In this study, the researcher used a descriptive method of research which aims to describe, analyze, and interpret the gathered information regarding the Mathematics difficulties among Grade 11 students of Ramon Magsaysay Technological University – Iba Campus.

According to Zulueta and Costales [6], the descriptive method involves the conversion of data in order to test the hypothesis or to answer questions concerning the current status of the subject of the study.

Descriptive research is fact finding with adequate interpretation. It is something more and beyond data gathering; the latter is not reflective thinking or research. The true meaning of data collected should be repeated from the point of view of the objective and the basic assumption of the project underway. This follows logically or after careful classification of data. Facts obtained may be accurate expression of central tendency or deviation or correlation; but the report is not research unless discussion of those data is not carried up to the level of adequate interpretation. Data must be subjected to the thinking process in terms of ordered reasoning [7].

Descriptive method signifies the gathering of data regarding the present situation [8]. It also includes of data to test the hypothesis and the answer to the questions concerning the present status of the study [9].

2.2 Respondents and Location

The study about Mathematics difficulties among Grade 11 students was conducted in Ramon Magsaysay Technological University – Iba Campus. These include the following tracks: Accountancy, Business and Management (ABM); Science, Technology, Engineering and Mathematics (STEM); Humanities and Social Sciences (HUMSS); Information and Communication Technology (ICT) – Computer Programming; Home Economics (HE) – Food and Beverage Services; and Industrial Arts (IA) – Shielded Metal Arc Welding (SMAW), Electrical Installation and Maintenance (EIM), and Technical Drafting (TD).

The respondents were the two hundred fifty – seven (257) Grade 11 students of Ramon Magsaysay Technological University – Iba Campus. The researcher was used Sloven's Formula to determine the number of respondents in the study. In identifying the specific number of samples, a simple random sampling technique was employed.

2.2 Instruments

The test question (formative test) was the main instrument used in gathering data in this study. The researcher formulated the questionnaire based on the teaching guide or module issued by the Department of Education (DepEd) and

other related references. It was constructed by the researcher after getting the available materials on the topic and was submitted to the adviser for the corrections and suggestions.

The test question was composed of two (2) parts. The first part included the personal profile of the respondents such as age and sex. The second part of the questionnaire dealt with the Mathematics problems in the following strands: Patterns and Algebra, Geometry and Trigonometry, Probability, and Statistics.

2.3 Data Collection

The researcher asked permission from the Senior High School Principal and the Grade 11 students of Ramon Magsaysay Technological University – Iba Campus. To get the grade point average in Mathematics academic performance (from First Quarter to Fourth Quarter in their Grade 10 years) of the respondents, the researcher asked permission from their advisers to provide the aforesaid request. The researcher personally distributed the questionnaire to the target respondents so that he can clearly explain and assist them in answering the instrument. The data gathered was analyzed and interpreted.

3 RESULTS AND DISCUSSIONS

Table 1 shows the mean grades and descriptive equivalents of the Grade 11 students of RMTU in their Mathematics Academic Performance when they were in Grade 10 from First Quarter to Fourth Quarter.

Out of two hundred fifty – seven (257) student – respondents, the mean grade of their first quarter (86.38), second quarter (85.57), third quarter (85.99), and fourth quarter (86.60) were all interpreted as proficient.

Summarizing the result, it revealed that they were all average in four subjects (First Quarter: Patterns and Algebra, Second Quarter: Geometry and Trigonometry, Third Quarter: Probability, Fourth Quarter: Statistics) that they were taken in their Grade 10 year in the New Mathematics Curriculum when it comes to their academic performance. This is similar to the study of Carbonel [10] on the students' performance during the second semester of 2013 at Kalinga-Apayao State College, which noted that the students in Algebra had an "average performance" as evidenced by the computed mean of 2.15. Specifically, 50% of them fall under average performance, 35% of them are within "low performance", while only 15% of them have "high performance".

This finding also similar to the study of Cura and Gozum [11] about the relationship between the Adversity Quotient and the mathematics achievement of the sophomore students of PLM- College of Engineering and Technology in the school year 2010-2011. He found out that the overall mean in Probability Achievement of the respondents is 2.265 and the level of Probability Achievement of the majority of the respondents is good.

Table 1: Level of Mathematics Academic Performance from First Quarter to Fourth Quarter

Descriptive Equivalent	Grade Point Average	First Quarter (Patterns and Algebra)		Second Quarter (Geometry and Trigonometry)	
		Frequency	Percent	Frequency	Percent
Advanced	90 & above	66	25.68	43	16.73
Proficient	85 – 89	97	37.74	107	41.63
Approaching Proficiency	80 – 84	58	22.57	76	29.57
Developing	75 – 79	35	13.62	31	12.06
Beginning	70 – 74	1	0.39	0	0.00
	Total	257	100.00	257	100.00
	Mean	86.38		85.57	
		Proficient		Proficient	
Descriptive Equivalent	Grade Point Average	Third Quarter (Probability)		Fourth Quarter (Statistics)	
		Frequency	Percent	Frequency	Percent
Advanced	90 & above	48	18.68	59	22.96
Proficient	85 – 89	114	44.36	116	45.14
Approaching Proficiency	80 – 84	66	25.68	55	21.40
Developing	75 – 79	29	11.28	27	10.51
Beginning	70 – 74	0	0.00	0	0.00
	Total	257	100.00	257	100.00
	Mean	85.99		86.60	
		Proficient		Proficient	

Table 2 shows the mean scores and descriptive equivalents of the respondents in their Level of Mathematics Difficulties in the four areas of Mathematics.

Contrary to the results of the Mathematics Academic Performance of the Grade 11 students, it revealed that in Patterns and Algebra, they got a mean score of 8.32 or 8 out of 15 questions which was interpreted as moderately difficult while in Geometry and Trigonometry (4.74 or 5), Probability (4.77 or 5), and Statistics (5.22 or 5) were all interpreted as Difficult.

The results show that among the four areas of Mathematics, Patterns and Algebra has been the highest in the formative test result of the Grade 11 students. It could be assumed that this area has been more mastered by the students. Meanwhile, Geometry & Trigonometry and Probability considered as the lowest among the four areas. These could be the least mastered. However, it is a fact that the result of the examination was low, the level of Mathematics difficulties is difficult.

This result is similar to the study of Capate and Lapinid [5], where they conducted a study about the performance and difficulties of the Grade 8 students of Don Bosco

Technical Institute – Makati during the first conduct of the new K to 12 Mathematics curriculum. Results of the study showed that among the three areas (Algebra, Geometry, and Statistics & Probability), Algebra turned out to be more mastered content area (77.45%) interpreted as developing level which could mean that students had difficulty grasping content of these areas during discussions.

It is not any secret that high school Geometry with its formal proofs is considered hard and very detached from the practical life. Many teachers in public schools have tried different teaching methods and programs to make students understand this formal Geometry, sometimes with success and sometimes not. Same in Trigonometry, students find it difficult because it is not offered in depth in the high school to the extent that Algebra and Geometry were taught [12].

At any level, students appear to have difficulties developing correct intuition about fundamental ideas of probability for at least three reasons. First, many students have an underlying difficulty with rational number concepts and proportional reasoning, which are used in calculating, reporting, and interpreting probabilities [13].

Table 2: Level of Mathematics Difficulties

Descriptive Equivalent	Score	Patterns and Algebra		Geometry and Trigonometry	
		Frequency	Percent	Frequency	Percent
Very Difficult	0 – 3	33	12.84	73	28.40
Difficult	4 – 6	56	21.79	129	50.19
Moderately Difficult	7 – 9	39	15.18	47	18.29
Easy	10 – 12	103	40.08	8	3.11
Very Easy	13 – 15	26	10.12	0	0.00
	Total	257	100.00	257	100.00
	Mean	8.32 or 8 Moderately Difficult		4.74 or 5 Difficult	

Descriptive Equivalent	Score	Probability		Statistics	
		Frequency	Percent	Frequency	Percent
Very Difficult	0 – 3	68	26.46	60	23.35
Difficult	4 – 6	131	50.97	120	46.69
Moderately Difficult	7 – 9	56	21.79	65	25.29
Easy	10 – 12	2	0.78	12	4.67
Very Easy	13 – 15	0	0.00	0	0.00
Total		257	100.00	257	100.00
Mean		4.77 or 5 Difficult		5.22 or 5 Difficult	

Table 3 shows the Analysis of Variance to test the difference on the level of academic performance of the student – respondents in First Quarter to Fourth Quarter when grouped according to profile variables.

Based from the results, the academic performance of the students from first quarter to third quarter has a significant difference on the age profile since the computed significant value of each quarter was less than 0.05 alpha level of significance. Meanwhile, there is no significant difference between the academic performance from first quarter to third quarter as to sex profile. However, the fourth quarter has a significant difference on both age and sex profile.

In some cases, student's gender strongly affects their academic performance, with girls performing better in Algebra. Girls usually show more efforts leading towards better grades at school [14]. It is very important to have comprehensible understanding of the factors that benefit and hinder the academic progress of an individual's education.

According to Boocock [15] "Test scores indicate that on all measures there is considerable overlap between the dis-

tribution of scores for the two sexes; and that on tests of total or composite abilities, the sexes do not differ consistently, and superior or highly developed ability is more or less equally distributed among boys and girls". Nevertheless, males do consistently score higher than females in mathematics, while females score higher on tests of verbal skill. The gap between males and females in math achievement has narrowed, though, as the number of females enrolling in math courses has risen. Girls have an initial academic advantage over males, in elementary school they consistently outperform males in grades, and maintain this grade advantage into high school, even in math and science [16]. At the elementary level males are six times more likely to have learning disabilities or to be emotionally disturbed.

However, from the beginning of school boys tend to express more interest than females in mathematics and science. This difference increases with age. Studies of students who are extremely gifted in mathematics found that gifted boys outnumbered gifted girls by a substantial ratio [17].

Table 3: Analysis of Variance to Test the Difference on the Level Mathematics Academic Performance as to Profile Variables

Source of Variation			First Quarter			Second Quarter			
		df	Sig.	Decision/ Interpretation		F	Sig.	Decision/ Interpretation	
Age	Between Groups	3	0.04	Reject Ho	Significant	3.73	0.01	Reject Ho	Significant
	Within Groups	253							
	Total	256							
Sex	Between Groups	1	0.21	Accept Ho	Not Significant	2.82	0.09	Accept Ho	Not Significant
	Within Groups	255							
	Total	256							
Source of Variation			Third Quarter			Fourth Quarter			
		df	Sig.	Decision/ Interpretation		F	Sig.	Decision/ Interpretation	
Age	Between Groups	3	0.01	Reject Ho	Significant	5.52	0.00	Reject Ho	Significant
	Within Groups	253							
	Total	256							
Sex	Between Groups	1	0.16	Accept Ho	Not Significant	5.23	0.02	Reject Ho	Significant
	Within Groups	255							
	Total	256							

Table 4 shows the Analysis of Variance to test the difference on the level of Mathematics difficulties in Patterns and Algebra, Geometry and Trigonometry, Probability, and Statistics when grouped according to profile variables.

It revealed in this table that Patterns and Algebra has a significant difference on both age and sex profile while there was a contrary in the result of Geometry and Trigonometry since there has no significant difference on both age and sex profile.

In some other cases for Probability and Statistics, it shows that the results were the same since there is a significant difference on the age profile and there is no significant on the sex profile for both areas.

Explanations for the gender gap between boys and girls have focused on different factors. Traditionally, girls' lower performance in mathematics was explained as relating to both internal and external contextual factors – for example, lower perceived support for learning Algebra [18]. Other stud-

ies attributed the girls' drop – in performance to their mathematics feelings that their classrooms were unattractive, uncomfortable and hostile. Factors of importance for girls' performance in mathematics were teacher and peer support [19]. Such results concerning mathematics are supported by general findings indicating that teacher and peer support are positively connected to academic attitudes, achievement, emotions, learning, motivation and self efficacy [20],[18].

Fabiyi [22] said that there is a difficulty to learn about

Geometry concepts by the Senior Secondary students in Ekiti State, Nigeria which includes: Construction, coordinate geometry, circle theorem and so on and reasons given for perceiving geometry concepts difficult includes: Unavailability of instructional materials, teachers' method of instruction and so on. Also, students' gender had a great influence on the learning of concepts in geometry at 0.05 level of significant in favor of female students.

Table 4: Analysis of Variance to Test the Difference on the Level Mathematics Difficulties as to Profile Variables

Source of Variation			Patterns and Algebra			Geometry and Trigonometry			
		df	Sig.	Decision/ Interpretation		F	Sig.	Decision/ Interpretation	
Age	Between Groups	3	0.00	Reject Ho	Significant	2.48	0.06	Accept Ho Significant	Not
	Within Groups	253							
	Total	256							
Sex	Between Groups	1	0.00	Reject Ho	Significant	0.39	0.53	Accept Ho Significant	Not
	Within Groups	255							
	Total	256							
Source of Variation			Probability			Statistics			
		df	Sig.	Decision/ Interpretation		F	Sig.	Decision/ Interpretation	
Age	Between Groups	3	0.05	Reject Ho	Significant	2.92	0.03	Reject Ho	Significant
	Within Groups	253							
	Total	256							
Sex	Between Groups	1	0.78	Accept Ho	Not Significant	0.06	0.81	Accept Ho Significant	Not
	Within Groups	255							
	Total	256							

Table 5 shows the Pearson r to test the significant relationship between the level of academic performance and the level of Mathematics difficulties in different strands of the student – respondents.

There was a high significant relationship ($r = 0.627$, $\text{sig.} = 0.000$) between Mathematics difficulties and academic performance. The computed significant value of 0.000 which is lower than 0.01 Alpha Level of Significance, therefore, the Null Hypothesis is Rejected, hence there is highly significant difference on the variables. There is highly significant relationship between the academic performance in First Quarter, Second Quarter, Third Quarter, and Fourth Quarter to their Mathematics difficulties in Patterns and Algebra, Geometry and Trigonometry, Probability, and Statistics, respectively.

This is much related to the study of Effandi and Normah [23], according to them that the students' academic performance towards Mathematics are very much related to their Mathematics difficulties in particular with the problem – solving skills. They add that negative attitudes need to be overcome, so that later in life, students will not suffer from poor problem-solving skills. It is important to master problem solving skills as these skills are essential for dealing competently with our everyday life. Their claim is supported by O'Connel [24] who points out that students must have positive attitude towards problem solving if they are to succeed. He proposes that solving problems requires patience, persistence, perseverance and willingness to accept risks.

Table 5: Pearson r on the Relationship between the Academic Performance and the Level of Mathematics Difficulties

Source of Correlation		Performance	Difficulties	Interpretation
Performance	Pearson Correlation	1	0.627**	High Relationship
	Sig. (2-tailed)		0.000	
	N	257	257	
Difficulties	Pearson Correlation	0.627**	1	Significant
	Sig. (2-tailed)	0.000		
	N	257	257	

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

4 CONCLUSIONS AND RECOMMENDATIONS

Based on gathered data and findings of the study, the researcher concluded that the Grade 11 student – respondents were typically female and adolescent. They are all proficient in their Mathematics academic performance in First Quarter, Second Quarter, Third Quarter, and Fourth Quarter. These results are contrary on the level of Mathematics difficulties of the student – respondents. Patterns and Algebra was Moderately Difficult while in Geometry and Trigonometry, Probability, and Statistics were all interpreted as Difficult. These imply that there was a problem with regards to the retention of topics that they had encountered in their junior years.

When it comes to the differences between the level of Mathematics academic performance in the First Quarter, Second Quarter, and Third Quarter, there has a significant difference in age and have no significant difference in sex while in Fourth Quarter were both has a significant difference in age and sex. The student – respondents' level of Mathematics difficulties in Patterns and Algebra has a significant difference in both sex and age, Probability and Statistics has a significant difference in age and has no significant difference in sex, while in Geometry and Trigonometry has no significant difference in both age and sex. There is a high relationship between the academic performance in First Quarter, Second Quarter, Third Quarter, and Fourth Quarter and the Mathematics difficulties in Patterns and Algebra, Geometry and Trigonometry, Probability, and Statistics, respectively.

In order to cope with the low performance of the Grade 11 students in K to 12 Mathematics curriculum, the researcher has formulated recommendations. First, efforts should be made to educate parents as to why they should, and how they can, help their children by making follow – up or check the activities, assignments, or worksheets.

Second, the coordination of the curriculum, instructional materials, assessment, instruction, professional development, and school organization around the development of Mathematics difficulties should drive school improvements efforts.

Third, the integrated and balanced development of all four strands of the new Mathematics curriculum in the K to 12 should guide the teaching and learning of school Mathematics. Instruction should not be based on the extreme positions that the students learn, on the one hand, solely by internalizing what a teacher or book says or, on the other hand, solely by inventing Mathematics on their own.

Fourth, teachers, researchers, and curriculum developers should explore ways to offer a middle school curriculum in which algebraic ideas are developed in a robust way and connected to the rest of Mathematics.

Fifth, textbooks and other instructional materials should develop the core content of the four strands (Patterns and Algebra, Geometry and Trigonometry, Probability, and

Statistics) in a focused way, in depth, and with continuity in and across grades.

Lastly, practice should be used with feedback to support all strands of Mathematics and not just procedural fluency. In particular, practice on computational procedures should be designed to build on and extend understanding.

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