



PAQIA: The Relationship between Freshman College Students' Academic Performance and the Performance Analysis Quadrants, Interest, and Attitudes in Mathematics 11

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Abstract— *The teaching of the subject Mathematics in the Modern World is one of the new course in the first year college requires teachers to be a high tech teacher-leader or teacher-manager in their respective classrooms. This study surveyed freshmen college students in Math 11(Mathematics in the Modern) on their level of interest, attitudes, and academic performance and did a correlational approach to the gathered data. It also adopted the Performance Analysis Quadrant (PAQ) for employees by Jones (1993 to analyze the relationship of the factors like attitudes towards Mathematics and the level of performance indicated by the freshmen students in the areas of Mathematics. The results showed that: That most of the students have low interest and unfavorable attitude in Math 11(Mathematics in the Modern World) in which most of them have grades of 80 to 84%. The correlation of the level of interest in Math and academic performance is “positive moderate correlation”, while the attitude and level of interest in Math is “positive low or weak correlation”, and the attitude and academic performance is also “positive low correlation.” This implies that as attitude change, the academic performance also changes moderately. “The performance analysis quadrant revealed that most of the students have satisfactory performance but with unfavorable attitudes towards Math 11(Mathematics in the Modern World). Thus, the level of interest can contribute to the attitudes and the academic performance of the students in Math 11.*

Keywords— *Performance Analysis Quadrant, Mathematics 11, TIMMS.*

I. INTRODUCTION

Background

The 21st century challenges offers upgraded of curricula with varied new concepts and approaches and with this, it requires technical and technological knowhow to be able to deliver it in the classrooms. The subject Mathematics in the Modern World is one of the new course in the first year college which requires teachers to be a high tech teacher-leader or teacher-manager in their respective classrooms in order to sell the ideas of the subject to the students. Today, the overall trends in Mathematics are reviewed in the Trends in International

Mathematics and Science study (TIMMS). This serves as another tool for assessing quality and student achievement in science and Math globally. The Philippines participated in the 1999 and 2003 TIMMS which was administered to the fourth and eighth grade levels in 50 countries.

Similar to the NAT results, the 2003 Philippine TIMMS results revealed that Grade Four pupils got higher scores in Math than in Science, with overall achievement rates of 358 and 332, respectively. The scores of Second Year students in Math and Science had only a one-point difference, with scores 378 and 377 respectively. However, all scores fall under the low benchmark of 400

established by TIMMS (as against the advanced benchmark of 625, high benchmark of 550 and international benchmark of 475). Grade four Filipino pupils ranked 23rd in both Math and Science administered to 25 countries; while the Second Year students ranked 41st in Math and 42nd in science to 45 countries. Again, a redeeming result is that compared with the 1999 performance, the Philippines showed the most improvement in both Math and science among the Second Year students of the 45 countries with 33 and 32 points difference from 1999 to 2003. Only one other country Israel, showed at least 30 points increase in average scale scores in Math, while Lithuania did so in Science (Jerry E. Esplanada <http://wiki.answers.com/Q/current-issues-in-the-phil-math-educ>).

During Asian Math Competition ,the Philippines beat Asian Mathematics powerhouses China and Taiwan to emerge as overall champion with 216-medal haul, including 31 gold in the just-ended 2015 Singapore International Math Competition (SIMC) here in the so-called "Lion City". China bagged 27 gold medals while Taiwan took home 19 gold to place second and third respectively. (www.mtghil.org).

From the result of the National Achievement Test (NAT) in Grade VI by Region and Subject Area, SY 2004-2005, region CAR ranked fourteenth with a mean percentage score (MPS) of 55.0 in Mathematics and lowest in science with a mean of 51.3. While Eastern Visayas ranked number one with 72.1 in Mathematics and lowest in science with 63.7 MPS. In fourth year NAT, region CAR ranked eight with a mean percentage scores of 49.8 in Mathematics and 38.2 in science as the lowest subject. Again Eastern Visayas got the first ranked with 68.9 in Mathematics and lowest in Filipino with 47.8 mean percentage score (Cadalg, 2005).

Generally, there is a common perception that Mathematics is a very difficult subject. As much as possible students tend to avoid taking Math courses. Avoiding Math courses severely restricts the fields a student can study and the jobs one can find nowadays however, many have realized the importance of Mathematics, not only from the point of view of getting an academic qualification at school or college, but is also a subject that prepares one for the future as well, irrespective of which walk of life one chooses to be a part of. (www.mathematics blurtit.com).

Mercer and Jordan (1998) stressed that like any other subjects, there are Math disabilities, which keep children from performing to their full potential in school and beyond. At no time in history has this notion been truer.

According to Hadfield and McNeil (1994) their research-based Mathematics disability characteristics include: learned helplessness, passive learners, memory problems, attention problems, cognitive thinking deficits, low level of academic achievement, and Mathematics anxiety.

Mathematics learning should be carefully examined as one of the subjects in all levels from k-1 to k-12 and then in College. This study tries to assess the student's performance using the quadrant level of learners across the factors that affect their achievements in Mathematics.

Rationale

Assessing the factors that influence student's learning in Mathematics especially the new Mathematics subject in the first college is important to consider especially their academic backgrounds, attitudes, and interests, and the availability of instructional materials and technological facilities. In this study, the four quadrants to analyze the factors affecting the performance of students in Mathematics. This Performance Analysis Quadrant was an approach used to evaluate employee's job performance and it was introduced in the paper of Jones' (1993). His paper is titled "Performance Analysis Quadrant (PAQ) description of the four factors that affects job performance."

Measuring the achievements of students should not be enough as bases in evaluating how students got there course. Their knowledge and learning attitudes relationship with their achievement are important factors to look at by Mathematics educators. These are two things (knowledge and attitudes) are usually the reasons that made the achievements low or high when these are not discovered and used to strengthen the learners level of learning.

II. THEORETICAL /CONCEPTUAL FRAMEWORK

The study of complex mathematics in the first year college is interesting but the delivery of the lessons of the subject should first consider the level of interest, attitudes, and the initial or stock knowledge of the learners in mathematics. This three level of aspects in learning: interest, attitudes, and stock knowledge are very important in teaching difficult lessons like the Mathematics lessons with unfamiliar solving problem approaches.

In this study, the subject, Mathematics 11 (Mathematics in the Modern World) is something new to the freshmen college students in today's K-12 curriculum. This subject is offered in the first year college which

contains varied but advanced lessons in Mathematics in today's generation. It is the only basic subject in Mathematics offered in College. To the teachers, the subject contains some stranger topics but interesting though somewhat difficult to teach to students with few stock knowledge in mathematics.

One such tool is the "Performance Analysis Quadrant" (PAQ) for identifying the root causes of such problems. By discovering the answer to two questions, "Does the employee have adequate job knowledge?" and "does the employee have the proper attitude (desire) to perform the job?" and assigning a numerical rating between 1 and 10 for each answer, will place the employee in 1 of 4 performance quadrants: Performance Analysis Quadrant (PAQ), Jones' (1993) description of the four factors that affects job performance.

Quadrant A (Motivation): If the employee has sufficient job knowledge, but has an improper attitude, this may be classed as motivational problem. The consequences (rewards) of the person's behavior will have to be adjusted. This is not always bad as the employee just might not realize the consequence of his or her actions.

Quadrant B (Resource/Process/Environment): If the employee has both job knowledge and a favorable attitude, but performance is unsatisfactory, then the problem may be out of control of the employee. i.e. lack of resources or time, task needs process improvement, the work station is not ergonomically designed, etc.

Quadrant C (Selection): If the employee lacks both job knowledge and a favorable attitude, that person may be improperly placed in the position. This may imply a problem with employee selection or promotion, and suggest that a transfer or discharge be considered.

Quadrant D (Training and or Coaching): If the employee desires to perform, but lacks the requisite job knowledge or skills, then some type of learning solution is required, such as training or coaching.

This model shows a performance analysis being used when first presented with a performance problem, the ADDIE or ISD model, an ID model plugged into the ADDIE model to give it further design capabilities, the learning solution, which in turns helps to create the desired performance.

The concepts of Performance Analysis Quadrant (PAQ) by Jones (1993) is likewise applicable to examining students' academic performance. This is illustrated in the diagram below:

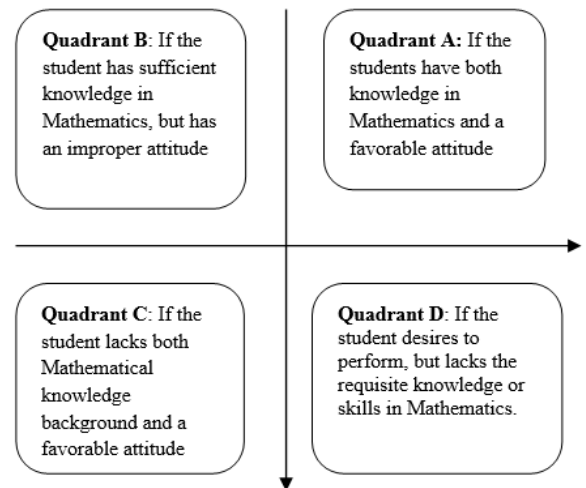
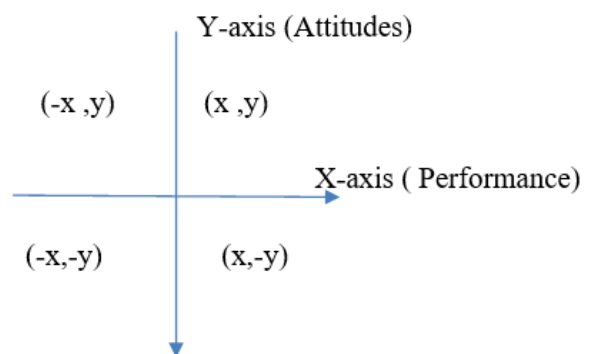


Fig.1- Analysis of the Quadrants



Statement of the Problem

The study shall generally look into the Performance Analysis Quadrant of the students in Mathematics specifically, the Mathematics in the Modern World.

Specific Objectives

It aims to find answers of the following objectives:

1. To assess the students' level of interest , attitudes, and their average academic performance (final grades) in learning the subject Mathematics in the Modern World;
 - 1.1 Is there a high degree of correlations of the level of interest, attitudes, and their average academic performance (final grades) of the students the subject Mathematics in the Modern World?
 - 1.2 Hypotheses:
 - a) There is a high degree of correlations of the level of interest, attitudes, and their average academic performance (final grades) of the students in the subject Mathematics in the Modern World.

2. To describe the performance analysis quadrant of the students in learning the subject Mathematics in the Modern World;
3. To determine if there is a significant relationship between the identified Performance Quadrant analysis of the students in Mathematics and their academic performance (final grades);
4. To determine if there is a significant correlation of the level of interest and attitudes towards the subject Mathematics in the Modern World;
5. To determine the basic mathematics subjects which the students would like to undertake before taking the subject Mathematics in the Modern World to refresh their knowledge in Mathematics.

Scope and Delimitation

This study is limited to students enrolled in Math 11 – Mathematics in the Modern World at Dagupan and Bulanao Campus.

III. REVIEW OF RELATED LITERATURE

The study of learning styles has brought great attention to the importance of modifying curriculum and unification of the perceptual differences of students. According to Barbe (1981) and Dunn (1988), research has developed more complex and comprehensive models that consider the effect to other elements of a person's unique learning style. For example, Keefe (1987) described three dimensions of personal preferences or styles in learning, as was stated in the dissertation by E. Paul (2001):

- Cognitive styles – information processing to include the way one encodes, Processes,
- Stores, retrieve, and decode information;
- Affective styles – personality dimensions to include attention span, motivation,
- Interests, and emotions; and
- Physiological styles – to include gender behavior, health-related behavior, and physical environmental conditions

Dunn (1989) states that identifying one's learning style is much easier than explaining its existence. Students are affected by their own emotionality, sociological, Environmental and physical preferences. According to Dunn, Dunn and Price (1979) each individual learns through a complex set of reactions to varied stimuli, feelings and previously established thought patterns that tend to be present when an individual learns. The learning process is conceived as environmental, emotional, sociological and physiological. The major premise of how individuals learn,

not the skills used in learning, is the foundation for the Learning Style Inventory.

Learning styles research is used in human resource management, sales, team development, counseling, academic applications, and many other fields (Kevin, 2010). Within the Academic applications of learning styles research, there are two general applications of learning styles information that affect classroom instruction and student learning. These two applications (often referred to as "using learning styles" in the classroom) are: 1. the use of learning styles information, surveys, and prescriptions by students to increase self-awareness and study skills. 2. The use of learning styles information, resources, facilities, and surveys by teachers and administration to customize pedagogy and the learning environment.

In Quadrant Analysis, Research America's experts compare consumer opinions on specific qualities of your product to those of your competitors. Statisticians depict the joint location of these two parameters in a two-dimensional quadrant graph so you can immediately identify which critical aspects are most loved and perform well, and where your product's features do not perform as well. Using Quadrant Analysis also reveals which less important aspects outperform your competition and where each company scores poorly in consumer opinion (<https://researchamericainc.com/>).

IV. METHODOLOGY

The study was conducted at Kalinga State University using the documentary analysis and survey method. The descriptive method using the quantitative and qualitative approach in addressing the needs of this study. Its main focus is the description of the relationships of the factor that influence the academic performance of the students using the Performance Analysis Quadrant Survey (PAQS) tool. The results of the survey were reinforced and validated through the conduct of interviews with some of the respondents.

Respondents

The respondents of this study used a total number of 146 students enrolled in the subject, math11 (Mathematics in the Modern World) for the first semester 2018 to 2019 at the Kalinga State University for Dagupan Campus.

Instrumentation

The reconstructed survey questionnaires were used to gather for the Performance Analysis Quadrant Survey (PAQS) and the level of interest and attitudes survey data of the students. Since the survey

questionnaire for the PAQS was revised according to the needs of the study, it was subjected to reliability test before it was finalized as an instrument for this study. From the results of the reliability test, it was found that the instrument is deemed reliable since as revealed by the computed $r = 0.86$ which is high reliable.

Data Treatment

The data in the performance analysis quadrant are categorized as: First quadrant (x,x), Second quadrant (-x,y), third quadrant (-x-y) and the fourth quadrant (x,-y).

Performance Analysis Quadrant

(where x-knowledge ;y- attitudes)

- A.(x,y); satisfactory performance and favorable attitudes
- B.(-x,y), low performance and favorable attitudes
- C.(-x,-y), low performance but unfavorable attitudes
- D.(x,-y), Satisfactory performance but unfavorable attitudes

While the grades shall be categorized using the 5-point Likertscale as follows: Outstanding, very satisfactory, satisfactory, fair, and poor. The level of interest of students in Mathematics were categorized using the 3-poin scale as follows: high interest, average interest, low interest; and their attitudes are summarized as: very favorable, favorable, and not favorable.

Statistical Tools

The tables of frequency, percentage, and mean was be used to summarize the data. The correlation wasused to determine the significant relationship between the Performance Analysis Quadrant and the academic performance data, the level of interest and attitudes of students in Mathematics.

V. RESULTS AND DISCUSSIONS

This section presents the results, discussions, interpretations, findings, conclusions, and the recommendations of the study.

Table 1. Distribution of Students (Respondents) According to their Level of Interest and the Attitude of towards their Learning in the Subject Mathematics in the Modern World

| Level of Interest | Frequency (Students) | Percent | Attitudes | Frequency (Students) | Percent |
|--------------------------|----------------------|---------|----------------------|----------------------|---------|
| High interest in Math | 9 | 6 | Very Favorable | 13 | 9 |
| Average Interest in Math | 77 | 53 | Favorable | 32 | 22 |
| Low Interest in Math | 60 | 41 | Not Favorable | 101 | 69 |
| Total | 146 | 100 | | 146 | 100 |
| Mean (low Interest) | 1.65 | | Mean(Not favorable) | 1.39 | |

The table reflected that the level of interest of the students in the subject Mathematics in the Modern World is described as “low” having a mean of 1.65. On the other side, their attitude towards the subject is also found as “not favorable” “having a mean of 1.39. How it specifically showed under the level of interest in Mathematics that most of the students who were surveyed have average

interest in Math. As they have said in the interview during their first day in class that they are somewhat have interest to learn Mathematics. With regards to their attitudes towards the subject, most of them claimed that they displayed unfavorable attitudes in Mathematics due to its complex in nature.

Table 2- Distribution of Respondents According to their Final Grades in the Subject Mathematics in the Modern World.

| Final Grades in Mathematics | Number of Students | Percent |
|-----------------------------|--------------------|---------|
| 95-100 (Outstanding) | 4 | 3 |
| 90-94 (Very satisfactory) | 5 | 3 |
| 85-89 (Satisfactory) | 32 | 22 |
| 80-84 (Fair) | 63 | 43 |
| 75- 79 (poor) | 42 | 29 |
| Total | 146 | 100 |

Average = 82.41% Fair

Based from the table, the students got an average final grade of 82.41% in the subject Mathematics in the Modern World which is described as “fair.” This is also revealed in the distribution which showed that 63 or 43% out of 146 respondents have grades from 80 to 84%. According to

most of their feedbacks regarding the new curriculum of Math 11, they found the subject very difficult because they are not yet familiar as some of them are not products of the K-12 program. However, it is good that there were four (4) or 3% of them who had grades in between 95 to 100.

Table 3. Summary of Correlations of the Variables such as Interest in Math, Attitudes in Math, and the Academic Performance in Mathematics

| Variables | Interest in Math | Attitudes in Math | Academic Performance |
|----------------------|------------------|-------------------|----------------------|
| Interest in Math | 1 | | |
| Attitude in Math | 0.187907813 | 1 | |
| Academic Performance | 0.606322739 | 0.07204 | 1 |

The summary of correlations among the three variables revealed that the attitude and interest in Math is 0.18 which means low or weak positive correlation, between the interest and academic performance it reveals that there is a moderate positive correlation. And likewise, the correlation between attitude and academic performance, it is found out that there is a very low correlation which is only 0.072. The results validates the reactions of the

students when they were exposed to the problem solving activities on the different topics of the subject in Math 11(Mathematics in the Modern World).However, between the attitudes and academic performance, it was found to be a moderate correlation with R-value =.60.This result implies that the attitudes toward a subject can really affect the result of grades.

Table 5. The Distribution of Students(Respondents) According to the their Performance Analysis Quadrant in Learning the Subject Mathematics in the Modern World

| Performance Analysis Quadrant (where x-knowledge ;y- attitudes) | Number of Students | Percent |
|--|--------------------|---------|
| A.(x,y); satisfactory performance and favorable attitudes | 33 | 23 |
| B.(-x,y), low performance and favorable attitudes | 31 | 21 |
| C.(-x,-y),low performance but unfavorable attitudes | 35 | 24 |
| D.(x,-y), Satisfactory performance but unfavorable attitudes | 47 | 32 |
| Total | 146 | 100 |

The table of Performance Analysis Quadrant is illustrated below using the X and Y axes in positioning the performance or knowledge of students and their attitudes. In the table it showed that 47 or 32 % of the 146 students who were surveyed, in Math 11 subject, is in quadrant D where-in there is positive X and –Y elements and this described the students as “satisfactory performance but unfavorable attitudes.” While, there were 33 students who

have satisfactory performance and have good attitude towards the subject Math 11(Mathematics in the Modern World). The rest also are 35 or 24% students with low performance and negative attitude or unfavorable attitudes in Math 11. And lastly, there were 31 or 21 % students out of 146 are described to unsatisfactory in performance but favorable attitudes.

Table 6. The summary of Correlation and t-test between the Level of Interest in Mathematics and Attitudes towards the Learning of the Subject Mathematics in the Modern World.

| Variables | Mean | Correlation coefficient | R square | t-stat | p-value |
|---------------------------|------|-------------------------|----------|--------|---------|
| Level of Interest in Math | 1.65 | 0.18 | 3.5% | 2.29 | .02 |
| Attitude in Math | 1.39 | | | | |

r =.18, Low correlation but significant at .05 level

The table reflected that there is a low positive correlation or direct relationship but considered low. However, the t-test described the correlation between interest and attitudes toward Math 11 as significant. This implies that the level of interest can also influence the attitudes or the behavior of students in dealing with Mathematics.

Summary of Findings

The conducted study revealed that the level of interest of the students in the subject Mathematics in the Modern World is described as “low” having a mean of 1.65. On the other side, their attitude towards the subject is also found as “not favorable” having a mean of 1.39. On the performance, the students got an average final grade of 82.41% in the subject Mathematics in the Modern World which is described as “fair.” With regards to correlations result, the summary of correlations among the three variables revealed that the attitude and interest in Math is 0.18 which means low or weak positive correlation, the interest in Math and academic performance it reveals that there is a moderate positive correlation. And likewise, the correlation between attitude and academic performance, it is found out that there is a very low correlation which is only 0.072.

On the PAQ, The table of Performance Analysis Quadrant, the table showed that 47 or 32 % of the 146 students who were surveyed, in Math 11 subject, is in quadrant D where-in there is positive X and -Y elements and this described the students as “satisfactory performance but unfavorable attitudes.” While, there were 33 students who have satisfactory performance and have good attitude towards the subject Math 11 (Mathematics in the Modern World). The rest also are 35 or 24% students with low performance and negative attitude or unfavorable attitudes in Math 11. And lastly, there were 31 or 21 % students out of 146 are described to unsatisfactory in performance but favorable attitudes. And lastly, the correlation between the level of interest in Math and their attitude is positive low correlation, however, the t-test revealed that it is significant.

VI. CONCLUSIONS

Based from the findings of the study, the following can be therefore concluded: That most of the students have low interest and unfavorable attitude in Math 11 (Mathematics in the Modern World) in which most of them have grades of 80 to 84%. The correlation of the level of interest in Math and academic performance is “positive moderate correlation”, while the attitude and level of interest in Math is “positive low or weak correlation”, and the attitude and academic performance is also “positive low correlation.” This implies that as attitude change, the

academic performance also changes moderately.” Further, that the Performance Analysis Quadrant Survey (PAQS) result revealed that most of the students have satisfactory performance but with unfavorable attitudes towards Math 11 (Mathematics in the Modern World). The level of interest can contribute to the attitudes and academic performance of the students in Math 11.

VII. RECOMMENDATIONS

From the conclusions, the following can be recommended:

1. The new Mathematics curriculum, Mathematics in the Modern World requires more enhancement of interest and attitudes of students since the content of the course is not familiar and difficult to them;
2. The teaching and learning of the subject Math 11 (Mathematics in the Modern World) should be simplified and interesting activities and projects should be available, probably an instructional material;
3. The performance analysis quadrant (PAQ) tool can be adopted to describe the behavior of students and their corresponding performance.
4. The teachers in Math 11 as well as the chairman may consider standardized syllabus and provide simple but applicable activities (instructional materials) to make their students become interested in learning the new subject in Math (Mathematics in the Modern World) or not, offer the basic mathematics in college to equip the students first on the important basics of Mathematics.

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