"EXPLORING QUADRONOMETRY IN CONTENT AND PERFORMANCE ASSESSMENTS" (A NEW MATHEMATICAL CONCEPT IN TEACHING GRADE 10 MATHEMATICS)

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ABSTRACT

Critical thinking, according to Scriven and Paul (1987) is intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning or communication, as guide to belief and action. On the other hand, according to Polya (1945 and 1962), mathematical problem solving is finding a way around a difficulty, around an obstacle, and finding a solution to a problem that is unknown.

As stated from above, we need to enhance the Mathematics especially here in the Philippines, which are through innovations or nearly developed concepts, specifically by conducting this action research. This action research aims to introduce the newly discovered or invented concept in mathematics known as "Quadronometry".

We are going to explore the newly invented term by means of applying it to the assessments of content and performance of the students' learning after the discussion of the said invention.

INTRODUCTION (CONTEXT AND RATIONALE)

The conceptual framework of K to 12 Curriculum Guide Mathematics (December 2013) states that "Mathematics is one subject that pervades life at any stage and in any circumstances. Thus, its value goes beyond the classroom and the school. Mathematics as a school subject, therefore, must be learned comprehensively and with much depth. The twin goals of mathematics in the basic education levels, K to 10, are critical thinking and problem solving."

The newly invented term, the Quadronometry, according to some social media journals and websites, the newly found noun defined as a study about squares or four – sided figures according to the submitted article of Robin from Virginia, USA on January 31, 2008. Also, the word Quadronometry is a concept that is applied for architecture, photography, fine arts and other analogous applications according by John Kosmopoulos. But in this action research, we will tend to figure out the conceptual framework of the term Quadronometry in a very different

way (because when the researcher found out that the word was not yet found in the Merriam – Websters even in Oxford, it is the call for duty to construct the concept). Through the process of this action research, specifically about the content and performance assessments, Quadronometry will become very visible and interesting due to its very comprehensive principles, postulates, theorems, definition of terms, equations and applications. The content of this action research has two main justifications: exploration of the newly invented mathematical concept (Quadronometry) and the significant correlations and differences in content – based and performance based assessments. By applying the concept of Quadronometry, we will know how relative yet differ the content assessment from the performance assessment through the involvement of experimental and control group. This will cause the researcher to know the appropriateness and effectiveness of the said mathematical invention, whether it is suitable in lower level, grade ten or higher.

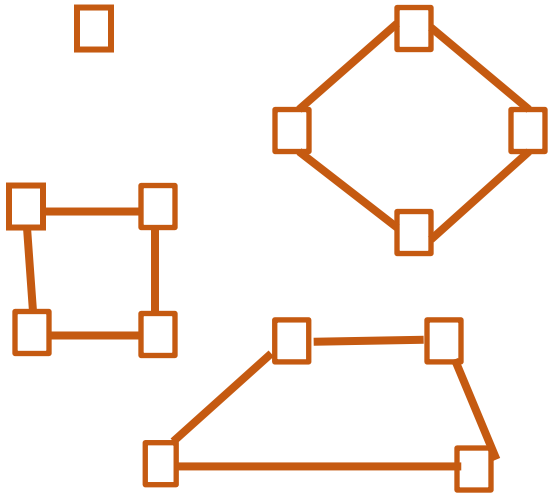
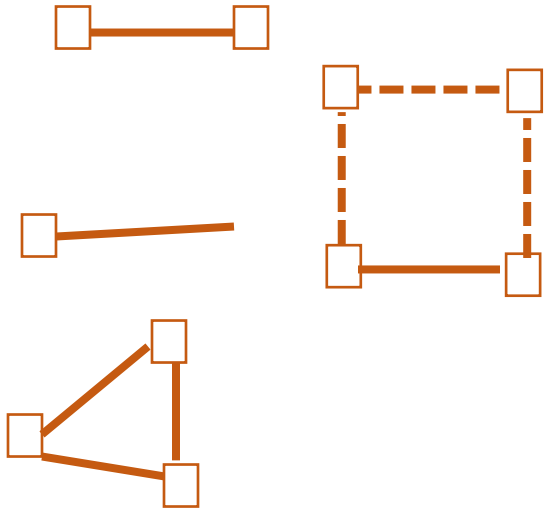
Consider this essay coming from Melanie Anne Phillips, *"Well, I'm not much of a mathematician, but twenty years ago when we first considered the relationship of a trig[onometry] to the pair relationships by function; it occurred to us that we needed an additional dimension of function to describe that relationship. We jokingly said that somebody someday was going to have to come up with "quadronometry" as an expansion to trig[onometry]. But now I'm not so sure that is far off the mark. After all, the quad includes all four dimensions – Mass, Energy, Space and Time. And if we look at it in terms of psychology (the Story Mind) we see the internal equivalents of these – Knowledge, Thought, Ability and Desire. I've written elsewhere about the correlations between the external and internal dimensions, so I won't be labour it here. Point is – trig provides three dimensions and Dramatica's function requires four."* (Trigonometry and Dramatica posted on August 26, 2012 by Melanie Anne Philipps).

As stated from above essay, Quadronometry can only be a pre – mature terminology which has to have so many definitions or of being an ambiguous term. But in this action research, the researcher will make a design of the conceptual framework to figure out the fundamentals of understanding the word "Quadronometry" only here in the Philippines.

THE CONCEPTUAL AND THEORETICAL FRAMEWORK

(QUADRONOMETRY by John Austin B. Mendoza, LPT)

Let Q be a quadronometric design that is made up of a little four – sided polygon (denoted by q) or at least one squad design denoted by Q_{sd} (made up of four little four – sided polygons with four solid segmenters/tails).

Examples of Quadronometric Designs	Examples of NOT Quadronometric Designs
	

Definition of Terms:

Quadronometric Function – a function that represents a rule of pattern in replicating quadronometric designs.

Quadronometric *Equation* – an equation contains quadronometric functions. Also known as Quadronometric Identity or Equivalence.

The Rank – a continuous nth level of rule of pattern to produce replicas of Q. The first rank starts at q.

***Quadronometric Replica* –** a replicating feature; there are five types of replicating features: checkered, span, web, window and firm.

Definitive – it is the process of getting the rule of pattern of a function by means of intervals in Q(n) with respect of intervals in n (n is a natural number denoting the rank).

Definition – it is the process of getting the definitive of a quadronometric function.

Partial Replications – the replica is not the gap itself; either the gap contains squad design or not.

Full Replications – the replica has a gap, which is itself (copy and paste system).

- Ways on how to name little q's, squad designs and tails (q, Q_{sd}, and Q_t)
  - For little q's: q_1, q_2, q_3, and q_4
  - For Squad Designs: $Q_{sd}(1, 2, 3, 4)$
  - For Tails: $Q_t(q_1, q_2)$

Kinds of Quadronometric Designs:

Locator – the little four sided polygon (q)
Righteous – either a square or a rectangular shaped squad design.
Astrayed – an oblique squad design
Convex – with intersecting diagonals
Concave – without intersecting diagonals

Five Types of Quadronometric Replica/Replicating Features:

Checkered Window Span Firm Web

STATEMENT OF THE PROBLEM
(Action Research Questions)

The purpose of this study is to explore the Quadronometry in content assessment (measuring students' mastery in terms of terminologies) and performance assessment (measuring students' mastery in terms of problem solving or equation solving). There are two groups that will be involved in this study: namely the Grade 10 A (First Highest Section) and the Grade 10 B (Second Highest Section). Thus, this study determines to answer the following questions:

1. Is there a significant correlation of the scores between the content assessment and performance assessment after the discussion of the fundamentals in Quadronometry concept?
2. Is there a significant difference between the experimental group (Grade 10 B) and the control group (Grade 10 A) in terms of the scores in content assessment and performance assessment (by means) after discussing the fundamental in Quadronometry?

METHODOLOGY AND RESEARCH DESIGN

(Action Research Method)

Research Design

This Quantitative Research is a study that will make use of the One – Shot experimental design, specifically, administering a test after the discussion of the fundamentals in Quadronometry concept.

There are two variables involved: content assessment (measuring students' mastery in terms of terminologies) and performance assessment (measuring students' mastery in

terms of problem solving or equation solving). After administering the test, the researcher will gather the scores in a column, then computing for the statistical measures of significant difference and correlation: T – test of Independent Means and the Pearson Product Moment Coefficient of Correlation.

Instrumentation

The study employs the following instruments:

1. Paper and pencil test (the test paper is a 30 – item test)
2. Timer (preferably, 1 – hour examination)
3. Chart of the scores (content assessment and performance assessment)
4. Bar graph

Data Gathering Procedure (Sampling Participants)

The following procedures were employed in conducting this study:

1. The teacher – researcher will administer the One – Shot test, giving the top 30 students in each group.
2. The teacher – researcher will record the scores in a chart namely the content – based scores and the performance – based scores.
3. The teacher – researcher will plot the data in a bar graph. (Content/Performance)

Statistical Treatment of Data (Data Gathering Method/Analysis Plan)

In the study, the following statistical tools were used:

1. The means of content – based scores and the performance – based scores will be computed.
2. The standard deviation will be used to determine the homogeneity of the scores, both in content and performance of experimental group and control group.
3. The T – Test of Independent Means will be used to determine if there is a significant difference between the experimental group (Grade 10 B) and the control group (Grade 10 A) in terms of content assessment and performance assessment after discussing the fundamentals of Quadronometry.
4. The Pearson Product Moment Coefficient of Correlation will be used to determine the relationship between content and performance assessment based from the scores of their content – based and performance – based.

Grade 10 A Data (Control Group)	Content – Based Scores		Performance – Based Scores		Grade 10 B Data (Experimental Group)
	A	B	A	B	
Content: Mean = 28.80 Median = 28.50 Mode = 30 SD = 9.09	0	30	0	5	Content: Mean = 27.83 Median = 30 Mode = 30 SD = 7.59
	30	30	3	3	
	28	30	2	3	
	28	30	16	5	
	30	30	3	3	
	30	30	3	3	

Performance: Mean = 6.30 Median = 7 Mode = 3 SD = 5.84	30	30	3	3	Performance: Mean = 3.13 Median = 3.5 Mode = 3 SD = 1.07
	23	30	13	5	
	28	30	2	3	
	30	29	15	3	
	29	30	13	4	
	30	30	11	4	
r = 0.31 (low)	18	0	10	0	r = 0.31 (high)
Skewness = - 2.49 (Content)	30	30	3	3	Skewness = - 3.62 (Content)
	28	30	11	4	
Skewness = 0.59 (Performance)	29	30	3	3	Skewness = -1.18 (Performance)
	30	30	16	3	
	30	30	3	3	
	28	30	11	3	
	30	29	3	3	
	29	30	0	3	
	30	30	3	3	
	29	30	0	3	
	30	30	11	3	
	30	30	18	3	
	30	30	10	3	
	30	27	3	3	
	27	30	0	3	
	0	0	0	0	
	0	30	0	4	

CONCLUSION

1. **THERE IS A SIGNIFICANT CORRELATION of the scores between the content assessment and the performance assessment of Quadronometry concept; however, there is a low relationship between the content and performance assessment in the class of Grade 10 A (Control Group) whose r = 0.31, it means that the class of Grade 10 A (Control Group) tried not to be affected in their scores between memorization and equation solving. On the contrary, the class of Grace 10 B (Experimental Group) has a very high r = 0.80, it means that the class believes that if they are excelling in memorization, then they are also excelling in equation – solving.**
2. **Under the confidence interval of 0.95 acceptance region with the degrees of freedom of 58 whose resulting t – value is 1.96, we follow the following remarks:**
   - **The Null Hypothesis: There is NO significant difference between the experimental group (Grade 10 B) and the control group (Grade 10 A) in terms of the scores in content assessment and performance assessment (by means) after discussing the fundamentals of Quadronometry.**
   - **If t>1.96, REJECT the null hypothesis**
   - **If t<1.96, ACCEPT the null hypothesis**

	GROUP 10 A MEAN	GROUP 10 B MEAN	SIGNIFICANCE?
CONTENT	25.80	27.83	t = 0.94; t<1.96 (none)
PERFORMANCE	6.30	3.13	t = -2.92; t<1.96 (none)

From the abovementioned table and remarks, it shows that THERE IS NO SIGNIFICANT DIFFERENCES between the experimental group (Grade 10 B) and the control group (Grade 10 A) in terms of the scores in their content and performance (by means). It signifies that the discussions of the Quadronometry Concept can be learned or taught in ALL SECTIONS/GROUPS IN THE HIGHER LEVEL, starting from grade 10 up.

RECOMMENDATIONS

I highly recommend the following endeavors:

1. Creating a fundamental syllabus for this newly invented mathematical concept.
2. To conduct seminars and trainings on how to fully grasp this Quadronometry concept; preferably, the resource speaker is the proponent himself (yours truly, Mr. John Austin B. Mendoza); and
3. To write a modular book for the Quadronometry concept.

THE APPLICATIONS OF QUADRONOMETRY

Here are some applications of Quadronometry which are yet to be discovered by so many potential proponents:

1. Quadronometric Tactics (Quadro Tactics)
   - A military tactic and strategy that can be used by an Armed Force with Quadronometric Application.
2. Quadronometric Warp (Quadro Warp)
   – An apparatus to expand the space of a vehicle with application of Quadronometry to perform elasticity.
3. Quadronometric Meter Billing System (Quadro Bill)
   – A meter billing system for both water and electric that will help the community to lessen their monthly bills.
4. Quadronometric Friction Enhancer (Quadro Friction)
   – An apparatus to increase or decrease the friction using Quadronometric Designs.
5. Quadronometric Architectural Design (Quadro Arch)

– An architectural design for giving more strength to an infrastructure using Quadronometric Designs.

6. Quadronometric Engine (Quadro Engine)
   – An engine to distribute well – rounded engines to desire a highly mechanical advantage and efficiency using Quadronometric system.
7. Quadronometric Arts (Quadro Arts)
   – An art with Quadronometric Concept and Design.
8. Quadronometric Bridge (Quadro Bridge)
   – A bridge with an application of Quadronometric Concept, can be with applications of Quadro – Arch, Engine or Warp.
9. Networking Capital, for Business Networking Plans
10. Using Quadronometry to be applied in Conceptual and Theoretical Frameworks for all pertinent research.
11. Using Quadronometric designs in Cooperative Learning Activities.

REFERRENCES

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