

## PRACTICAL UTILITY OF MATHEMATICS CONCEPTS AMONG SENIOR SECONDARY SCHOOL STUDENTS IN RIVERS STATE

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### ABSTRACT

Mathematics in all ramifications relates to real life and the application of its concepts in our daily activities make life easier and interesting. This paper examined the conventional and innovative strategies of teaching Mathematics concepts with a view to ascertain productivity in terms of applying the concepts in practical situations. It also stressed the need for Mathematics Laboratories in Primary and Secondary schools and recommended that adequate training through workshops be given to Mathematics teachers on the effective use of standard laboratory apparatus in the teaching and learning of Mathematics.

**Keywords:** Innovative, Imaginative, Conventional, Content.

### INTRODUCTION

The inclusion of Mathematics as a core subject in the Secondary School curriculum is due to the key roles Mathematics has to play in the achievement of the objectives of the secondary school education, such as promoting of science and technology, provision of trained manpower in the applied sciences, technology and commerce, and the acquisition of appropriate skills, abilities and competence both mental and physical, as equipment for the individual to live on and contribute to the development of his society (Federal Republic of Nigeria, 2014).

Mathematics is one of the school subjects that any nation needs for industrial and technological advancement, useful for most vocation and higher specialized courses of learning (Odili, 2006; Sidhu, 2006). According to Nwoke and Nnaji (2011), Mathematics is the study of quantity, structures, space and change. It developed through the use of abstraction and logical reasoning, from counting, calculation, measurement and the study of the shapes and motion of physical objects. Mathematics is an excellent vehicle for the development and improvement of a person's intellectual competence in logical reasoning, spatial visualization, analysis and abstract thought (Curriculum Planning and Development Division, 2007). Students who study Mathematics, therefore, develop numeracy skill, reasoning, thinking skills and problem solving skills through the learning and application of Mathematics. CPDD (2007) stipulated that the aims of Mathematics education are to enable students to:

- (i) Acquire the necessary Mathematical concepts and skills for everyday life, and for continuous learning in Mathematics and related disciplines.
- (ii) Develop the necessary process skills for the acquisition and application of Mathematical concepts and skills.
- (iii) Develop the Mathematical thinking and problem solving skills and apply these skills to formulate and solve problems.
- (iv) Recognize and use connections among Mathematical ideas and develop Mathematical tools (including information and communication technology) in the learning and application of Mathematics.
- (v) Produce imaginative and creative work arising from Mathematical ideas and develop positive attitudes towards Mathematics.

These aims could be achieved through the use of innovative Mathematics teaching strategies instead of the conventional approach.

## Conventional Mathematics Teaching Approach

In order to realize the objectives of teaching Mathematics, the readiness of the learner, teacher proficiency and effective use of appropriate teaching strategies are important indexes. The teaching of Mathematics according to Ogunkunle (2007) has taken a stand point of talk and chalk at the secondary school level. The use of talk and chalk method, has become burdensome and of worry because it does not establish the link between Mathematics concepts learnt in the classroom and their applicability to real life situations hence denying students of meaningful learning (Ogunkunle & George, 2015; Sidhu, 2006). Jonah-Eteli (2010) observed that generally teachers discuss worked examples, sometimes leading to formulae and then ask the students to work exercises based on the examples or using the formulae. Jonah-Eteli (2010) asserted that this method of teaching leads learners to memorize Mathematical formulae, methods and examples as presented by the teacher.

The result of this conventional approach is poor literacy in Mathematics, poor performance in external examinations in Mathematics and students' general dislike or phobia for Mathematics. The poor Mathematics achievement of students in West African School Certificate (WASSCE) between 1991 and 2012 is shown on table 1 below.

**TABLE 1: WASSCE Results of General Mathematics (May/June, 1991 – 2012)**

Year	Total Entries	Total No. who sat	No. of failures	% of failure	No. of students' who obtained Credit & above	% of Credit & above
1991	299,338	294,079	261,352	87.3	32,727	11.1
1992	366,196	361,506	282,480	77.1	79,026	21.9
1993	498,775	491,755	438,196	87.9	53,559	10.9
1994	526,525	518,118	434,926	82.6	83,192	16.1
1995	466,971	462,273	386,193	82.7	76,080	16.5
1996	519,656	514,342	462,755	89.1	51,587	10.0
1997	621,841	616,923	569,671	91.6	47,252	7.7
1998	640,624	635,685	565,098	88.2	70,587	11.1
1999	648,120	642,819	584,961	90.3	57,858	9.0
2000	537,266	530,074	356,258	66.3	173,816	32.8
2001	886,909	843,991	493,245	55.6	350,746	41.6
2002	1,004,308	949,139	806,550	80.3	142,589	15.0
2003	550,029	518,516	281,139	51.1	237,377	45.8
2004	309,660	309,531	142,992	46.2	166,539	53.8
2005	943,371	634,604	426,460	45.2	208,244	32.8
2006	1,040,117	1,023,102	649,147	62.4	373,955	36.6
2007	925,288	908,235	598,826	64.7	309,409	34.1
2008	968,475	940,200	661,855	68.3	278,345	29.6
2009	998,282	902,350	559,692	62.0	342,658	38.0
2010	1,004,308	949,139	806,550	80.3	142,589	15.0
2011	1,045,317	1,004,102	895,540	89.2	148,690	14.8
2012	1,695,878	1,046,722	397,566	37.0	649,156	62.0

**Source:** Test Development Division, West African Examination Council (WAEC) Lagos.

The table indicated poor percentage students' achievement within 1991-2002, where credit level pass is below 40%. In 2001, 2003, 2004 and 2012, students' credit pass level was 41.6 percent, 45.8 percent, 53.8 percent and 62.0 percent respectively. According to Charles-Ogan (2014), the consistent poor performance of students in Mathematics poses a great threat to the much desired scientific and technological advancement of the nation. If the students lack proper understanding of the Mathematics concepts, low acquisition of Math skills inadequate problem solving techniques, but have vested interest in passing school certificate Mathematics examinations, the problem of poor achievement will be difficult to solve over time.

### **Innovative Mathematics Teaching Strategies**

The import of Mathematics excellence is hinged on understanding the concepts and its applicability. Sierpiska (1994) defined understanding as the mental experience of a subject by which he/she relates an object (sign) to and other object (meaning) in mathematics, understanding is also used in the processes for assessing students' learning where teachers are involved in helping the students to establish agreed relationships between terms, mathematics expressions, abstractions and techniques. Johnson (1987) agreed with the view of Sierpiska (1994) but added that understanding is a social construct "is the way we are meaningfully situated in our world through our bodily interactions; our cultural institutions, our linguistic tradition and our historical context".

A lot of innovative Mathematics teaching strategies have been developed by researchers in order to intimate students with the applicability of the Mathematics concepts, reducing Mathematics phobia and anxiety among students, easing their proficiency in Mathematics problem solving skills and mastery of the concepts rather than rote and memorization. These strategies are the use of Mathematical modeling (Ghosh, 2012), use of Mathematics laboratory resource materials (Gilbert, 1994) practical teaching approach to number bases (Aminu, 2004), use of learning objects (Kay & Knaack, 2008).

Mathematics concepts include numerical concepts, Algebraic, geometrical, statistical probabilistic and analytical concepts (CPDD, 2007). In order to have deep understanding of these concepts in terms of content and applications, the use of manipulative (concrete materials), practical work and use of technological aids should be part of the learning experiences of the students. According to Jonah-Eteli (2010) teaching Mathematics by textbook worked examples impedes students' Mathematical concepts development and results to their inability to apply their subject matter conceptual knowledge in other problem situations. Mathematical concepts could be developed in learners without resorting to examples (Bello, 2005; Nurudeen, 2007, Aminu, 2004).

### **Concepts of Mathematics**

Mathematics is the bedrock of all scientific technological investigations and has provided the route to modern world of science and technology. In order to understand the subject matter, teachers and researcher have developed problem solving models and strategies to consequently, improve the performance of learners (Adaramola & Onwoiduokit, 2010). The Nigerian Educational Research and Development Council (2014) provided a thematic presentation of the mathematics for concepts effective teaching and learning in the senior secondary as shown in table 2.

**TABLE 2: CONTENT OF SENIOR SECONDARY EDUCATION CURRICULUM FOR MATHEMATICS**

Year	Theme	Topic	Remarks
SS1	1. Number and numeration	Indices and logarithms set	
	2. Algebraic process	1. Quadratic equations 2. Graphical representation of quadratic equation	
	3. Geometry	Plane geometry Mensuration Trigonometry	
	4. Statistics	1. Data presentation: Tallying 2. Graphical presentation of data	
SS2	1. Number and numeration	Indices and logarithms set	
	2. Algebraic process	1. Quadratic equations 2. Graphical representation of quadratic equation	
	3. Geometry	Plane geometry Mensuration Trigonometry	
	4. Statistics	1. Data presentation: Tallying 2. Graphical presentation of data	
SS3	1. Number and numeration	Indices and logarithms Number approximation Error estimate Progression and regression	
	2. Algebraic process	1. Quadratic equations 2. inequalities	
	3. Geometry	Plane geometry Trigonometry	
	4. Statistics	1. Group data presentation and 2. Measure of central tendency and dispersion for ungrouped and grouped data 3. Probability	

Source: Nigerian Educational Research and Development Council (NERDC), Abuja.

Some of the key concepts include Number and Numeration, Algebraic manipulation, Geometry, Statistics and Probability. Understanding the concepts of mathematics as viewed by Obanya (2004) referred to the knowledge required to show versatility and flexibility, not simply the ability to store and produce facts and figures hence Jonah-Eteli (2010) stated that if teachers in schools are aware that the examples they use are only tools for developing concepts

and not the “in thing”, it would be part of their instructional strategy to solve more examples until the students have a grasp of the idea, meaning and diversified knowledge of the concept. Although Jonah-Eteli (2010) recommended that teachers be trained on teaching strategies that would emphasize conceptual understanding rather than rote mathematical concepts, teachers’ pedagogical change from the conventional approach appears difficult. Ogunkunle (2007) opined that secondary school teachers use conventional methods in teaching mathematics concept and that this method does not impact positively on academic achievement of the students.

An interesting idea of Sierpiska (1994) on mathematical concepts, their meaning and understanding is that mathematical knowledge represented information understanding occurs when the representations achieved are connected by a more progressive and cohesive network. For example the various forms or ways of understanding that exists for each concept, possible and desirable aspects or components of mathematical concepts for students to learn at a given time and how these components are developed. In classroom instruction, the teacher has to sequence those components as to create some levels of similarity and application between one concept and the other in order to ease students group of the concepts, usually from simple notations to a progression until complex ones are met-the mathematics syllabus for Senior Secondary School is prepared thematically to catch this idea.

Gebremichael (2014) stated that the mismatch between the learning of mathematics concept and its application in other school subjects is due to students’ low motivation for engagement in mathematics and limited utility of the mathematics concepts. Michelsen and Sriraman(2009) explained that the poor application of the mathematics concepts is due to the students’ difficulty in translating word problems “word problems are difficult to understand”. Gebremichael (2014) advised that the making of connections between mathematics and other school subjects through word problems has an advantage in exposing to the students that learning mathematics has utility beyond the mathematics classroom or success in examinations.

### **Practical Utility of Mathematical Concepts**

Students’ practical use of mathematics concepts is possible where the knowledge of subject matter have been achieved. Such deep understanding and application of the mathematics concept require their active participation in learning, use of manipulative (concrete materials), practical work and even technological aids to create varieties of learning experiences and meaningful learning. According to Woodard (2004), Furner and Berman (2003) and Plaisance (2009), the use of manipulative would enhance young learners understanding of the concepts they represent and mastery of the mathematical concepts.

Practical utility of Mathematics concepts is therefore important for subject-matter mastery, and encourages students’ interest and exploration on diverse ways, of usefulness or importance of Mathematics. The practical applications of Mathematics are observed effectively in management of finances such as investment account, balancing of check book, reconciliation of bank statements, compound and simple interests’ where the concepts of algebra (addition and subtraction) are utilized. Similarly, in cooking and home improvements, for example, the concepts of simple fraction and geometry are relevant respectively. The application of Mathematics concepts, according to All Kinds of Mind (AKOM, 2015) in <http://www.allkindsofminds.org> is an important goal of a mathematics instruction since students see the relevance of the concepts to everyday life; the presenter suggested the following helpful hints in the following concepts:

- i) Basic concepts should be taught with concrete objects in the classroom hence exploring numeracy by use of addition or subtraction of number of objects.
- ii) In measurement, use comparison of weights of bodies, volume of liquids in volumetric flasks or equipment, prices of a jacket, determining price differences and calculation of profit and loss should be employed.
- iii) Statistical representation of class population, pictogram, bar and pie charts among others. Use of physical dice in teaching probability and models or Mathematics laboratory for geometry and mensuration should be encouraged.

Emma (2015) in discussing the use of Mathematics in everyday life maintained that using real world examples would ignite a spark of practical interest, in areas of measurement at home (use of bathroom scale, people on medication need to understand different dosages), dimensions of carpet and decorators, distance-time relationship in travel, buying and selling at the store, averaging and statistics for sports past-timers. It is therefore necessary to carry out a research to evaluate students' Practical Utility of Mathematics Concepts in order to improve their active participation in the learning process, understanding and application of the Concepts of Mathematics.

## CONCLUSION

Mathematics concepts are ideas or mental impressions which are primarily related to computing, quantitative relationship, systematic reasoning or configuration. Students learn these concepts differently with differential performance rating. Some of the students get low grades in their performance due to lack of concept, understanding of the fundamental manipulation or Mathematical skills which has created a lot of difficulties for learners (Charina, 2015). Many researchers agree that the child characteristics, learning environment, teacher characteristics especially in their inability to adopt innovative strategies involving use of resource materials, that guarantee students active participation in the learning process have adversely affected the performance of students in Mathematics concepts. The innovative strategies involving the use of learning objects developed by (Kay & Knaack, 2008; Ogunkunle & George, 2015) if properly utilized will engender the practical use of Mathematical concepts in real life situation among the learners.

## RECOMMENDATIONS

The use of visualization tools, improved Mathematics laboratory apparatus and their utility should be established in both Primary and Secondary schools across the state. Also the persistence of teachers' use of conventional teaching method in all content of Mathematics instruction should be discouraged through the teachers' use of resource materials. Finally, workshops should be organized for Mathematics teachers on the use of Standard Laboratory apparatus in teaching Mathematics contents.

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