

GEOGEBRA: THE ESSENTIAL DEVICE FOR THE THIRD MILLENNIUM MATHEMATICS CURRICULUM IN NIGERIA

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Introduction

In the early years of the 20th century, the traditional concepts (accepted usage) identifies curriculum as “planned learning experiences”, which is more or less of “instruction”; and “a body of subjects or subject matter prepared by the teachers for the students to learn”, this was synonymous to the “course of study” or “syllabus”, Olalere (2013). Even though curriculum exists as a field of study, it is to a great extent an ill-defined field. Many efforts have been made to conceptualize it. Consequently, there are many conceptions of curriculum and a wide variety of definitions. Some of the definitions are given below to demonstrate the existing diversity of the use of the term, curriculum.

Tanimola (2003) defined curriculum as “all planned and guided activities carried out within or outside the school”. To Oliva (1997), curriculum is “a plan for a sustained process of teaching and learning”. Several other definitions from Oliva (1997) are that the Curriculum is:

- That which is taught in schools
- A set of subjects
- Content
- A program of studies
- A set of materials
- A sequence of courses
- A set of performance objectives
- A course of study
- Is everything that goes on within the school, including extra class activities, guidance, and interpersonal relationships.
- Everything that is planned by school personnel
- A series of experiences undergone by learners in a school
- That which an individual learner experiences as a result of schooling.

Also, Olalere (2013) highlighted some other definitions about curriculum, they are:

- The planned interaction of pupils with instructional content, materials, resources, and processes for evaluating the attainment of educational objectives.
- All the learning which is planned and guided by the school, whether it is carried on in groups or individually, inside or outside the school.

- Outlines of the skills, performances, attitudes, and values pupils are expected to learn from schooling. It includes statements of desired pupils' outcomes, descriptions of materials, and the planned sequence that will be used to help pupils attain the outcomes.
- The total learning experience provided by a school. It includes the content of courses (the syllabus), the methods employed (strategies), and other aspects, like norms and values, which relate to the way the school is organised.
- The aggregate of courses of study given in a learning environment. The courses are arranged in a sequence to make learning a subject easier. In schools, a curriculum spans several grades.
- Curriculum can refer to the entire program provided by a classroom, school, district, state, or country.

As early as the seventeenth century, the University of Glasgow referred to its "course" of study as a curriculum, and by the nineteenth century European universities routinely referred to their curriculum to describe both the complete of course of study (as for a degree in Surgery) and particular courses and their content, (Wikipedia, 2013). Curriculum has numerous definitions, which can be slightly confusing. In its broadest sense, a curriculum may refer to all courses offered at a school. This is particularly true of schools at the university level, where the diversity of a curriculum might be an attractive point to a potential student. A curriculum may also refer to a defined and prescribed course of studies which students must fulfil in order to pass a certain level of education.

Ehindero (2014) stipulated that "curriculum is a structured series of intended learning outcomes". Meanwhile, curriculum came from the Latin word "*Currere*" which means to run / to proceed, referring to the course of deeds and experiences through which children grow to become mature adult (Olaere, 2013).

How to Develop a Curriculum?

Let us consider the various definitions of curriculum as stated and outlined above. What are the characteristics we can deduce from the various definitions? You will be right if you were able to deduce that the curriculum has the following characteristics:

- A curriculum has a content
- It is made up of experiences for the learner
- It is planned

Tanimola (2003) noted the following about the curriculum:

- Why are we having a particular curriculum? Or What purpose is the curriculum intended to achieve? - (Objective)
- What learning experiences are to be presented? - (Content)
- How will such learning experiences be presented? - (Methodology)
- How are the learning outcomes assessed? - (Validity and Reliability)

These major questions are intricately related. The objective appears to be first, if education is viewed as a process of initiated in worthwhile activities. The reason for embarking on a series of planned and guided activities will determine somewhat the content and the methodology which will influence the choice of evaluation, instruments which in turns tries to determine whether the stated objectives have been achieved. The outcome of such evaluation should also help to assess the learning experiences (content) and the methodology used and their appropriateness in achieving stated objectives.

Sometimes, new developments in the immediate society or in the larger world society such as new research discoveries, changing structure, re-orientation in a society, new economic, social and technological needs, among others, may reveal previous curriculum as inadequate and indicates the reason for the new objectives, which should be satisfied by new contents, new methodology and evaluation instruments; such changes in curriculum are usually placed in the hand of a special task force or committee, which will investigate the courses, the weaknesses or inadequacies of such curriculum and consider personnel, training, development of instructional materials and physical structures.

Referring to secondary school education, curriculum could be referred to in two forms; (i) the range of courses from which students chose what subjects matters to study, and (ii) a specific learning program. In the latter case, the curriculum collectively describes the teaching, learning, and assessment materials available for a given course of study. Presently, a spiral curriculum is promoted as allowing students to revisit a subject matter's content at the different levels of development of the subject matter being studied.

Olalere (2013) further pointed out the steps to follow while trying to develop a curriculum, they are:

- Define the objective(s) of the curriculum;
- Choose an appropriate title;
- Create a scope and sequence;
- Determine the teaching approach;
- Build in an assessment component;
- Establish a system of curriculum evaluation.

GeoGebra and Mathematics Curriculum in Nigeria

Mathematics is a compulsory subject offered in Nigerian primary and secondary schools and is taught daily in all the schools or at least four times in a week. "It is a core subject in the school curriculum at least to the secondary level", Opayinka (2012). The first National Mathematics Curricula for Primary and Secondary Schools used in the country were developed in 1979. However, the secondary school curriculum was revised in 1985 to make provision for the 6-3-3-4 (6 years of primary, 3 years of junior secondary, 3 years of senior secondary, 4 years of tertiary) system of education introduced in the country at that time as against the 6-5-4 (6 years of primary, 5 years of secondary and 4 years of tertiary) system that was in existence before then. The Universal Basic Education (UBE) programme was launched in the country in 1999 as a replacement of the 6-3-3-4 system in the country. The programme

consists of a 9-3-4 system and involves 6 years of primary school and 3 years of junior secondary school indicating 9 years of uninterrupted schooling. The introduction of the Universal Basic Education (UBE) was a move by the Nigerian Government to strive to attain the Millennium Development Goals (MDGs) and achieve the critical targets of the National Economic Empowerment and Development Strategies (NEEDS) which include value orientation, poverty eradication, job creation, wealth generation and empowering the citizens through education, (Okafor and Anaduaka, 2013).

GeoGebra originated from Markus Hohenwarter's Master's thesis project in 2001 at the University of Salzburg, Austria, (Preiner, 2008). Since 2004, the number of visitors to GeoGebra's website (www.geogebra.org/wiki) has increased from 7000 per month to over half a million per month coming from 190 countries, (Hohenwarter and Lavicza, 2010). GeoGebra was included in the Curriculum of Romania (Europe) for the first time during 2010-2011 school year for students of XI-th level in Pedagogical High School (Antohe, 2010).

“There are numerous GeoGebra workshops offered at various conferences as well as there will be at least seven specialised GeoGebra conferences in 2010 in Europe, North America, and Asia. Furthermore, owing to the good work of local GIs there are hundreds of well-trained (certified in most cases) GeoGebra trainers who support teachers in their communities” (Hohenwarter and Lavicza, 2010).

“The contents of the old curriculum (1985), was infused with elements of capital market studies, which carefully structured, resulting in the removal of obsolete topics and addition of modern topics that are relevant to the global world. The team that prepared the new curriculum made efforts to ensure that topics that will improve the mathematical competency of Nigerian children as well as prepare them for further and tertiary education are included” (FME, 2007).

“The curriculum reflects depth, appropriateness, and interrelatedness of the curricula contents. Also, emerging issues which covered value orientation, peace and dialogue, including human rights education, family life / HIV and AIDS education, entrepreneurial skills etcetera were infused into the relevant contents of the new Senior Secondary School Curriculum”, Obioma (2007).

It therefore became necessary that the existing curricula for primary and junior secondary school be reviewed and updated to fit into the 9-year Basic Education Programme. A New National Mathematics Curriculum for Basic Education in Nigeria emerged in 2007. Issues that relate to value orientation, peace and dialogue, human rights education, population and family life education, drug abuse, environmental degradation, entrepreneurial and ICT skills as well as HIV/AIDS education were then infused into the relevant contents of the curriculum to make it responsive to the needs of the Nigerian Child and the developmental needs of the country. Quantitative

reasoning problems as well as topics like transactions in the home and offices, computer applications, use of measures of central tendency to analyze information on drug abuse, HIV/AIDS and to show the importance of voting, were also included (Okafor and Anaduaka, 2013). In line with the above points, Ayeni (2012) agreed that “curriculum cannot be permanent and it must be reviewed from time to time especially in the light of new knowledge”. GeoGebra could therefore be employed to achieve the aims and objectives of this new Mathematics curriculum since “the use of technology is becoming a substantial part of today’s education”, (Hohenwarter and Lavicza, 2010).

The current Mathematics curriculum for senior secondary school could be summarized under the following five themes: Number and Numeration, Algebraic Processes, Geometry, Statistics and Introductory Calculus.

Table 1. Summary of the Current Mathematics Curriculum for Senior Secondary Schools

YEAR	THEME	TOPIC
SSI	Number and Numeration	<ul style="list-style-type: none"> - Number Base System - Modular Arithmetic - Indices and Standard Form - Logarithms - Sets
	Algebraic Processes	<ul style="list-style-type: none"> - Simple Equations and Variations - Graphical Representation of Quadratic Equations - Logical Reasoning
	Geometry	<ul style="list-style-type: none"> - Plane Geometry (Constructions) - Proofs of Some Basic Theorems - Trigonometry Ratios - Mensuration
	Statistics	<ul style="list-style-type: none"> - Data Presentation: Tallying - Graphical Presentation of Data
SSII	Number and Numeration	<ul style="list-style-type: none"> - Logarithms - Approximation - Error Estimation - Sequence and Series
	Algebraic Processes	<ul style="list-style-type: none"> - Quadratic Equations - Simultaneous Linear and Quadratic Equations - Gradient of a Curve - Logical Reasoning - Linear Inequalities - Algebraic Fractions
	Geometry	<ul style="list-style-type: none"> - Plane Geometry: Chord Properties and Circle Theorem - Trigonometry

		- Bearings
	Statistics	- Measures of Central Tendency and Dispersion for Ungrouped Data - Histograms of Grouped Data - Cumulative Frequency Graph - Measures of Central Tendency for Grouped Data - Probability
SSIII	Number and Numeration	- Surds - Matrices and Determinants - Laws of Logarithms - Arithmetic of Finance
	Algebraic Process	- Application of Linear and Quadratic Equations to Capital Market
	Geometry	- Trigonometry Graphs of Trigonometric Ratios - Surface Area and Volume of Sphere - Longitude and Latitude - Coordinates Geometry of Straight Lines
	Introductory Calculus	- Differentiation of Algebraic Functions - Integration of Algebraic Functions

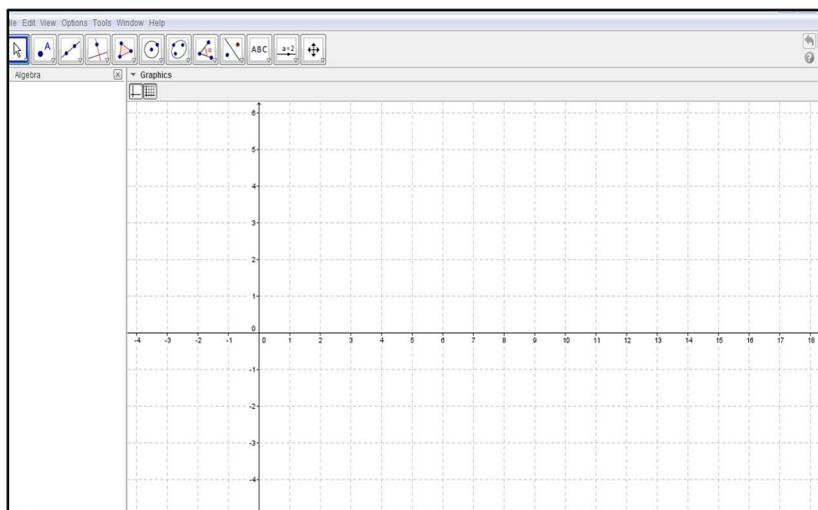


Fig 1. Screen Shot of a GeoGebra Window (a)

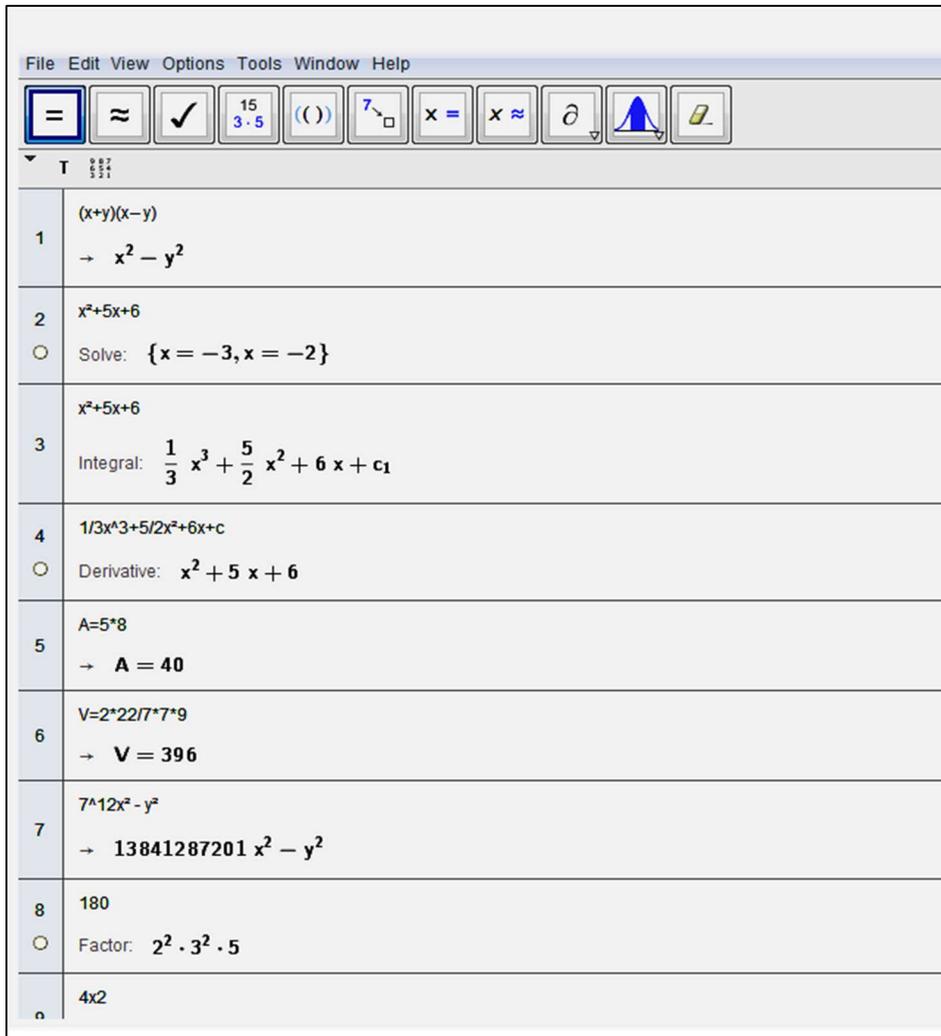


Fig 2. Screen Shot of a GeoGebra Window (b)

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