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MALI'S EDUCATIONAL SYSTEM: AN OVERVIEW OF MATHEMATICS CURRICULUM IN MALI, FROM KINDERGARTEN TO SECONDARY SCHOOL

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Abstract:
Mali as an undeveloped country, education is still placed in an important role. To make more people know its education, this article presents the structure of the education system in Mali and especially for mathematics education. Mathematics play a key role in people's lives. Whether one is intellectual or illiterate mathematics are useful for everybody, Mathematics education and the cure for mathematics education is a great concern in the Malian education system. Our goal in this paper is to formulate recommendations for improvement and development of mathematics education in Mali. It gives an overview of the mathematics education programs such as the purpose and objectives of mathematics education from kindergarten to high school. It also concerns the method of mathematics teaching or the pedagogy used. In addition, there is a reflection of the content of mathematics curriculum of the first and second cycle of basic and secondary education. Our concern here is teaching and learning approaches of mathematics in Mali. The article also measures about the Master Training Institutes (IFM) and teacher training schools of secondary education; it clearly lists the problems of mathematics education besides and finally.

Keywords: educational system, mathematics education in Mali, mathematics curriculum

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1. Introduction

It is obvious that the entire humanity needs mathematics. Whether one is an intellectual or not, it certain that one use mathematics every day in the daily affairs. Mathematics is basis of scientific of knowledge and technological knowledge necessary for the socio-economic development of a Country. Its role is to train in the art of reasoning and the scientific method of analysis.

Mathematics education aims to impart mathematical competencies, most often by explaining and applying scientific methods.

Mathematics contributes in learning different forms of expressions other than the usual language (numbers, figures, graphs, formulas, tables, diagrams). It is exciting that doing pure mathematics can bring out ideas that illuminate our reading of nature, but this is not the only process, far from it (Nicolas Bouleau, 2002). Thus, mathematics education plays the key role in mathematics learning.

In Mali, mathematics is a compulsory subject from kindergarten through basic to secondary school. In fact, Mali, like many African countries, benefited this form of knowledge from the colonizers. A reform is necessary because an economic and social political revolution can only be fully effective if it goes hand in hand with a consistent policy of education (La Réforme de l'Enseignement Au Mali, 1962). The supreme aim of colonial education was the moral and intellectual assimilation of peoples. After freedom and food, education is the first need and the greatest good of people. Thus, after the independence of Mali, September 22 1960, like many African countries, carried out a reform of education in 1962. For this reform, the study of mathematics in all classes was linked to the practical use of the theoretical notions learned. This will be the necessary link between theory and practice, allowing mathematics to be perceived not as an abstract science, but as a means of knowledge, an instrument at the service of other sciences. It presents an educational system that meets the national needs, programs and diplomas requirement that was to the realities. This reform was inspired by the experiences of the socialist countries or states that have known, experience, the colonial regime and its governance (Guinea, Tunisia, Czechoslovakia, People's Republic of China, Vietnam, Soviet Union, etc.). As such Mali started its own educational system starting 1962 after independent.

All French-speaking countries in general, but Mali is in particular, inherited the mathematics program, with other subjects from the French program. The reform has been to modify at a certain level to adapt it to our socio-economic situation.

Since infancy, which covers the period from 0 to 8 years during which the state invests enormous resources for its survival, protection and education. The Ministry of National Education supports the education of children from 3 to 6 years old through early childhood development centers (CDPE) which are fundamentally different from school. The CDPE program offers introductory activities to elementary mathematics. Mathematics is introduced to children through geometric figures and recognition of numbers. Mathematics is taught throughout the school curriculum. With the Convergence Approach (APC) adopted by Mali since 2011, mathematics remains a

major and compulsory subject until the beginning of secondary education. It makes it possible to homogenize the level of the pupils coming from the previous classes in order to provide them the chances in the continuation of their later studies.

2. The Structure of Education in Mali

It is important to note that, Mali Educational System has a structure as follows:

- basic education;
- general secondary education;
- technical and vocational education;
- higher education.

This system paves a foundation for smooth transition from basic education to secondary education.

2.1 Kindergarten

Early childhood education remains a concern of the Malian political and administrative authorities. It concerns children from zero to eight years old, on whom the state invests huge resources for its survival, protection and education.

The education of children from three to six years is especially the responsibility of the Ministry of National Education under the supervision of Early Childhood Development Centers (CDPE). The result of this care is the entrance to school from the age of six.

CDPE are fundamentally different from school. The children they welcome are children with special needs (physically, emotionally and cognitively) still very fragile and very vulnerable. Any form of stiffness and violence in the execution of the program is not recommended.

It covers three years as follows:

- the small section (3 - 4 years old): It welcomes children from three to four years old. Their training includes the following: Psychomotor Activities, Language Activities, Initiation Activities in Elementary Mathematics, Sensory Activities, Visual Arts Activities, Body and Musical Expression Activities, Moral and Civic Education, Environmental Education and Education at Work, Games and finally Celebrations and Leisure.
- the means section (4 - 5 years).
- the section of large (5 - 6 years).

The educational program of the CDPE establishes a necessary continuity between all sections. The same activities will found in different sections at different levels of according to the progression or abilities.

According to the CDPE program (2018), a good conduct of the activities of this program will enable a child to achieve the following skills:

- Act effectively in a variety of cognitive, motor and socio-emotional contexts;
- Affirm one's personality;
- Interact harmoniously with others;

- Communicate using the resources of the language;
- Using perception skills to understand one's environment.

The end of infancy stage, which is marked by the period of six to eight years, is entrusted to the first cycle of basic education.

2.2 The Fundamental Education

Basic school is much more popular and keeps children in their natural environment. It keeps the children in their places of birth environment until they are about 15 years old. Indeed, each village has a basic school (usually a first cycle) except some nomadic villages. The basic education is placed under the administration and the technical control of the National Direction of the Normal Education (DNEN) which comes under the Ministry of National Education through Centers of Pedagogical Animation (CAP) where each occupies schools in his riding. The State ensures to all citizens, from six to eight years of age in particular, have a general basic education comprising two cycles:

- a first cycle of six years,
- a second cycle of three years.

2.2.1 First Cycle of Basic Education (6 years)

This period of training takes six years of study period divided into three classes of two years each, which are:

- Introductory classes: 1st and 2nd year,
- Aptitude classes: 3rd and 4th years,
- Orientation classes: 5th and 6th years.

The following activities are found: Civic and Moral Education, Observation Sciences, Technology, Artistic Education, Family Economics, Physical Education and Sports, History and Geography, Mathematics, French, Activities of Awakening and Drawing.

History and Geography are introduced from the 4th year, the second year of the aptitude classes.

In Mali, the official language is French. Language of work and communication, French is average and educational object. In so-called classical schools, French is the medium of instruction, it is introduced orally at least a quarter in the first year before the written form. On the other hand, in the so-called curriculum classes, the mother tongue is at the same time a medium and an object of instruction in the first year and during the first trimester of the second year, French is introduced from the second trimester of the second year under oral form; Mathematics is taught in the mother tongue until the 3rd year and it is from the 4th year that they are taught in French.

2.2.2 Second Cycle of Basic Education (3 years)

The second cycle covers a three years study: 7th year, 8th year and 9th year. It ensures continuity of primary education. The different teaching activities are: French, Drawing, History and Geography, Physical Sciences, Technology, Music, Practical Activities and

Rural, Civic and Moral Education, Natural Sciences, Physical and Sports Education, Family Economics, English and Mathematics.

English is introduced in the 7th under the name of the first Living Language (LV1) to endow the student, at the end of his schooling, effective means of communication and an adequate tool of work.

The second cycle allows students to be directed either to general secondary education or to sectors of economic activity (technical and vocational education).

Basic studies lead to the Diploma of Fundamental Studies (DEF) taking into account both class work and the results of an exam.

2.3 Secondary Education

In secondary education in Mali, pupils are referred to different training or activities according to their objectives, interests or aptitudes following to the courses offered by general secondary education, vocational and technical.

Article 37 of the orientation law on education assigns to General Secondary Education and Technical and Vocational Education a specific objective, namely: "*General and technical secondary education provides general quality necessary for the pursuit of higher education. Like all other levels of education, it prepares the producing citizen by providing useful skills for entering the workforce. It is in this respect, a terminal cycle.*"

2.3.1 General Secondary Education

General secondary education is provided in high schools. Its training duration lasted three years. The general secondary education is placed under the administration and the technical control of the National Direction of the Secondary Education which also falls under the Ministry of National Education through the Directions of Teaching Academy where each one deals with the High schools in its area. The studies are sanctioned by the Baccalaureate taking into account both the class work and the results of an examination. It opens access to higher education. The following sectors are found:

- the 10th year: it begins in 10th commune. All students follow the same educational programs in their first year of high school.
- the 11th year: it breaks down into three major streams or classes according to the competency and objectives of the student, there are: 11th Letters (L), 11th Economic and Social Sciences (SES), 11th Sciences (S).
- the 12th year or the final class: it could be found the classes of Terminals following the classes of 11th year:
  - the 11th year Letters gives access to the Terminals Langue's- Letters (TLL) and Terminals Arts-Letters (TAL);
  - the 11th year of Economics and Social Sciences gives access to the Social Science Terminal (TSS) and the Economic Sciences Terminals (TSECO) classes;
  - the 11th Sciences in turn gives access to the classes of Terminal Sciences Exacts (TSE) and Terminal Sciences Experimental (TSEXP).

In all these classes French remains the teaching medium. Mathematics is taught either as a main subject with an important coefficient and as a secondary subject with a

low coefficient according to the courses. English remains the first living language (LV1) and the second living language (LV2) appears in the 10th of which students will choose a language among: German, Arabic, Chinese, Russian and Spanish.

2.3.2 Vocational and Technical Education

Vocational and technical education is provided in Vocational Training Centers, Technical High Schools and Specialized Schools. It must allow the training of managers at all levels according to national needs in the shortest time and in a spirit consistent with the democratic option. Vocational and technical education is placed under the administration and technical control of the National Directorate of Vocational and Technical Education which also falls under the Ministry of National Education. The specialized schools that desire no interest are linked to other ministerial departments other than the Ministry of National Education. For example, Health Schools belong to the National Directorate of Health, the National Institute of Arts (INA) under the National Directorate of Arts and Culture, Sports High Schools are affiliated with the National Directorate of Sports, etc.

A. Vocational Schools

They include two sectors (Industry and Tertiary) also following two cycles of study.

CAP (Certificate of Vocational Study) Cycle

Its duration of training is two years. The studies are sanctioned by the Certificate of Vocational Study (CAP) taking into account both the work of class and the results of a written and practical exam in the courses as follows:

- industry sector: it is divided into four specialties namely Electro Mechanics (EM), Mechanics-Auto (MA), Building Design (DB) and Plumbing;
- tertiary sector: there are two classes, Bureau Employee (EB) and Transit and Secretariat (TS).

In all the specialties of the different sectors there are the first year and second year classes.

Mathematics is taught in industry classes. The CAP gives access to the third year of the Technician's Certificate (BT) cycle in case the graduate decides to continue his studies.

BT (Technician's Certificate) Cycle

It has a four-year training period and the studies are certified by the Second Part Technician's Certificate (BT2) following a written and practical examination that also takes into account class work. There are the following classes:

- industry sector gives us the following specialties: Practical Works (TP), Design Building (BT), Electromechanical (EM), Mechanical-Auto (MA) and Metal Construction (CM);
- tertiary sector where there are two specialties: Accounting and Secretariat.

In all the specialties of the different sectors there are the 1st year, 2nd year, 3rd year classes where the first part Technician Certificate exams (BT1) and the 4th year where there is the BT2.

As in the CAP cycle, mathematics is taught in industry classes. The BT2 is a professional degree but can also give access to higher education related to the required specialty.

B. Technical High Schools

As in the classical high schools (General secondary education) its duration of training is three years (10th year, 11th year and 12th year or Terminal). The studies are sanctioned by the Technical Baccalaureate taking into account both the class work and the results of an examination. It opens access to higher education related to the specialty of the degree. There are two major streams that are Technical and Management Sciences (STG), Technical Sciences and Industry (STI); broken down as follows:

- the 10th year: It begins in 10th commune. All students follow the same teaching programs in their first year at Technical High School as in the classical high schools.
- the 11th year: It is broken down into two major fields of study that break down into several series or classes according to the competency and objectives of the student, there is:
- the 11th year STI: Civil Engineering, Mechanics, Electronics Engineering, Mining Engineering, Energetic Engineering;
- the 11th year STG: Management and Economics, Finance and Accounting.
- the 12th year or Terminal: the classes of Terminals exist in all the series (there is one of terminal corresponding to each class of 11th year).

2.3.3 The Training Institutes of Masters (IFM)

Like basics schools, IFMs also fall under the DNEN. They train the kindergarten teachers and the teachers of the basic schools. Mali has about twenty IFMs which are at AdjelHock, Bamako, Bougouni, Dire, Gao, Kangaba, Kati, Kayes, Kita, Koutiala, Koro, Nara, Niono, Nioro Sahel, Segou, Sevare, Sikasso, Timbuktu, Tominian and a single School of Training of Preschool Educators (EFEP of Bamako). Entry into IFMs is subject to a competition for holders of the DEF (Diploma of Fundamental Study) and the Baccalaureate. They have a four-year training period for the DEF level and two for a Bachelor's degree in the following sectors and specialties:

A. Generalists or Undergraduate Masters

- Generalist Baccalaureate with entry profile level Bachelor: two years of training (1st year, 2nd year).
- DEF generalist with DEF entry profile: four years of training (1st year, 2nd year, 3rd year and 4th year).

B. Specializations or Masters of Second Cycle

- Specialist Baccalaureate with entry profile level Bachelor: two years of training (1st year, 2nd year).
- DEF specialist with DEF entry profile: four years of training (1st year, 2nd year, 3rd year and 4th year).

There are the following specialties: MPC (Mathematical Physics Chemistry), SNPC (Natural Science, Physics Chemistry), LMD (Languages Music Drawing), LHG (Letter History Geography).

Mathematics is taught in all streams and specialties and at all levels. The studies are sanctioned by the IFM diploma and only those graduates or equivalent graduates are allowed to teach in basic schools.

2.4 Higher Education

Higher education covers Universities, Large Schools and Research Institutes. They are placed under the administration and the technical control of the Rectorates for Universities and Directorates of Schools and Institutes which all belong to the Ministry of Higher Education, Research and New Technologies. It is located more than 50% in the Malian capital Bamako and two other regional capitals among a dozen regions namely Koulikoro (which is about sixty kilometers from Bamako) and Segou (which is 240 kilometers from Bamako). It is found that two schools of training teachers of secondary education: Superior Normal School (ENSUP) and Normal School of Vocational and Technical Education (ENETP). Only graduates of ENSUP and ENETP or equivalent diplomas are recruited to teach in secondary education by the State.

2.4.1 Superior Normal School (ENSUP)

ENSUP opened its doors in October 1962 providing training: teachers for secondary education, inspectors of basic education.

It trains teachers in the following teaching areas: Mathematics, Physics-Chemistry, Biology, Philosophy, Sociology, Dramatic Arts, Letters and Languages (English, German, Arabic, Chinese, Spanish and Russian).

The training was for two years as an entrance profile, but in recent years ENSUP has adopted the LMD system (Bachelor-Master-Doctorate). Therefore, the training is six (6) semesters for the license and four (4) semesters for the master. Its access is conditioned to the success of a contest. The competition is open to bachelors, the outgoing IFM ranks "Master Principal", License L3 and Master1.

2.4.2 Normal School of Vocational and Technical Education (ENETP)

ENETP is a public higher education institution (Ordinance n°10-032, 2010). It is looking to fill the sector of technical education of Mali with competent human resources. According to Article 2 of Ordinance (n°10-032, 2010), the mission of ENETP is:

- initial training of teachers of Technical and Professional Education;
- the training and development of supervisory staff in Technical and Vocational Education;
- postgraduate training in the sciences of Education for Vocational and Technical Education;
- the development and production of educational and didactic materials;
- continuing vocational training of trainers of organizations, public or private;
- the promotion and development of educational and technological research;

- providing consulting, expertise, educational production and industrial application services for external partners, public or private.

The duration of the training is six (6) semesters for the license and four (4) semesters for the master. The ENETP offers four training courses in the first year which will be divided from the third year into options as follows:

- Office and Communication (BUCO): Economic and Social Administration, Public Administration, Human Resources Management, Information and Communication;
- Accounting Management (COGE): Accounting, Management Control, Audit;
- Civil Engineering: Buildings and Public Works, Hydraulic Facilities;
- Industrial Engineering: Electrotechnics, Electronics, Energy, Mechanics, Mining.

Entrance to the ENETP is subject to a competition for holders of the Baccalaureate and Technician's Certificate Part 2 (BT2) and title following a written test for those who have a University Diploma of Technology (DUT) , License L3 and Master1. For holders of an engineering degree or equivalent, access to the school is on title, a study of the file followed by a written test for candidates whose records are considered acceptable. In addition to the skills to be major players in education (vocational training centers, technical high schools) ENETP diplomas also offer skills in the following areas: energy (production, transport, distribution), construction (building, roads, engineering structures, hydraulics), Mining (expiry, exploitation, processing), NTIC (telecommunications, networks), Administration (management, private sectors and local authorities) and Consulting (audit, communication, marketing, consulting firms).

2.5 Training of Mathematics Teachers

In Mali, mathematics teachers in the second cycle of basic education are trained in all the 20 IFMs scattered in many of the administrative regions as listed above. They are trained to teach mathematics, physics and chemistry in grades 7th, 8th and 9th of basic school. Mathematics teachers in secondary education (general, technical and vocational) are trained at ENSUP (only) located in Bamako (the capital of Mali). These teachers teach only mathematics in secondary schools (general, technical and vocational). Math teachers are trained in the special methodology of teaching math courses.

3. Competency-Based Approach (APC)

It is teaching pedagogy in Mali for a few years.

3.1 What is APC?

How to situate the skills approach? Clearly as an attempt to modernize the curriculum, to bend it, to take into account, in addition to knowledge, the capacity to transfer and mobilize it. The competency-based approach transforms some of the disciplinary knowledge into resources to solve problems, carry out projects, make decisions. This could offer a privileged entry into the world of knowledge: rather than relentlessly

assimilating knowledge by agreeing to believe that "they will later understand what it is for", students would immediately see knowledge as a conceptual foundation and theoretical of a complex action, either as procedural knowledge (methods and techniques) guiding this action. In principle, everyone would then have a better chance of linking knowledge to social practices, thus grasping their scope and meaning. This would be particularly important for students who do not find in their family culture this relationship to the particular knowledge that values it independently of its uses and origins, as a value in itself (Philippe Perrenoud, 2000).

The competency-based approach asserts that it is not enough, without turning our backs on knowledge (Perrenoud, 1999b), without denying that there are other reasons to know and to know (Perrenoud, 1999a), it is important to link knowledge to situations in which they allow action beyond school.

Acting is here facing complex situations, so think, analyze, interpret, anticipate, decide, regulate, negotiate. Such action is not satisfied with motor, perceptual or verbal skills. It requires knowledge, but it is relevant only if it is available and can be mobilized wisely, at the right time:

Competence is not a state or knowledge possessed. It is not reduced to knowledge or know-how. It is not comparable to an acquired training. Possessing knowledge or abilities does not mean being competent. Accounting techniques or rules can be known and not know how to apply them in a timely manner. One can know the commercial law and badly write contracts.

Every day, experience shows that people who have knowledge or skills do not know how to mobilize them in a relevant and timely manner in a work situation. The actualization of what one knows in a singular context (marked by working relationships, institutional culture, hazards, temporal constraints, resources ...) is indicative of the "passage" to competence. (...) There is competence only competence in act. Competence cannot function "empty", apart from any act which is not limited to expressing it but which makes it exist (Le Boterf, 1994, p.16, cited by Perrenoud).

The competency-based approach is therefore a global and systemic approach to learning, an approach in which the development of skills becomes the organizing principle of all educational activities.

If the competency-based approach remains a "half reform", which does not give up anything and does not force anyone, it is unlikely to advance the fight against academic failure. If nothing changes, except words, if one does under cover of skills what one did yesterday under the guise of knowledge, why would one expect to produce less failures school?

If the curriculum reform loses sight of this major idea, it will only substitute texts for texts. But the challenge is to change practices ... (Philippe Perrenoud, 2000).

3.2 Aims of the APC

Jerome Bruner said recently in an interview with Le Monde (2002):

> *"In my opinion, the purpose of the school is not to shape the students' minds by inculcating them with specialized knowledge whose meaning and purpose they do not*

understand. Students need to appropriate a culture, integrate knowledge based on the questions they ask themselves. For that, we must challenge ready-made programs. One must question, discuss, explore the world. This is how you take ownership of culture, become an active member of a society. The competency-based approach is a political choice that is justified by a need to adapt education to the realities of the country that are political, socio-cultural, economic and educational."

Given the state of deterioration of the education system, it was imperative that the policies and managers of the Malian school design a credible alternative, allowing the school's products to adapt to an international environment in perpetual scientific progress and technologies and to cope with globalization.

3.3 The Objectives of the APC

There are basically three main objectives (Roegiers, 2000):

- first of all, to focus on what the student needs to master at the end of each school year, and at the end of compulsory schooling, rather than what the teacher should teach;
- learning has a meaning: it is a question of showing the student what is the point of everything he learns at school. For this, it is necessary to go beyond the content-content lists to remember by heart, knowledge, meaningless know-how, which too often annoys the student and does not give him the desire to learn. On the contrary, the competencies-based approach teaches him to continually situate learning in relation to situations that make sense to him, and to use its competencies in these situations;
- the aim is to certify the pupil's achievements in terms of resolving concrete situations, and no longer a sum of knowledge and knowledge that the pupil is often quick to forget, and of which he do not know how to use in working life.

4. Mathematics Program

The school curriculum is "*a structured set of competencies, objectives and learning contents to guide and facilitate the training of learners and the assessment of their progress*"(Loi n° 99-046, 1999).

A program is an integrated set of training activities aimed at developing competencies. The curriculum of each class is built around competencies from classes older than the current class. The competencies are broken down into various components that help to identify the different facets. The component describes the essential aspects to the development of the competency. It allows the teacher and the learner to give them a concrete representation and to grasp the main elements involved during their exercise. Demonstrations are explanations of the components. They serve as a basis for developing teaching / learning situations. The contents correspond to the repertoire of resources required for the development and exercise of the competence (MFPESG-12, 2013).

4.1 Aims and Objectives

The study of mathematics in all classes must be attached to the practical use of the theoretical notions learned; In this way, we will build this communication between theory and practice, allowing us to conceive mathematics not as an abstract science, but as a means of knowledge, an instrument at the service of other sciences.

A. The introductory activities to the elementary Mathematical notions begin since the small section of the CDPE aiming to develop the intelligence of the child, to solve small problems.

B. The mathematics education in the first cycle of the basic school aims to:

- to foster the integration of each pupil, by endowing him with knowledge and know-how and the means by which he can solve, by reducing them (if necessary) to mathematical models, the problems that arise in the daily life;
- encourage learning from other disciplines (experimental sciences, geography, etc.);
- provide each student with the necessary tools to pursue studies at the Second Cycle of the Basic School or in Vocational Schools (POEM- PCEF,2011).

C. In the second cycle of basic school, the teaching of mathematics aims, in addition to the points cited in the first cycle of the basic school, to provide the student with the tools necessary for the continuation of studies in secondary schools.

D. The new mathematics program of secondary education according to the APC aims to standardize the level of students from previous classes in order to offer them the same opportunities in the pursuit of their university studies. It also makes it possible to harmonize the pedagogy of mathematics and to make available to students the acquisition of solid training.

E. Mathematics education in IFMs aims to:

- to provide future masters of the basic school with a deepening of their theoretical and practical knowledge of mathematical concepts and know-how involved in the program;
- practice a model of pedagogy that arouses their mathematical activities so that they are made aware of the effectiveness of such a methodology; This will encourage them later in the exercise of their profession to draw inspiration from this model by eventually adapting it to the specialties of the environment (POEM des IFM).

4.2 Partial Content of Programs

On the whole the main concern is to avoid the brutal introduction of a new notion, by making a progressive study, preparing for their complete study in the upper classes.

4.2.1 The first cycle of the Fundamental School

The main content areas covered in all classes of the first basic cycle are:

- Number and Numeration: This covers the pre-numerical activities introduced in the first year (which consist in sorting, classifying and storing), whole numbers (from 1 to 5, from 0 to 999,999 to hundreds of millions), decimals and fractions.

- Operations: This covers addition and subtraction (introduced in 2nd year), multiplication and division approach (introduced in 3rd year), multiplication table or table of Pythagoras (introduced in 4th year), even numbers and odd, divisibility characters (par 2, 3, 5, 9 and 10), decomposition of a number into a product of prime factors, measure of duration, operations with decimals.
- Problems and Proportionality: This covers counting problems and situations relating to addition and subtraction (introduced in 2nd year), problems of approach of proportionality (introduced in 4th year), problems related to everyday life in relationship with the topics studied (numeration, geometry, measurement), proportionality (tables, coefficient of proportionality, rule of three, scales, percentage) (introduced in 5th year), flow, average speed.
- Geometry - Topology: This covers the open lines-the closed lines up to the stroke line and a segment (since the 1st year), symmetry with respect to a straight line, solids (introduced in the 2nd year), the square and triangles (axes of symmetry), the cube, drawing perpendicular straight lines and perpendicular (introduced in 3rd year), recognition and drawing of angles (right angle, acute angle, obtuse angle) to the cylinder (observation, base , height) (introduced in 4th year), circle and disk, axial symmetry (introduced in 5th year), convex and concave polygons, trapezium, parallelogram and rhombus.
- Measure: This covers length, mass, currency, capacity (introduced in 2nd year), duration, notion of period (introduced in 3rd year), area, volume (introduced in 4th year), units, conversions, calculation of perimeters (square, rectangle, triangle, circle) (introduced in 5th year), agrarian measure (ha, a, ca), capacity / volume ratio (in 6th year).
- Mental calculation (or fast): From the 1st year to the 5th year, it covers the table of addition, subtraction, multiplication, calculate the doublet, the triplet, the quadruplet, estimate an order of magnitude of a result on the number from 0 to 999.999.

4.2.2 The Second Cycle of the Fundamental School

The main content areas covered in all classes of the second basic cycle are:

- Algebra: This covers sets of numbers (natural numbers $\mathbb{N}$, relative integers $\mathbb{Z}$, decimal numbers $\mathbb{D}$ [from the 7th year], rational numbers $\mathbb{Q}$ [from 8th year] and real numbers $\mathbb{R}$ [9th year]); equation of the first degree to an unknown and inequality of the first degree to an unknown (graphic solution) (from the 8th year); remarkable products $(a + b)^2$, $(a - b)^2$, $(a + b)(a - b)$; first-degree equation with two unknowns and system of two first-degree equations with two unknowns (graphical solution), first-degree inequality with two unknowns and system of first-degree inequalities with one unknown and two unknowns (graphical solution) (these equations and inequalities will only include numerical coefficients, they will be used in solving practical problems), rational fraction function (definition set, calculation of numerical values) (in the 9th year).

- Geometry: It covers the right, elements of geometry in space, location (graduated right, plane, sphere), angles, polygons, circle, polyhedral (from the 7th year), vectors, projections (in 8th year), trigonometry practice, translation, symmetries (central, orthogonal), homothety (in 9th year).

4.2.3 High Schools (Classical and Technical)

The 10th grade classes (common) in the different high schools (classical and technical) have the same mathematics program, the 11th grade Sciences classes and the 11th year Industrial Technical Sciences have a common mathematics program, all the classes of 12th Technical Sciences Industry and the 12th Experimental Sciences have the same program of mathematics, it is the same for the 11th year of Economics and Social Sciences and 11th year Technical Sciences and Management, the Economics Sciences Terminals and the Terminals Management and Economics and Finance and Accounting have also the same mathematics program.

The main content areas covered in all high school classes are:

- Trigonometry: This covers the use of geometry materials (compass, ruler, reporters for constructions, use of calculators) up to the fundamental relation of trigonometry, trigonometric ratios of complementary, supplementary angles (in 10th year); calculations on oriented angles, measuring an angle oriented up to the resolution in $\mathbb{R}$ of equations and inequalities of the type: $\sin x = a$, $\cos x = a$, $\tan x = a$, $\sin x < a$, $\cos x < a$ (in 11th year Science).
- Numerical functions: This covers the various determinations of a numerical function, the polynomial functions, the rational functions (set of definition, simplified writing of the image of a real x by a rational function f) (in the 10th year) ; continuous in all 11th grade and Terminal classes at different degrees (TLL and TAL are limited to limit and function derivation; Primitives, Integrals, Logarithm and Exponential functions are studied in all other classes terminal).
- Geometry: Plane geometry (notion of barycentre of 2 to 4 points, construction and elementary properties) and geometry in space (right prism, tetrahedron, cone, cube, pyramid, cylinder) are studied in continuous 10th year only in 11th year Sciences; conics (generality, study and representation of conics) in TEXP and TSE; barycentre (vector and scalar functions of Leibniz, scalar product and median of a triangle) and affine applications (definition and properties, case study of transformation of the plane, isometry and similarity of the plane, matrices) in TSE.
- Statistics: Introduced in all 11th years except the 11th year Letters (introduction to vocabulary, graphical symbolism representing a statistical series up to the evaluation of the dispersion: quantiles, mean deviation, arithmetic mean, variance, standard deviation) and continues in all classes of Terminals.
- Enumeration-Probability: This covers the number of arrangements, the number of combinations in all 11th year only the 11th year Letters is limited to the notion of set (cardinal of a set, operation on the cardinals) and continuous in all the classes of Terminals except the classes TAL and TSS.

- Differential equations: Introduced in TSE and TEXP, this covers the definition, study of the different cases of differential equations.
- Complex Numbers: Introduced also in TSE and TEXP, this covers definition and properties, operations in $\mathbb{C}$ up to the complex and geometrical transformation of the plane.
- Arithmetic: studied as a chapter only in TSE, it covers introduction and definition, reasoning by recurrence, system of numeration, congruence modulo n, primes between them, resolutions in $\mathbb{Z}^2$ of the equation $ax + by + c = 0$

4.2.4 Vocational schools

A. Industry Specialty

The main content areas covered in all these classes are:

- Trigonometry: Taught in 1st and 2nd year with the same content as in 10th and 11th year High School Science.
- Numerical functions: This covers from the definition to the graphical representation (without recourse to the derivative) in 1st year; boundaries, continuity and derivation (number derived in one point, derived function), study and representation of functions (from the set definition to the study plan of a function) in 2nd year; primitive, integral and area calculation in 3rd year; the functions logarithms, exponentials and powers in 4th year.
- Geometry: Plane geometry covers the fundamental notions on the triangle and circle, metric relation in a right triangle in 1st year; barycentre (of the definition and the coordinates of the center of gravity of 2 and 3 points weighted) and circle (Cartesian equation, determination of the center and radius from its Cartesian equation) in 2nd year. Geometry in space covers straight lines and planes in space (the relative positions of a line and a plane, orthogonality), study of the volume of some solids (quadrangular prism, cylinder, cone, rectangular parallelepiped, cube, sphere, pyramid) in 1st year; operation with vectors (vector addition and multiplication), collinear vectors and linear combination (definition and properties) in 2nd year.
- Complex Numbers: Studied in 3rd year, they cover the definition, operations in $\mathbb{C}$, conjugate, module, argument and trigonometric form teaching / learning of a complex number and equations in $\mathbb{C}$.
- Differential equations: Introduced in 4th year, this covers the definition, study of different types of differential equations.
- Numerical Suites: Studied in the 4th year, they cover the generality of the sequences (definition, representation of the n first terms of a sequence), arithmetic and geometric progressions (calculations of the term one and the sum S_n).

B. Tertiary specialty

Mathematics (general) is not taught in these streams; financial mathematics is included in their program.

4.2.5 IFMs

In these institutes, the last year of training is devoted to the six-month practical training period in the basic schools, culminating in the submission of a final report.

A. General Practitioners (DEF + 4 years) or Basic Undergraduate Teacher

Mathematics is taught in the first three years (1st year, 2nd year, 3rd year) and includes:

- Algebra covers the different sets of numbers ($\mathbb{N}, \mathbb{Z}, \mathbb{D}, \mathbb{Q}$): the remarkable identities $(a + b)^2$, $(a - b)^2$, $(a + b)(a - b)$, $(a + b)^3$, $(a - b)^3$, $(a - b)(a^2 + ab + b^2)$, $(a + b)(a^2 - ab + b^2)$, the powers of real numbers (positive, negative or zero exponents) in 1st year; fractions, applications, equations-inequalities-systems (equations and inequalities of the first and second degree to a unknown without parameter, systems of two first-degree equations with two unknowns, systems of two inequalities of the first degree with two unknowns (graphic resolution), proportionality (definition, properties), numerical function of a real variable (set of definition, increasing and decreasing functions on an interval, function refines by pieces, other functions: $f(x) = ax + bx + c$, $f(x) = \frac{a}{x}$, $f(x) = \frac{ax+b}{cx+d}$ with $c \neq 0$, point-by-point construction) in year 2, the ten-based and two-based numeration systems (sum, difference, product, quotient calculations), numerical sequences (arithmetic sequences and geometric sequences), reasoning by recurrence, time measurements (units of measure of time) in 3rd year.
- Geometry: It covers in the first year the right (right, half-line, segment), right measure (distance), angular-angle sector (notation, construction of sectors, trigonometric ratios of an acute angle (cosine, sinus and tangent) of a zero angle and a right angle, use and demonstration of the results $sin^2a + cos^2a = 1$ and $tan(a) = \frac{sina}{cosa}$, relative positions of two lines of the plane (intersecting, parallel lines and perpendicular), mediator of a segment (construction), graduated straight line (algebraic measurement, Chasles relation), circle (perimeter, units of measurement of an arc), usual polygons, perimeters and area (units of length measurements , in area and agrarian), in the 2nd year the elements of geometry in space (flat and non-planar surfaces), polyhedron and round bodies (cube, pavement, etc.) and 3rd year transformations (translation, central symmetries and orthogonal, homothetic).
- Teaching activity: Delivered in 3rd year and covers the development and exploitation of a progressive weekly distribution, development of a lesson sheet, collection of material, presentation of a mathematics lesson, elaboration and use of a teaching grid, lesson evaluation.
- Mental Calculation: It covers the complete use of the addition table and multiplication, use of addition and multiplication properties to quickly calculate a sum or a product. This chapter is only taught in the 3rd year.

B. Specialists MPC (DEF + 4 years) or master of the second cycle fundamental (MPC)

The mathematics are taught in the first three years too (1st year, 2nd year, 3rd year) and there are found:

- Geometry: It covers in 1st year the definition of trigonometric ratios from the triangle, the Pythagorean theorem, the vectors of the plane, scalar product, barycentre of two weighted points, straight and affine plane, Cartesian and parametric equations of a straight line , transformation of the plane (homothetic, isometric, composition of isometrics, composition of isometric and homothetic); in 2nd year the trigonometric circle (study and graphical representation of the functions of the type: $\sin x$, $\cos x$, $\tan(ax + b)$, with $a \neq 0$), plane rotation, vector normal to a straight line, projection, isometrics, similarities, symmetry and projection in any direction, Cartesian and parametric equations of a line and a plane, distance from a point to a plane, circle in the plane, sphere (equation); 3rd year barycentre of two, three and four weighted points.
- Algebra and Analysis: This covers in 1st year calculations in $\mathbb{R}$ $(\mathbb{N}, \mathbb{Z}, \mathbb{D}, \mathbb{Q}, \mathbb{R})$, equations and inequations (equations and inequalities of the second degree to an unknown in $\mathbb{R}$), numerical functions of a variable real (zero and factorization of a polynomial function, rational function, constant function, monotonic function, graphical representation without the derivative); 2nd year applications (injection, surjection, bijection), local study and global study of a numerical function; complex numbers (complex number fields, resolution in $\mathbb{C}$ of second degree equations), numerical sequences (recursion reasoning, definitions), primitives of usual functions (logarithm and exponential functions), integration (definition, calculation) in 3rd year.
- Enumeration-Probability: Introduced in 2nd year, covers the arrangement, the combination, the principle of Pascal's triangle, definitions (test, universe, eventuality, events), probability calculation.
- Statistics: This covers in the 2nd year (only) the introduction to statistics (elementary definition, position characteristic, mode of representation of a statistical series).
- Methodology: Dispensed in 3rd year and having the content that the Pedagogic Activity of the 3rd year of the general cycle.

C. General Practitioners (Baccalaureate + 2 years) or Basic Undergraduate

Mathematics courses cover the first year only, where the following chapters are found: numeration (set $\mathbb{N}$, fractions, set $\mathbb{D}$), proportionality (definitions, properties) , geometry (straight polygons, angles, circle, disc, polyhedra and round bodies, transformations), measure (units of area, volume, capacity, mass, time, agrarian and area and volume calculation), activity pedagogical and mental calculation (as taught in the 3rd year General).

D. Specialists MPC (Baccalaureate + 2 years old) or master of the second cycle fundamental (MPC)

As at general level Baccalaureate, mathematics courses cover only the first year, the following chapters are found: arithmetic (same content as in TSE), equations, inequalities, systems (systems of equations and inequalities of 2, 3 unknowns), the vectors of the plane, scalar product, symmetry, homothetic, equations of straight lines,

barycentre of two, three and four points weighted and mathematical teaching methodology.

4.3 Teaching and Learning Approach to Mathematics in Mali

4.3.1 Teaching Methodology

A balance mathematics program integrates conception learning and the development, conservation and application of skills. These should be taught in such that learners progress their capability to think mathematically (Alhadji Bakar Kamara, 2018).

In the APC, the vision of learning is global: the competencies are the same for the entire school curriculum. Each of the chapters covering the entire mathematics curriculum is composed of four parts:

- Situation-Problem: an open activity allowing a lot of new knowledge to be addressed.
- Preparatory activities: preparatory activities, simple approaches to new concepts based on knowledge acquired in previous classes.
- The course: Nothing but the essential in clear and simple language with demonstrations. Each definition or theorem is followed by a simple example, short, in situation, which can serve as a reference and a help to the demonstration.
- Exercises and problems:
  - exercises: new and orderly as the course progresses, they contribute to the acquisition and assimilation of the course;
  - the problems: varied, they are problems of synthesis or open problems to go further in the acquisition of your knowledge without going beyond the program in force.

4.3.2 Use of Teaching and Learning Materials

Materials: Bringing the child to discover through activities is the important phase in learning mathematics. The student must live situations allowing him to acquire new knowledge, so any mathematical learning must begin with the manipulation of material that can be usual (leaves, sticks, ruler, compact, calculator, etc.) or structured (trigonometric table , graph, etc.)

Manuals: They contain problem-solving techniques that increase competencies and foresight in mathematics. It is essential that children have an equal opportunity to read mathematics textbooks (especially new ones) in class and at home. However, teachers need to know that textbooks are tools to support the application of a program.

4.3.3 Evaluation in Mathematics

Competence-based assessment differs from traditional evaluation in several ways, including:

- the content of the exercises and the form of writing used;
- training students in such exercises;
- the support and the form of the evaluation;

- the use of a weighting (and not a scale);
- the exploitation of the answers with a view to targeted remediation.

It is formative. The student is confronted with a situation that involves different types of knowledge.

To graduate students' progress in developing or building competencies, one of the following strategies could be followed:

- present a succession of situations of the same nature, while gradually reducing the support offered to the student to help him to evoke the resources he must use;
- present a series of graduated situations in terms of requirements and mobilization difficulties (MFPESG-11, 2012).

4.4 Problems of Mathematics Education

Before the advent of APC in Mali, there were two 10th grade classes in high school (the 10th grade sciences where mathematics occupied the largest weekly hourly volume, 7 hours a week, and the 10th grade letters based on the literature and languages with 2 hours of mathematics per week), there are observed a drop in mathematics by students due to the large flow of students to grade 10 classes, for example, during the school year 2008-2009 at Mamadou M'BODJ high school in Sebenicoro, there were 3 classes of 10th year science against 9 classes of 10th year letters and the same in high school Falikali Sidibe of Kalabancoura there was only the class of 10th year letters. This phenomenon has existed in all the high schools of Mali (almost all).

Students' mathematics performance has declined over the years. There are few qualified mathematics teachers (out of IFM or ENSUP) for many basic and secondary schools. The reasons that led to this drop in performance included: the lack of competent staff (the bachelor students taught basic mathematics and often even high school), insufficient teaching materials, lack of motivation (the contractual teaching was recruited with one third of the salary of a state government teacher with the structural adjustment imposed on Mali and many African countries by the World Bank) and the wrong approaches of teachers and students, the degradation of practices.

In recent years, all the teaching objectives of a mathematics session have rarely been achieved, and the annual programs are also rarely performed at 100%, due to many factors: strikes (teachers, pupils and students), insufficient time devoted to the teaching of the mathematics program and plethoric number of classes which often, whatever the effort of the teacher, he cannot watch over all the pupils.

The biggest problem facing the Malian school today is due to insecurity prevailing in the North and Center of the country which has led to the closure of hundreds schools in these regions.

4.5 Remedies to the Problems of Teaching Mathematics

Since the advent of democracy in 1992, Mali has seen policies to revalue education, first with regularity in the collection of wages (which were not regular). The very important policy was the endowment of each village of a Basic School and the construction of

many Secondary Schools (IFM, High Schools and Vocational Centers) and the endowment of these schools with a computer room. The adoption of the APC has been beneficial to motivate students towards mathematics, especially with the creation of classes of 10th communes in high schools. There is the foundation of Dr. Cheick Modibo Diarra who organizes camps of excellence during the summer holidays to motivate girls to embrace scientific fields. The creation of Baccalaureate programs in IFMs reserved for young DEF holders has increased the number of mathematics teachers in basic education and improved their level. The recruitment of Bachelors at ENSUP with the adoption of the LMD system (License-Master-Doctorate) which was reserved for the license holders will be a considerable asset in the training of mathematics teachers. The Pedagogical Committees of Mathematics are frameworks for the valorization of the methods of teaching and standardization in the execution of the programs.

4.6 Recommendations the Teaching of Mathematics in Mali

- Peace and security are a very important factor in any teaching and learning process. Securing and reopening schools in the North and Central regions is essential for the future of the country in general and mathematics in particular. Teachers should be in a peaceful and secure environment to conduct well the teaching / learning activities.
- The APC relies on discovery itself, teachers and students should be trained in the effective manipulation of computer tools to solve and interpret mathematical problems and to research the net.
- Untrained and unskilled teachers should receive scholarships in IFM's and ENSUP and multiplication of training seminars for the application of APC for all teachers in general and teachers of mathematics in particular. This will strengthen the competence of mathematics teachers in program delivery.
- The creation of IFMs in all major cities and secondary teacher training schools such as ENSUP in all regional capitals. This will particularly increase the number of qualified teachers in general and mathematics teacher.
- The percentage of mathematics teachers is too low (0% at ENETP and ENSUP currently). To reduce the gender gap, more girls should be encouraged to love and teach mathematics.
- The revision of the content or the hourly volume reserved for the mathematics program. This will facilitate the correct and complete execution of the program. Indeed, among the constraints of the APC, there are: the busy schedule of students, all support and development activities in addition to a very busy week; the distribution of all hours between disciplines, leaving little time for interdisciplinary projects.
- The government to give more premiums on mathematics since it lays the foundation of science and technology (Alhaji Bakar Kamara, 2018).
- The establishment of the Association of Mathematics Teachers and Mathematics Clubs in Schools and IFM's to promote mathematics throughout the country; the online forum for discussion on teaching and learning mathematics.

5. Conclusion

Mali's education system sees mathematics as an essential subject from kindergarten to university. The Ministry of National Education is responsible for the education of children from 3 to 6 years whose completion of this care is the entry to school from 6 years. The period of 6 to 8 years which marks the end of kindergarten is entrusted to the first cycle of basic education. Entrance to secondary education from the age of 15 is linked to obtaining the DEF, marks the end of the second cycle of basic education and makes it possible to direct pupils either towards general secondary education or towards sectors of economic activity (technical and vocational education). The Ministry of National Education is also responsible for the training of mathematics teachers of basic education through the Directorate of Normal Education. The content of the program is indicative. It is accompanied by a teaching guide that should allow users to keep in mind the competencies to develop. The organization of the teacher training modules in the new mathematics program makes it possible to promote mathematics through a correct execution of the program.

Our countries must not only prepare their citizens to understand and apply mathematics in everyday life, but also ensure the training of mathematicians useful for their economic, scientific and technological development (Saliou Touré, 2002).

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