

Quality of Mathematics Education in Burkina Faso Junior High School: Prescriptions, Practices, and Issues

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Abstract

The purpose of this paper is to find the issue of mathematics education at junior high school in Burkina Faso. We start by a prescription of mathematics teaching in the curriculum related to 1) objectives, 2) pedagogical methodology including methods of teaching and lesson structure, and 3) student's performance. Then, we will analyze what is obtained in the practice, and the problems that need to be confronted. From this analysis, we will find some recommendations to improve mathematics teaching and learning at junior high schools in Burkina Faso.

Keywords: Mathematics Education, Junior High School, Burkina Faso, Teaching Methods, Lesson Structure

1. Introduction

In the 21st century, Science and especially Mathematics have a crucial and unique role in human society and represent a solution for the development of the whole of humanity (Francis et al., 2016). According to Salifu et al. (2017), in society, Mathematics is considered as a source of scientific and technological knowledge that is crucial in the social-economic development of the nation. However, developing countries face many difficulties in development through Science, Computer Technology, and Mathematics. Therefore, these disciplines, and particularly Mathematics, represent a strategic key to the development of these countries (Ernest, 2012). Ouaro¹ (2018) argues that Mathematics must be integrated into the development process of African

countries. He goes on to say that, looking at the past and also history, mathematics underpinning general science has been the basis, if not the foundation, of every modern technology, from medical devices to satellites, work organization, plumbing, and telecommunications.

In Burkina Faso, these subjects occupy an important place in the development process through its education system. It is in this sense that the education authorities undertook several actions to improve the teaching of these subjects by building the Institute of Sciences² and by creating scientific high schools at the national and regional level. Unfortunately, students encounter many difficulties in these scientific subjects, especially in Mathematics. According to the World Bank, evaluation results of Burkina Faso's school achievements by the Conference of Ministers

¹ Professor of Mathematics, current Minister of Education of Burkina, former President of the University of Ouaga II, and President of the Network for Excellence in Higher Education in West Africa: https://www.lepoint.fr/economie/afrique-les-mathematiques-au-service-du-developpement-02-02-2018-2191689_28.php (viewed on 2 April 2021)

² Training school for teachers of scientific subjects: Mathematics, Physics, Chemistry, Life and Earth Sciences.

of Education of Countries Using French as a Common Language (PASEC) are not satisfactory. Burkina Faso has participated in PASEC in 1995-1996 and 2006-2007. The rate of students who obtained more than 40% correct answers in Mathematics was 60% in 1995-1996, which is worsened considerably to 34.8% in the 2006-2007 exam.

To find a solution to these problems, Burkina Faso promulgated the Law No. 013-2007/AN of 30 July 2007 (Assemblée Nationale, 2007) on the orientation of education, emphasizing on scientific subjects, one of the aims of which is “to provide training adapted in its content and methods to the requirements of economic, technological and socio-cultural evolution, considering the aspirations and value systems in Burkina Faso, Africa, and the world” (Law No. 013-2007/AN, article 14 paragraph 2). Also, to improve the quality of Mathematics education, the country joined a Japanese project through Japan International Cooperation Agency (JICA). This project aimed at Strengthening Mathematics and Science Education at the basic level, through in-service training (INSET) (JICA & MENA, 2015). Burkina Faso participated in the first phase from January 2008 to January 2011. This has borne fruit and Burkina Faso has committed to the second phase from January 2011 to January 2015.

As a result of these educational reforms, Matachi et al. (2017b) observed some improvements in lesson delivery for those countries that have participated in the Strengthening Mathematics and Science Education (SMASE) project and introduced the Activity Student Experimentation Improvement/Plan do See (ASEI-PDSI) approach of teaching from the project. However, in Burkina Faso, the results are only observable at the primary level as the educational reform has not been implemented at the post-primary level. Several actions have been taken at the post-primary level to improve the quality of science teaching, especially Mathematics, but it remains as an issue to be improved.

2. Prescription of Mathematics education in the curriculum and practice at junior high school

In Burkina Faso, junior high school is the second compulsory cycle of the education system and

welcomes students who graduated primary school. This cycle is part of basic education since the promulgation of the law on the orientation of education and has four years/grades of general education. The end of the cycle is marked by a Brevet d'Etude du Premier Cycle (BEPC³) examination. Mathematics occupies an important place in all the grades of the cycle due to the number of hours per week allocated (5 hours per week, which is the second-highest subject volume after French: Table1). In view of its importance, Mathematics teaching in all classes must be taken seriously in following the objectives of teaching.

Table 1. Burkina Faso general low secondary education: weekly hours by subjects

Subject	Grad 7	Grade 8	Grade 9	Grade 10
German	-	-	3	3
English	5	5	3	3
French	7	7	5	5
History/Geography	4	4	4	4
Mathematics	5	5	5	5
Life Science	3	3	3	4
Physics/chemistry	-	-	4	4
Physical education	2	2	2	2
Weekly total	25	25	28	29

Notes: “-” indicates these subjects are not taught in grades 7 and 8.

2.1. Objectives of Mathematics Education at junior high school

At the junior high school level, the teaching of Mathematics emphasizes the consolidation of the knowledge acquired during primary school. These knowledges are important to use numbers competently, reason logically, read and interpret numeric data, solve problems involving calculations and mathematical reasoning, as well as communicate effectively. Also, the teaching of mathematics is to provide students with practical knowledge, usual techniques, and operating methods that will allow them to solve simple problems that arise in everyday life or during other lessons. Its teaching at junior high school is, therefore, to contribute to the intellectual formation of students and allow them to test their aptitudes (MESSRS, 2009).

Other objective is to provide learners with a solid

³ Patent of study of the first cycle “junior high school leaving certificate for upper secondary”

base for the in-depth studies that they will be likely to carry out later on without anticipating such studies. It is the acquisition of these qualities and the important quality of functional mathematics that education in Burkina Faso aims to emphasize in the teaching and learning of Mathematics at junior high school (MESSRS, 2009).

The first objective shows that junior high school teachers should know what was taught in primary school. Unfortunately, in practice, this is not observed in Burkina Faso. De Kessel et al. (2011) summarized that junior high school teachers do not know enough about the methods, the teaching tools and the curriculum of primary school Mathematics. In Burkina Faso, there is little or no collaboration between primary and post-primary teachers. Therefore, the post-primary teachers do not know the basics of the student coming out of primary school. In reality, although both sub-cycles—primary and junior high schools—belong to basic education, teachers usually do not try to know what are the content taught in other cycles. Some issues observed are a few or non-existent interactive forums or meetings for teachers resulting in a missing link between primary and junior high school teaching contents and methods.

The curriculum of mathematics education at junior high school is the same in all provinces of the country and has been divided into two units of numeric and geometric activities. For its implementation, junior high school teachers have to use the pedagogical methodology recommended by the Ministry of Education.

2.2. Pedagogical methodology of mathematics teaching at junior high school

The pedagogical methodology follows the instruction of the curriculum. Here, “curriculum” is a collection of user experiences provided and directed by educational institutions to achieve predetermined goals (Onwuka, 1981). In Mathematics, it is a set of mathematical contents along with instructions on how it should be rendered. However, some teachers do not always follow the specified curriculum very closely. Also, teachers are unable to cover what it planned for them, before going into a new concept. Malgoubri (2021) says that in Burkina Faso, except from the last grade in primary school, junior high and upper high school, teachers rarely cover all the items in the textbook and syllabus.

2.2.1. Methods of teaching

The method used must constantly stimulate learners’ activity by making a large part of observation and manipulation. This method must:

- 1) cultivate the observation and analysis skills of each learner,
- 2) help the learner to convert the concrete representation to a concept to develop the capacity for abstraction,
- 3) stimulate learner’s imagination through induction, generalization, and search for examples that illustrate a property or counterexamples that refute a proposition,
- 4) train learner in deductive thinking in short sequences, and,
- 5) exclude dogmatic presentations, by introducing each of the notions studied from various examples and by making these notions work once the understanding is acquired through application exercises (MESSRS, 2009).

This method is the most recommended in teaching and learning by the Ministry of Education. Table 2 shows some methods and techniques recommended to emphasize the approach in post-primary education.

Table 2. Some recommended methods and techniques in mathematics teaching at junior high school

Teaching Methods	Teaching techniques
Discovery	Problem solving, Questioning
Rediscover	Teaching through activities, Questioning
Experimental	Manipulation, Observation, Questioning
Interrogative	Questioning
Intuitive observation	Observation, Graphics, Questioning

In the practice, learning is mainly done through lectures despite the fact that the methodology advocates active pedagogy. However, according to Douamba (2015), teachers practice transmissive teaching in primary and post-primary education. Indeed, at the time of his intervention, out of 24 secondary school teachers 14 teachers were simply lecturing instead of active teaching method. This is because teachers may have difficulties in following the active method. For example, Maheshwari (2013) asset that an expository lesson helps students to stay

focused on the topic at hand because teacher provides only necessary knowledge in a given lesson. He continues by saying that if students are exploring freely to obtain information about the contents of a lesson, they can get distracted and confused by unnecessary information and have difficulty determining what's important without teacher's guidance. Teachers' skills can affect the way they teach. According to UNESCO (2004a), the quality of teachers, teaching and continuous professional development remain the key to quality education. Unfortunately, in Burkina Faso teacher training is to some extent weak due to the lack of trainers in practice and quality (Saïdou, 2018). This has an impact on the qualification of future teachers. The Summary Report of the Parliamentary Commission of Inquiry into the Education System in Burkina Faso (Assemblée Nationale Commission d'Enquête Parlementaire, 2017) underlines that among post primary teachers, we deplore an insufficient level of some teachers whose mastery of the contents of their subject is not perfect. Also note that for some time the government has been recruiting a sufficient number of post primary teachers each year without initial training. In the Summary Report of the Parliamentary Commission of Inquiry into the Education System it is mentioned that with the shortage of post primary teachers, many teachers have been recruited and sent directly to the field without initial training. In-service training, as well as pedagogical conferences and class visits that could have solved this shortage are lacking.

The teaching of science and mathematics often takes place as a simple lecture at junior high, resulting in the disconnection of students from the environment and their daily life. However, the SMASE training course for learning mathematics and science has reached a very large number of primary school teachers on these principles to provoke scientific curiosity in children: simple demonstrations carried out by pupils, communication of the objectives of the experiment using simple language and objectification of the knowledge learned. This approach has made it possible to introduce learning materials that are livelier and motivating for the children in the report of Education and Training Sector Program in 2017.

Douamba (2015) found that students who learned under teachers trained in the ASEI-PDSI approach have a higher achievement level than the dry method.

This result is one of many studies showings that lesson structure instruction has an impact on students' achievement. Emmanuel et al. (2021) assert that students taught using the ASEI-PDSI approach performed better when compared to discussion and demonstration methods. The lesson plan contributes to good instruction in the classroom. In Burkina Faso, the current lesson plan is used for many years at the junior high school level.

2.2.2. Lesson structure

Lesson Plan

According to the instruction official for mathematics teaching, Table 3 is a common lesson structure at lower and upper secondary schools in Burkina Faso.

Table 3. structure of lesson

Introduction	a) Presence control b) Checking the prerequisite c) Motivation for the introduction of the new concept
Development	a) Activity to state the notion... b) Making the concept work c)
Conclusion	a) Final evaluation b) Task at home and filling in the textbook

Teacher's Instruction

At junior high school, the teacher is recommended to start by checking attendance and revising the previous lesson or giving activities related to today's lesson with the pupils. He/she corrects any misunderstandings students have and reviews the essential knowledge and skills to be mastered to tackle the day's lesson. For motivation, he gives activity or history to attract the pupils' attention before the lesson begins and communicate the objectives of the lesson. In development, the teacher teaches and explains the mathematical concept to the pupils and gives examples with activities, walks around to check pupils' work during individual seatwork and group work, asks the student to put the answer on the board. After the teacher asks whether pupils understand or not., he/she summarizes the activity, has the pupils state the concept, helping them to formulate it well. The teacher asks if pupils got any question and give an exercise to consolidate the new

concept. The conclusion is the phase of evaluation, where the teacher gives an exercise to check if students reached the lesson objective. The teacher also gives exercise as an application and checks pupils' work and reviews their learning. According to this result, the teacher makes any necessary readjustments, if possible, then gives homework.

Based on my experience in learning and teaching mathematics, however, the teacher usually neglects the recommended approach described above. Many teachers, to finish specified content, adopt another mode of teaching in the class, which is to teach mainly for students to obtain good scores on exams. As a result, junior high school teachers prefer to assign individual tasks during lessons and spend most of their time teaching and explaining the concept. This instruction does not allow teachers to have enough time to help students. During the lesson, many students are quiet, passive, and do not feel secure enough to express their idea. In other words, there is not enough group work or discussion, but students spend working on exercise individually for most of the time.

In Burkina Faso, although the 1996 ministerial decree sets the number of pupils for post-primary education at 70, the reality is different. In fact, in the first classes of some post-primary schools, the number of pupils quite often exceeds one hundred in many regions of the country. However, Pedagogy of Large Class (Malgoubri, 2021) is explored, but that can only serve as a short-term solution as overcrowded classes do not allow the teacher to use diverse teaching methods and strategies, not to mention the differentiated instruction for special need student.

2.3. Student's performances

In 2005, UNESCO (2004b) identified cognitive development as a major explicit goal of all education systems. If quality is defined in terms of cognitive achievement, then the means of ensuring higher quality are neither simple nor universal. However, considering cognitive development, quality only exists when students demonstrate their knowledge. Thus, assessment of learners' progress can provide a signal about how well they are doing at key exit points from the school system, which usually helps educational institutions or employers to select the most qualified people for further education. The assessment tools

put in place by the Ministry of Education (MOF) in Burkina Faso are Evaluations of School Achievements, PASEC, national examinations and classroom evaluations.

2.3.1. Evaluations of school Achievements

EAS (Evaluation of School Achievement) is strongly inspired by PASEC-type assessments. Its measurement is based on the scores obtained by pupils in tests in two subjects. EAS is seen as a reflection of the tests that teachers are normally expected to use to assess the level achieved by their pupils at a given time of the year. The level of knowledge of pupils is thus measured through the two subject areas of French and Mathematics. Unfortunately, this evaluation began in 2001 and was not carried out at the junior high school until 2016. The results of EAS at junior high schools are not satisfactory in the two subjects.

The survey on the evaluation of learning outcomes in post-primary education, particularly in the 7th grade, which took place in May 2016, was the first of its kind organized by the MOE. The results obtained and the analyses show the weakness in both disciplines evaluated, namely French and Mathematics. Indeed, they obtained average scores of 32.1 and 34.2 (out of 100) respectively. In French, only 12.3% of them obtained a total of points higher than 50; in Mathematics, those who reached this threshold are 8% of the total number of pupils assessed (MENAPLN, 2017).

This assessment in 2018 measured the performance of pupils in grade 3, grade 6 and grade 8. For grade 8, the performance of students in French and Mathematics was assessed. The assessment produced overall results by domain and by ability. This section presents the average scores out of 100 obtained by pupils in grade 3 and grade 6 in French, Mathematics and Science, and those in grade 8 in French and Mathematics. At post-primary level, the performance of pupils is worrying: 74.73% of pupils assessed in French and 87.72% in mathematics obtained less than 50 out of 100 (MENAPLN, 2019).

2.3.2. PASEC

PASEC is a program that was created in 1991 by the Conference of Ministers for Francophone States and Governments (CONFEMEN). PASEC's

methodological model is based on the measurement of pupils' basic skills in the language of instruction and in mathematics at the beginning and end of the primary cycle. The results of the evaluation of learning outcomes are not satisfactory for Burkina Faso (JICA, 2012).

2.3.3. National Examinations

Burkina Faso organizes national examinations at the end of each school year for pupils leaving primary, post-primary (junior high school) and secondary school (high school). The results of the post-primary level are not satisfactory compared to those of the primary level, as shown in Figure 1.

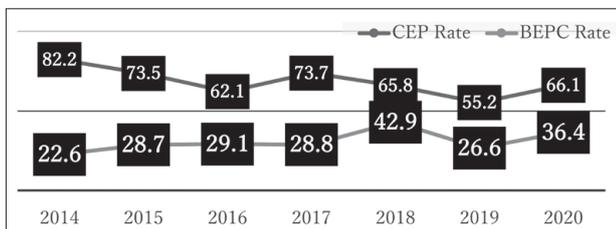


Figure 1. Success rate of national exam grade 6 (CEP, blue) and grade 10 (BEPC, red).
Source: MENAPLN/DGESS (2019).

As can be seen in Fig. 1, the pass rate has been fluctuating around 30% level with the highest rate of 42.9% recorded in the 2018 session. However, even though the pass rate seemed to be improved significantly in 2018, it dropped back to 26.6% in 2019, a drop of 16.3% in a year. Success rates in school exams have fluctuated for both exams, but for the last grade of primary school, the rate is over 50%.

Mathematics is a fundamental subject in all classes, its learning is difficult for some students and we can see it through their performance. Table 4 shows the Mathematics transcript at junior high school leaving exam for some students in 2018 and 2019.

Table 4. Mathematics transcript for BEPC 2018 and 2019

Note out of 20	[0;5] (0–4)	[5;10] (5–9)	[10;15] (10–14)	[15;20] (15–20)	Total
Number of students (2018)	104	67	20	3	195
Number of students (2019)	77	46	11	5	149

The level of the score in Mathematics, only 23 out of 195 students in 2018 and 17 out of 149 students in 2019 got the score of more than 10 out of 20, which is very low. These data show that Students have serious difficulties in mathematics at the last level of junior. A reflection must be carried out on the causes of such a poor performance to propose appropriate solutions mainly at the beginning of this cycle.

3. Challenges and Issues

In Burkina Faso, there are many issues in the education system to be resolved. In this paper, I will focus on some issues related to Mathematics at junior high school.

The first issue is that teaching and learning methods at junior high school emphasize student-centered and social constructivism where student construct their knowledge.

Unfortunately, Mathematics teachers mostly apply the transmission approach. The teaching is more transmissive and leaves little or no room for participatory and meaningful learning (MENA, 2013). According to Panthi (2016), this kind of situation does not allow students to learn at their pace and learn through interaction and negotiation. Teachers give lectures just to complete the syllabus. Active participation of students is necessary to have quality in mathematics instruction.

The second issue is that Burkina Faso Junior high schools are faced with a lack of initial teachers training and in-service training opportunities. Indeed, the Burkina Faso government recruits mathematics teachers without in preservice and in-service training as mentioned above. Traore (2012) assert There is a lack of coherence between theoretical and practical training and also a lack of tutors to encourage student teachers on placement. He goes on to mention the lack of continuous training. Therefore, the lack of training makes that some teachers have difficulty to teach some content or don't have the necessary competence in the subjects.

The Third issue is that in basic education, there is a lack of collaboration between primary and junior high school Mathematics teachers. Despite the Education Law of 2007 conducted junior high school and primary school as the basic education system, the practice goes slowly. There is still not much

collaboration between primary and post-primary teachers in Burkina Faso. Although both sub-cycles belong to basic education today, teachers do not try to know what students should see or have seen in the other sub-cycle.

The fourth issue is that the average number of school students in one class in Burkina Faso exceeds the norm in many schools. Teachers deal with an average of 100 students in a class. According to (Obiakor & Oguejiofor, 2020; Shamsuddin et al., 2017), these overcrowded classes present more challenges for classroom management, pupil control, and marketing, planning, and assessment. To improve the academic performance of students in schools, there is a need for effective teaching and learning within a controlled populated class.

The fifth issue is that the lesson structure at junior high school doesn't have specific instruction in the development section like in primary school (Table 5). The structure of the Lesson in primary school makes the teaching more active and also the students very participative. Indeed, in ASEI-PDSI, the learner occupies the predominant place, the teacher only intervenes when learners are unable to explain concepts, justify answers, demonstrate a technique, or simply repeat what is proposed by a learner for greater clarity. In junior high school, the lesson structure was introduced over a decade ago and most, of course, are transmissive; the teacher asked the question, expose the lecture, students answer and follow.

And the last issue is that students and some teachers have negative attitudes towards Mathematics. The teaching of mathematics is a problem for both

teachers and learners. It is seen as abstract and difficult. According to Sawadogo (2000), some teachers feel that their students are not good at mathematics, their mathematics class looks like a funeral and students say that mathematics and they do not go together. Also, some JICA studies affirm that teachers and students have poor (Negative) attitudes towards mathematics in many developing countries in Africa including Burkina Faso, and confirmed by Matachi et al. (2017a) in the summary paper of JICA's support to Africa: Focusing in Mathematics and Sciences Education.

4. Recommendations

From this study, we summarized that students found Mathematics difficult and have negative attitudes in the learning of Mathematics. However, teachers tend to use a more lectured method rather than interactive teaching for Mathematics.

Based on the findings, we recommend the use of new methods of teaching such as the Japanese Structured Problem Solving or ASEI-PDSI approach in presenting Mathematics lessons to facilitate students' understanding and their interest in Mathematics in junior high schools. This can also make the pedagogical practice more similar in primary and junior high school.

It is recommended also to have teacher collaboration group work that can improve teachers' pedagogical content knowledge and mathematics knowledge. These will help to foster a more positive attitude of students towards Mathematics.

Table 5. Comparison between lesson structure in Primary and junior high school

Lesson Structure	Lesson Activity at Primary School in Burkina Faso	Lesson Structure at Junior High School in Burkina Faso
Introduction	a) Mental arithmetic: PLM b) Reminder of the previous lesson/check of prerequisites: min c) Motivation	a) Presence control b) Checking the prerequisite c) Motivation for the introduction of the new concept
Development	a) Presentation of the Situation Problem and issue of hypothesis b) Analyze/Exchanges/Production c) Synthesis/Application d) Link with daily life and link with the lesson to come	a) Activity to state the notion... b) Making the concept work
Conclusion	a) Stage 1: Assessment of prior learning b) The teacher's performance c) Transfer or home exercise	a) Final evaluation b) Task at home and filling in the textbook

5. Conclusion

The main purpose of this paper was to find the issues of Mathematics Education at junior high school in Burkina Faso. To achieve the goal, we started by a prescription of mathematics teaching into the curriculum related to the objective, Methods of teaching, lesson structure, and students' performance.

Second, we show some challenges and problems faced in the teaching of Mathematics at junior high schools like Problem of teaching methods, lesson structure, large size, lack of collaboration between teachers, and teachers' and students' attitudes towards mathematics. These Issues allow us to propose some recommendations to improve the quality of mathematics teaching and learning at this level of education in Burkina Faso.

In Conclusion, we guess that Burkinabe teachers are facing difficulties to apply adequately student-Centered learning. This situation may explain low performance in different evaluations. The teaching of Mathematics in Burkina Faso at Junior high school faces serious issues mainly the ways of teaching which does not always conform to the approach of teaching.

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