

Introduction of The Competency Based Approach in Teaching and Learning Mathematics at Elementary School Level in Senegal -Successes And Challenges-

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Abstract

In Senegal, the generalization of the new curriculum 2013, has triggered profound changes and raised new challenges in the teaching and learning system in elementary schools. From Content and Objectives Based Approaches, teachers have been experimenting nowadays, the Competency Based Approach (CBA) which focuses not only on the transfer of knowledge, but also on the mastering of the core competencies. Based on the theories of constructivism and social-constructivism, this system of instruction promotes learner centered activity, creativity, critical thinking, problem solving and collaborative learning.

Despite the efforts of the Senegalese government in reforming the teaching and learning system, the quality of education is still a big issue for MoE. Assessment studies made at the national, regional and international levels, have shown that Senegalese elementary school students are lacking performances in reading and mathematics as indicated in the SNERS and PASEC, reports respectively in 2013 and 2014.

This study proposes an analysis of the introduction of the new curriculum in Senegal through the model of Competency Based Approach (CBA) in teaching and learning mathematics.

The methodology used to collect data was the questionnaire administrated to teachers, classroom visits and the exploitation of reports produced by the MoE.

The findings globally show that the implementation of the CBA is confronted with serious issues like the big gap between the intended and the implemented curriculum, the absence of integrative activities and feedbacks to students without forgetting the students' lack of performances in reading and mathematics.

These issues open the door of many challenges that need to be overcome by Senegalese education system stakeholders for a successful implementation of the reform.

Keywords : Senegal, Competency, Competency Based Approach (CBA), resource, integration, assessment

1. Introduction and background information

1.1 Brief History of School Education in Senegal

Basically, the Senegalese government, through its Development Policy Documents for the Education Sector (2013-2025), has clarified its strategic priorities

in terms of education and training, which include (i) improving the learning environment and opportunities for schooling, especially for marginalized groups and out of school children and youth; (ii) improving teaching and learning quality by reforming teacher training, and reinforcing the curricula for primary

and middle school; and (iii) further developing the quality assurance system and ongoing monitoring and evaluation of inputs, processes, performance and learning impact at all levels.

In fact, building an education system of quality is fundamental to the development and economic growth of every nation in the world and particularly for developing countries. For this purpose, many reforms have been undertaken by the Senegalese government. These reforms include among others the teachers' training system, the teaching approaches, the assessment system etc.

In the past, traditional methods of teaching were applied in Senegal for a long time right after the independence. However, international indicators suggest that traditional methods of educating students are diminishing the quality of education while also leaving large number of students behind. Nowadays, competition in the global marketplace, coupled with new technologies, has accelerated the need to embrace innovative methods of educating students, particularly in countries with economically disadvantaged backgrounds. In Senegal, from the independence to nowadays three teaching methods were experimented. These teaching approaches are the Content Based Approach (CoBA), the Objective Based Approach (OBA) and currently the Competency Based Approach (CBA).

Currently, there can be no denying the influence

of competencies on the development of the school and its curricula. It is increasingly the case that, to enroll in a socio-economic fabric, whether locally or globally, learners must learn to place their knowledge and know-how at the service of action: they must be able to deal with complex situations of daily and professional life. In short, they must be taught to transfer their knowledge and know-how. The school and its stakeholders must therefore be tooled to be able to handle this novelty: conducting learning processes in terms of competencies, but also assessing learners in terms of competencies.

1.2 The Senegalese Education System

Senegal has a 3,6,4,3 education system which is free in the public sector up to the age of 16 (official law 2004.37, December 15, 2004). The education system is built and divided into three cycles: the fundamental cycle which covers preschools, elementary schools and junior or middle schools, the secondary cycle with high schools and lastly the university cycle. Preschools welcome children aged from 3 to 5 years, for up to three years of study. Based on the French model of education, elementary school welcomes children aged from 7 to 12 years. The Senegalese elementary or primary cycle is divided into six years of study with three stages of two years each. It leads to the successful completion of the CFEE (Certificate of Elementary School Completion) and an entrance

Source: Ministry of Education (2013, p 57, 2014, p73-74, 2015, p81-82)
 Table 1.1. Results of PASEC (2014). SNERS (2013), INEADE (2015)

ASSESSMENT	Grade 6			Grade 2
	French		Mathematics	Students main issues
PASEC (2014)	40%		40.51%	37.2% notion of space Structuring quantity Counting and comparison of numbers < 100
SNERS ¹ (2013)	Grade 2, 4			
	Numeracy	Measurement	Geometry	Problem solving
	45.35%	35.98%	47.01%	34.97%
PAQEEB ² INEADE (2015)	Grades 2, 4, 6			
	Numeracy	Measurement	Geometry	Problem Solving
	57.3%	34.50%	45.33%	39.10%

¹ SNERS is a national examination which means National Assessment System of learners outcomes

² PAQEEB: Project for the improvement of quality and equity in Basis Schools

Table 1.2. Results of CFEE admission

Years	2015	2016	2017
CFEE admission rate	37.9%	58.30%	56.74%

test into the next cycle of education.

Junior high school education is aimed at students aged 13 and is composed of four years of study. At the end of the fourth year of study, students have to sit for a national exam to join secondary education.

1.3 Students learning achievements

Over the past few years, many strides have been made in achieving universal access to education in Senegal, by increasing primary school enrollment rates from 79,6 in 2004 to 86,8 percent in 2014 with an increase of 7,2 percent within 10 years (PASEC, 2014).

However, learning quality remains a crucial problem for the Senegalese education system. Indeed, the PASEC¹ tests in 2014 reveals that only 40% of students in sixth grade are achieving at desired levels in French and only 40.51% in mathematics. The SNERS' assessment report in April 2013, globally shows that 45.35% of students at elementary level have reached the minimum standards in Numeracy, 35.98% in Measurement, 47.01% in geometry and 34.87% in problem solving

Moreover, the national report of the Senegalese Education (Ministry of Education, 2017), as indicated in table 1.2, shows that the rate of admission of the primary school leaving examination for grade 6 students, is not satisfactory on the whole even though a progress was noted in 2016. This examination helps to determine grade 6 students' mastery of the competency of the cycle. Those who succeed get opportunity to pursue their studies at Junior high school level and those who fail simply repeat the class or just leave studies.

Many reasons can explain students lack performances in Senegal. The first reason is related to the fact that access to education has taken priority vis a vis quality of learning in recent years in Senegal. The second reason is due to teachers' difficulties

to implement effectively the CBA reforms in the education sector.

2. Purpose and methodology

Based on the context and background explained above, this study raises the following research purpose, research questions and methodology.

2.1 Purpose of the study

The present study aims at examining Senegalese elementary teacher's application of the CBA in teaching mathematics while highlighting the successes and challenges of this reform.

2.2 Research questions

To what extent Senegalese teachers understand and apply the CBA principles?

What are the successes and challenges of the CBA in Senegal?

2.3 Methodology

In order to address the previously raised enquiries, the methodology applied was literature review about CBA, questionnaire and classroom visits. The review of CBA literature is basically to redefine the meaning of CBA in order to confirm later to what extent teachers understand and manipulate CBA for lessons and assessment. The questionnaire was self-completed by a group 100 elementary school teachers of different grades. This questionnaire is to clarify teachers' consciousness about CBA and their perception of how they are applying CBA and assessment tools. In total, 20 mathematics lessons were observed to analyze how teachers applies CBA in lesson activities. Among the 20 lessons, 5 are in Numeracy, 5 in Measurement, 5 in Geometry and 5 in Problem solving.

¹ Complete name of PASEC in French is "Programme d'analyse des systèmes éducatifs de la CONFEMEN". This is a regional examination organized by the "Conférence des ministres de l'Éducation des États et gouvernements de la Francophonie (CONFEMEN)", which is an organization of ministries of education of French speaking countries.

3. Clarification of key concepts

3.1 Competency or competence

Competency and competence are interchangeable, though competence is more often used to describe a person's general ability, while competency is more often used to describe a person's ability to perform a certain task.

There are many definitions of the concept of competency in the educational sciences fields. According to Jonnaert (2009), "competency is a know-how that integrates ability and knowledge, it is complex, it refers to cognitive, affective, social or psychomotor skills and it is specific to a set of situations".

Roegiers (2012), defines the competence "as a variety of 'resources' composed of knowledge, skills and the life-skills that the student, like anyone else, mobilizes to solve a complex situation" and indicates that "It is a system of instruction or teaching method that aims to provide the learner with knowledge and skills to independently solve a set of tasks."

For Tardif (2003) (as quoted in Arena-Daigle 2006, p 28), a competency is "a 'knowing-how-to-act' complex based on the effective mobilization and combination of a variety of internal and external resources within a family of situations".

Based on these definitions, to have a comprehensive definition, the competency consists of the following three constant elements:

- A competency would be based on the mobilization and coordination of a variety of resources by a person, in a given situation, specific to the person, specific to the situation and / or to the context;
- A competency would only develop in a situation;
- A competency would be acquired only when the treatment of the situation is completed.

In Senegal, since the independence to nowadays mainly three teaching approaches were experimented. These are the Content Based Approach (CoBA), the Objective Based Approach (OBA) and currently the Competency Based Approach (CBA).

3.2 The Content Based Approach

The Content Based Approach (CoBA) was experimented and applied in Senegal right after the declaration of independence through the reforms of 1962, 1971 and 1979. In line with a traditional empty

vessel model (Lakoff & Johnson, 1980), knowledge here is an object of information to be transmitted from donor (teacher) to receiver (learner). With this teaching approach, students are rather passive listener and the teaching and learning are concentrated on theoretical method rather than practical aspects. The knowledge is decontextualized and acquired either by memorization or through simple exercises of recall as taught by the teacher.

3.3 The Objective Based Approach

Because of fact that the CoBA focuses mainly on the transferring of knowledge rather than practical things, the Objective Based Approach (OBA) was introduced in Senegal in 1987 through a reform with the creation of a new type of classrooms called 'classes pilotes'. In these new classrooms the teaching approach shifted from teacher centered to learner centered, focusing on practical things. With the OBA, the knowledge is fragmented into small pieces; there is a kind of disintegration of subject matter into isolated objectives. The only reproach of the OBA is that learners are somehow confronted to the difficulty to mobilize and transfer learning when it comes to solving significant problems of everyday life.

3.4 The Competency Based Approach

Because of the limitations of the previous teaching approaches, the CBA was introduced in Senegal since 2005. Its implementation followed a long process and the generalization at kindergarten and elementary school levels was effective in 2011. In this new teaching approach, knowledge is built as the competency is acquired. The role of the teacher consists in encouraging the learners to acquire the knowledge, which must be facilitated but not mechanically transmitted, and entrusting the preparation of certain tasks to the students. The teacher becomes a 'facilitator' who advises the learners, motivates and encourages them to be creative, ensures the planning and organization of activities, and suggests ideas without imposing them (Boutin, 2004).

The CBA aims at verifying and validating the student's achievements in terms of resolving concrete situations, not in terms of the sum of knowledge and know-how that the learner often hastens to forget, and which he does not know how to use in real life.

According to Perrenoud (2000), competency is

acquired in a global way and not in a piecemeal way. Students are placed in a situation (context) where competency will be demonstrated, less complex at the beginning and more complex at the end of the competency acquisition. Students are placed in the most authentic possible situation to acquire competency. They have to use their knowledge and the situation data to demonstrate competency.

In a CBA, there are essentially two moments in learning:

- *The punctual learning of resources:* basic knowledge, skills and attitude

- *Integration activities:* designed to teach the student to mobilize resources in complex situations.

A situation has a context and an instruction. The context presents to the student problems to solve, challenges to rise, constraints to overcome, it belongs to a domain of life or a scientific discipline. The instruction indicates clearly to the learner the task to do.

Referring to the definitions and discussions above, the authors elaborated an example of resource and

Table 3.1. Example of resource and integration activity

Example of resource: Multiplication of integers / Grade 4
Context: Your friend Ali is a carpenter, he bought 175 pieces of wood of which length is 4 m each. Instruction: Help him to calculate the total length of wood.

Example of Integration activity (Competency) : Mastering rules of multiplication and division / Grade 4
Context: Mammy bought 16 buckets of fish, each bucket contains 125 pieces of fish. She went to the market and sold the fish making sets of 5 fish each. One set costs 500FCFA. Instruction: calculate the total cost of fish.

Source: made by the authors

integration activity as follows:

The Resources are the prior Knowledge, skills and attitudes needed to build the competence. In the given example, students need to know when and how to do a multiplication.

An Integration activity consists of gathering a set of resources in a complex situation problem to measure the mastering of the competency. In order to solve the given problem situation, students need to master two resources multiplication and division.

3.5 Introduction of CBA in Senegal

The process of implementation of the CBA in Senegal started since the beginning of the 21st century. It was done in a very slowly way following several stages (Sambe, 2006).

- Stage 1: establishment of a National Committee to write a new curriculum based on the Livret Horaires et Programmes (LHP) and the CBA principles. (2000-2003)
- Stage 2: experimental period in Kindergarten and

Elementary schools level (2003-2005)

- Stage 3: evaluation and correction of the mistakes relating to first draft of the New Curriculum (2006-2007)
- Stage 4: second Experimental period in Kindergarten and Elementary schools (2007 to 2010)
- Stage 5: training of all kindergarten and primary school teachers (from 2007 to 2011) in the new teaching method based on CBA
- Stage 6: generalization of the New curriculum in October 2013 in Kindergartens and Elementary schools
- Stage 7: availability of teachers' guides and textbooks based on CBA since 2014

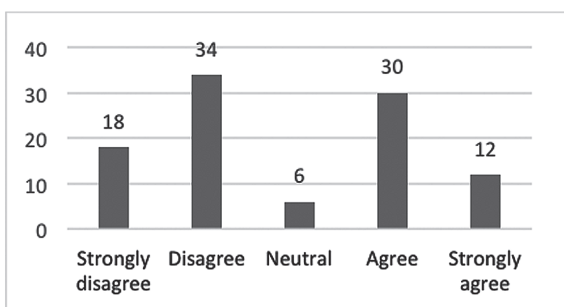
Considering the different phases of the implementation of the CBA in Senegal, the authors realize that the training of different actors occupied an important place in terms of duration. In fact, the training of actors especially teachers, was very important for the success of the reform. In addition, we can notice that teachers' guides and textbooks

were available one year later after the generalization of the CBA. These lack of documentation right from the beginning of the reform created some issues among teachers.

4. Results of questionnaire and lesson observation

4.1 Questionnaires results

As we can see in bar Graph 4.1.1, many teachers strongly disagree (34%) to share learning intention with the students and 18% have strongly the same attitude. In fact, sharing learning intention is very

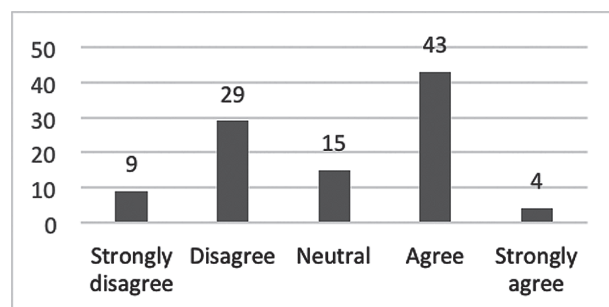


Graph 4.1.1. Teachers sharing learning intention with students
Source: made by the authors

Graphs 4.1.3 and 4.1.4 show that feedback is not given to students by the majority of teachers as well as remedial activities are not regular. In fact, feedback and remedial activities occupy an important place for the development of competency on the students.

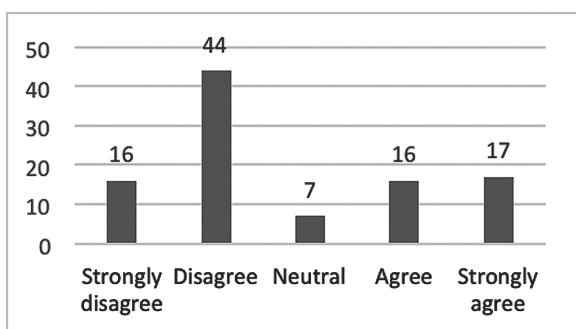
important as it could be a source of motivation and one of the key strategy to develop self-confidence on students on their way of mastering learning resources or the competency.

Graph 4.2.1 reveals 43% of teachers agree and 4% strongly agree providing regular assessment to students. In the other hand, 29% and 9 % respectively disagree and strongly disagree to give regular assessment to students. In fact, assessing regularly the students, could help teachers to be aware about their strengths and weaknesses and conduct remedial classes which are fundamental in the CBA.

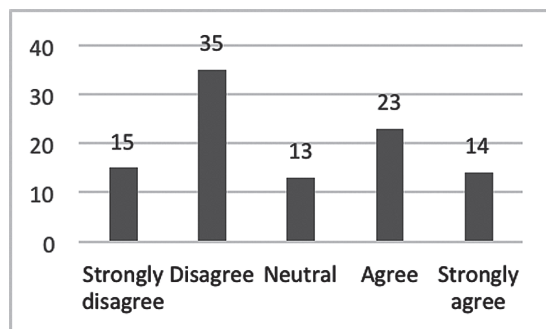


Graph 4.1.2. Teachers providing regularly assessment
Source: made by the authors

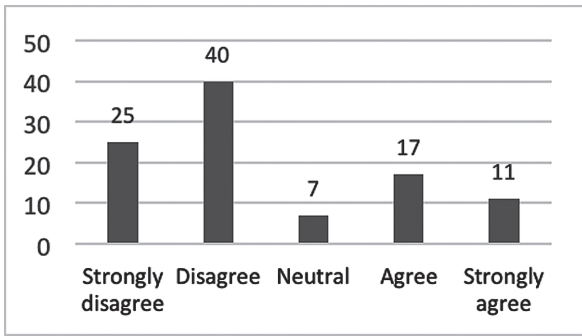
Feedback allows students to move forwards during the learning process and remediation are compulsory for the mastery of the competency especially for weak students.



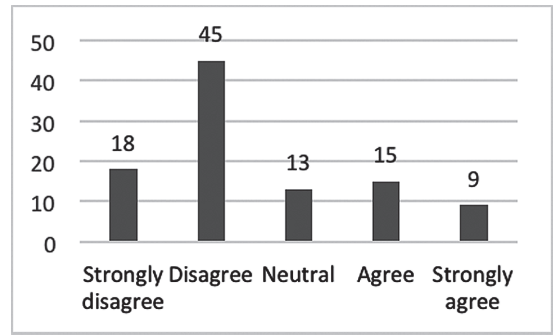
Graph 4.1.3 Teachers giving regular feedback
Source: made by the authors



Graph 4.1.4 Conducting remedial activities
Source: made by the authors



Graph 4.1.5. development of critical thinking
Source: made by the authors



Graph 4.1.6 conducting integrative activities
Source: made by the authors

Two things are essential for a good implementation of the CBA: the development of critical thinking and integrative activities. In fact, the above graphs show that these principles which are essential for the good implementation of the reform are not respected by the majority of teachers. Critical thinking should be developed through problem solving. Integrative activities help students to mobilize resources to solve complex problems situations.

4.2 Classroom observation

The authors conducted in the different classrooms (20) and assessed the lessons using assessment tool prepared to evaluate CBA application level. The Table 4.1 below was elaborated to collect data applying the Likert scale.

Table 4.1: classroom practice observation sheet

Classroom Practice Observation Sheet

School Name: Status: 1. Public 2. Private
 Date: Time:
 Subject: Teacher Name:
 Topic: Grade:

Appreciation of teacher’s practice and documents

Sn	Indicators	Strongly agree	agree	Neutral	Disagree	Strongly disagree
1	Availability of lesson plan					
2	Availability of relevant material					
3	Existence of relevant situations					
4	Effective student-centered learning					
5	Organization of group-work					
7	Application of CBA principles					
6	Existence of Integrative activities					
7	Feedback and remedial activities are conducted					
8	Effectiveness of formative assessment					

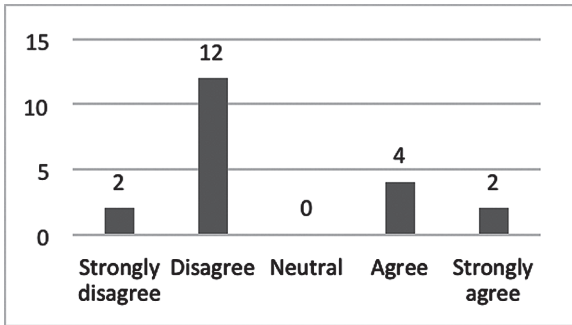
Source: made by the authors

It was revealed as shown in the Graphs 4.2.1 and 4.2.2. below that teachers in the majority are not developing student centered lessons based on CBA

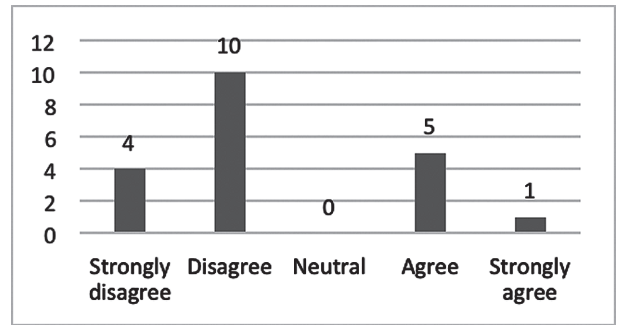
as recommended by the Ministry of Education. In fact, they are still confined in the traditional teaching methods. The situations proposed to students during

the different classes are mostly not relevant especially in problem solving. These situations are not connected

to real life and do not present any challenge to the students.



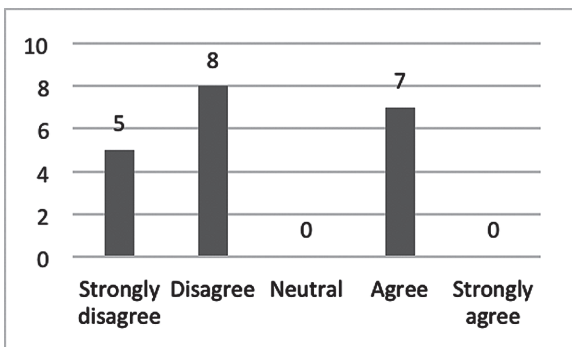
Graph 4.2.1. development of student centered
Source: made by the authors



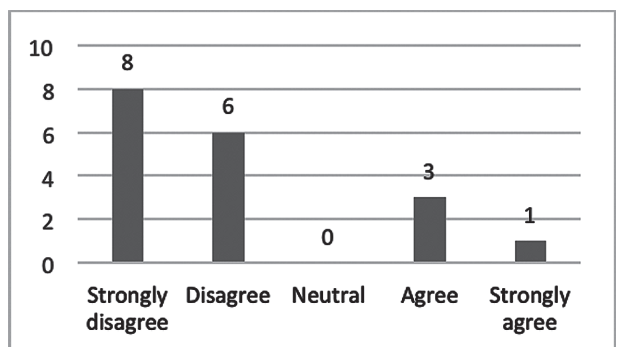
Graph 4.2.2. existence of relevant situations
Source: made by the authors

Currently, group works is one of the innovative methods of teaching since it helps to promote student centered learning; they work collaboratively and can support each other. Unfortunately, only 7 teachers

among 20, we visited were trying to apply this technic. In addition, the CBA principles are not well mastered and applied only by 4 teachers among 20.



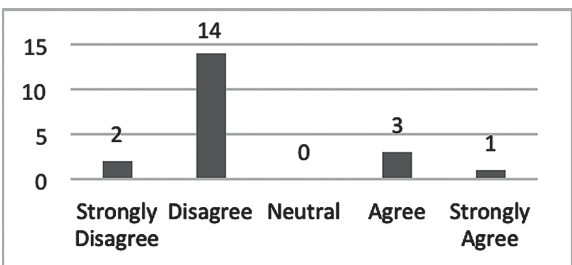
Graph 4.2.3 organization of group work
Source: made by the authors



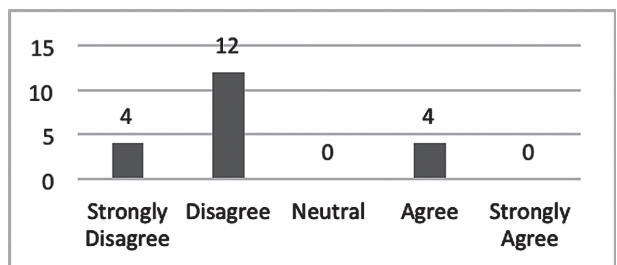
Graph 4.2.4. application of CBA principles
Source: made by the authors

The graphs 4.2.5 and 4.2.6. below confirm the questionnaire results, that many teachers do not

give feedback to students and a lack of formative assessment.



Graph 4.2.5. feedback to students
Source: made by the authors



Graph 4.2.6. effective formative assessment
Source: made by the authors

Conclusion

Senegal like African countries has been committed to bring reform in its educational system by changing the curriculum and the teaching approach from OBA to CBA. This new teaching method enables students to mobilize their knowledge, skills and attitudes in order to solve complex situations connected to real life.

The implementation of the reform was done in a very smoothly way with the help of partners, following many stages. From the writing of the new curriculum to the generalization of the CBA in 2013 many experimentations had been done to assure effectively the success of the reform.

In fact, the CBA has brought some successes like the revision of the curriculum, accordingly to international standards, based on the mastery of competencies, the training of different actors and new challenges in the teaching approach from teacher-centered to student-centered activities. Moreover, the PAQUET program has helped also to provide Senegalese teachers and students, textbooks and teachers guides for effective implementation of the reform.

Despite these successes, it worth mentioning that the implementation of the CBA in Senegal is still constrained with big issues and many challenges could be mentioned. In fact, the study shows that there is a big gap between the intended and the implemented curriculum. The questionnaire and classroom visits, we conducted disclose that many teachers are still teaching using traditional methods. Besides, integrative activities which help student to mobilize their resources to solve complex problem connected to real life are not often fulfilled by many teachers. Teachers are also showing a lack of ability to achieve good assessment based on CBA and their need of continuous training. But the most striking challenges could be the overloaded curriculum and the plethoric classes especially in urban area.

All in all, these challenges deserve to be overcome by the Senegalese Educational stakeholders for an effective implementation of the CBA and the development of an education system of quality.

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