Teachers' Practices in Teaching Mathematics in Selected Schools of Bujumbura Mairie Province in Burundi

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Abstract

The study analyzed teachers' practices in teaching mathematics in selected schools of Bujumbura Mairie Province in Burundi.. The study was guided by constructivism theory which clarifies how teachers can help learners to construct their knowledge. In this study, 92 mathematics teachers participated in this study. Mixed research methods were used in which both quantitative and qualitative data were employed. Findings revealed that the teachers use both learner-centered instructional and teacher-centered instructional methods but the classroom instructions are dominated by teacher-centered instruction contrary to aspiration of the national curriculum which emphases the use of learner-centered instructional practices. Directed observation revealed that many mathematics teachers focus on formal assessment than informal assessment. Therefore, suggests that mathematics teachers need some orientation and training to enhance their classroom practices.

Keywords: Clssroom practices, teachers' instructional principles, assessment strategies, mathematics

1. Introduction

The educational system consists of many elements including students, teachers, administrators, curriculum, financial resources, and technology (Ünal, 2017). However, teachers are the most essential element because the quality of education depend on the competencies and quality of teachers (Ünal, 2017). Teachers' practices vary from planning activities that will take place in class to instructing, motivating, guiding, and disciplining learners (Martínez, Stecher, & Borko, 2009).

Teachers in general, and mathematics teachers in particular, are expected to maintain an organized classroom that encourages and allows students to interact among them and to interact with their mathematics teachers (Merrilyn, Ray, & Katie, 2008). This interaction is of paramount importance as it helps students to significantly learn and conceptually understand the subject content. The case in point is Rwanda where teachers are encouraged to use the learner-centered approach (Rwanda Education Board [REB], 2015).

In Burundi, before the new curriculum which was implemented in 2013, the teaching was done in a transmission manner contrary to aspirations of the new curriculum, which emphases learner-centered instructional practices which encourages problem-solving (Ministere de l'Education de l'Enseignement Secondaire et de la Recherche Scientifique [MEESRS], 2015). However, generally, in Burundi teachers' classroom practices have been researched but less has been done in mathematics especially where there has just been a curriculum reform.

2. .1 Literature Review

The main objective of instruction at all educational stages is to cause a necessary adjustment in the learners' perceptions (Tebabal & Kahssay, 2011). To enhance the appropriate transmission of knowledge, educators should apply teaching approaches suitable for specific goals to produce good results.

Moreover, educational research constantly endeavours to examine the extent to which different teachers' practices enhance student learning growth. Some researchers have tried to classify teachers' practices according to the instructional practices such as learner-centred or teacher-centred, in a various ways (Borko, 1997; Heck, Banilower, Weiss, & Rosenberg, 2008; Swan, 2006; Tarr, Reys, Reys, & Chávez, 2015).

For example, Borko (1997) and Swan (2006) define the teacher-centred approach as one where the teachers transmit rules and information to the learners who are supposed to take it and reproduce it. They define learner-centered as an approach in which teachers enable the learner to seek help from each other while enhancing cooperation, critical and problem-solving, research, lifelong learning, and developing communication skills as well as promoting creative thinking and innovation among learners.

Most of the teachers today are encouraged in their practices to apply the learner-centered approach; to promote critical thinking, interest, and enjoyment among the learners and also to enable learners to seek help or information from each other while building a sense of oneness, enhancing cooperation and developing communication skills, encouraging interaction between pupils and teachers.

For example in Rwanda, teachers are encouraged to use learner-centered strategy (REB, 2015) where, besides the syllabuses, information communication and technology must support the emergence of teaching and pedagogical learner-centered approaches as well as encourage research, communication, and collaborative learning (REB, 2015).

In Tanzania, teachers are also encouraged to use a learner-centered approach (Kafyulilo, Rugambuka & Moses, 2013). However, the same authors found that in Tanzanian secondary schools learner-centered approach is not well implemented. In addition, Tilya, and Mafumiko (2010) found that some teachers in Tanzania are examination and textbook oriented in teaching practices.

In Burundi, since the school year 2012-2013, they adopted competences based curriculum where learner-centered approach is used in Schools. With this new vision, students will have a choice not only in the construction of their knowledge but also in its reinvestment in various situations with the ultimate objective of developing their skills. Teachers are required to have a diversity of skills as well as a sound knowledge of mathematics content, assessment and general mathematics teaching practices.

2.2 Theoretical framework

The study adopted Vygotsky's social constructivism theory (Vygotsky, 1978). The constructivist perspective views creativity and interactive methods in teaching and learning processes that effectively integrate environmental resources that a learner interacts with to enhance discoveries (Abbas, Leong, & Nizam, 2013). Furthermore, Vygotsky (1978) suggested that learning is enhanced if the learner can be assisted by more skilled persons, such as teachers and peers.

Teachers play important roles in the process of facilitating students' learning. Teachers give instructions, comments, and feedback to pupils. In this way, constructivist instruction gives paramount assessment to the development of learners' mathematical ideas and encourages pupils to use their methods to solve problems. Driscoll (2000) explained that instruction offers guidance on facilitating people to learn and develop. Teachers can also choose the teaching approaches, taking into consideration the learning contexts, selecting appropriate materials and activities for students to achieve desired learning outcomes.

Teachers must create a conducive learning environment for learners and teach them using different classroom instruction and assessment practices. Teachers can only do this by monitoring the learning process and knowing what kind of support the learners need at each particular point to enable them construct knowledge. This supports Brooks and Brooks (1999), who said that the main idea of constructivism is that knowledge is not passively received from an outside source but is actively constructed by the individual learner. This shows that the teacher's crucial role is to give instruction or provide the learner with all all sufficient materials and help them develop critical thinking and creativity and construct knowledge. Unfortunately, some teachers continue to teach how they were taught (where teachers were the centres of knowledge-teacher centredness) because human beings naturally look back and claim that the past offered the best.

3. Methodology

3.1 Research design and approaches

In this study, mixed method was adopted under the pragmatism research paradigm (Cameron, 2011; Creswell, 2014). A convergent parallel mixed methods research design was followed to collect and analyze both quantitative and qualitative data (Creswell, 2014). This design was adopted because it integrates the results of both quantitative and qualitative methods during the interpretation phase. The quantitative technique was used to collect information on the teaching practices that mathematics teachers are using in teaching mathematics, in the selected schools of Bujumbura-Mairie Province in Burundi.The researcher used qualitative techniques to get a clear information on mathematics teacher's practices using interview and direct observations in the classroom.

This study's main purpose was to explore the current teachers' practices in teaching mathematics in the selected schools of Bujumbura Mairie Province, Burundi. The targeted population was 120 teachers of Mathematics from 35 public schools of Bujumbura-Mairie Province. Those schools have a higher-level senior secondary school where mathematics is a major subject. The sample size of 92 mathematics teachers was

drawn from this population using online tools ("Sample size calculator," 2008). The 92 mathematics teachers were selected randmonly from the 35 selected secondary schools in Bujumbura–Mairie. As Bujumbura-Mairie has three communes, in each commune 2 schools were randomly for classroom observation and interviews.

The questionnaire had Likert scale statements with three options: disagree, neutral, and agree where disagree stands for never or almost never, neutral for half of time while agree stands for most of the times or almost always. That Likert scale was intended to allow the mathematics teachers reveal their opinion regarding the teaching instructional methods they use. This was followed by classroom observation and interviews that were intended for teachers to give their personal views and opions of why they use a given teaching method.

The quantitative data from the questionnaire were analyzed using descriptive statistics such as frequencies and percentages and was presented in tables to simplify reading and interpretations of the findings. Qualitative data from interviews and classroom observation were analyzed using content analysis which implies among others describing, interpreting, and creating explanations. Quantitative data and qualitative data were compared in order to come up with analytical findings, conclusions and recommendations. In the analysis: N stands for the total number of participants, Freq (frequency) represents the number of reponses and Perc represents the percentage.

4. The findings and discussion

This section presents the findings and the discussion of the key findings from the study on teachers' practices in teaching mathematics in selected schools of Bujumbura-Mairie province in Burundi.

4.1. Mathematics teachers' instructional practices in implementing the new curriculum

Questionnaires that covered teachers-centered instructional practices and learners-centered instructional practices were employed to collect quantitative information. These questionnaires, interviews, and classroom observations were used to respond to the first research question of this study. The findings regarding teachers' instructional practices are presented in Tables 4.1 below.

Table 4.1 Teachers' Responses on Questionnaire on the instructional methods used by teachers in the selected schools

No	Statements	Participants' questionnaire's responses (N= 92)					
		Disagree		Neutral		Agree	
		Freq	Perc (%)	Freq	Perc (%)	Freq	Perc (%)
1	The methods and activities I use reflect attention to	0	0	18	19.6	74	80.4

	learners' experience						
2	I Interact with my learners	2	2.2	21	22.8	69	75
3	Learners only use the method I teach to them	0	0	25	27.2	67	72.8
4	I encourage learners to work more slowly	66	71.7	18	19.6	8	8.7
5	I teach each topic from the beginning assuming learners don't have any prior knowledge of the topic	14	15.2	26	28.3	52	56.5
6	I teach the whole class at once	7	7.6	11	12	74	80.4
7	I try to cover everything in a topic	9	9.8	15	16.3	68	73.9
8	I draw links between topics and move back and forth between topics	5	5.4	26	28.3	71	77.2
9	I am surprised by ideas that come up in a lesson	38	41.3	42	45.7	12	13
10	I avoid learners making mistakes by explaining things carefully first	4	4.3	11	12	77	83.7
11	I tend to follow the textbook or worksheets closely	2	2.1	20	21.7	70	76.1
12	I encourage students to talk and share ideas	1	1.1	11	12	80	86.9
13	I tell learners which questions to tackle	3	3.3	11	12	78	84.7
14	I only go through one method for doing each question	40	43.5	39	42.4	13	14.1
15	I find out which parts students already understand and don't teach those parts	59	64.1	23	25	10	10.9
16	I teach each learner differently according to individuals needs	55	59.8	24	26.1	13	14.1
17	I tend to teach each topic separately	33	35.9	16	17.4	37	40.2
18	I know exactly which topics each lesson will contain	4	4.4	7	7.6	81	88
19	I encourage learners to make and discuss mistakes	64	69.6	17	18.5	11	11.9
20	I jump between topics as the need arises	13	14.1	26	28.3	53	57.6

Source: Field data (October-December, 2020)

The findings , as shown in Tables 4.1, show frequency with which the mathematics teachers use respective practices while teaching mathematics. The details of each aspect are discussed in the following sections:

Teacher-centered instructional practices: Participants' responses varied across different items. For example,regarding the item "*Learners only use the method I teach them*" the majority of the mathematics teachers [67 participants (72.8%)] agreed, while 25 mathematics teachers (2.3%) were neutral which mean that they used to do it sometimes or half of the times and no one reacted against. This implies that the majority of the mathematics teachers believed that learners would succeed if they only use the method given to them by the teacher.

With regard to the statement "*I avoid learners making mistakes by explaining things carefully first*", the majority of teachers [77 participants which represent (83.7%)] agreed, 4 teachers (4.3%) disagreed while [11 participants (12%)] were neutral on this statement. This implies that the majority of teachers prevent their students from making mistakes by explaining what they teach. Further, the majority of the teachers [78 participants (84.7%)] agreed that: "*They tell learners which questions to tackle"*. This implies that most teachers dictate to the learners what to do and how to do it. This is contrary to the theoretical framework (constructivism theory) which stipulates that the learners must construct their knowledge.

This is also an evidence that learners are classrooms as passive receivers. For example 52 mathematics teachers (56.5%) indicated that "*They teach each topic from the beginning, assuming students don't have any prior knowledge of the topic*" and 14 participants (15.2%) reacted against while 26 participants (28.3) were neutral.

This shows that learners rarely participate in class activities since they are mostly passive whereby the teachers give everything to them. This was in line with the statement which states that "*I know exactly which topics each lesson will contain*" where the majority of mathematics teachers [81 participants (88%)] indicated that they *know exactly which topics each lesson will contain.* Only 4 teachers (4.3%) disagreed with the statement and 7 participants (7.6%) of them were neutral. Further,68 teachers (73.9%) indicated that "*they try to cover everything in a topic*", 9 participants (9.8%) disagreed while 15 participants (16.3%) were neutral about this statement. This means that mathematics teachers try to add any materials that they judge important in a topic.

Furthermore, the majority of mathematics teachers [74 participants (80.4%)] agreed that they *teach the whole class at once*, 7 participants (7.6%) disagreed while 11 participants (12%) remained neutral. This shows that the majority of the teachers do not use other method such as as group work or cooperative learning.

The results also show that the majority of mathematics teachers [70 participants (76.1%)] *tend to follow the textbook or worksheets closely.* Only 2 teachers (2.2%) disagreed with this statement while 20 participants (21.7%) of them remained neutral.

This may imply that the majority of teachers do not add or make research but only take the content as indicated in the textbooks and give it to their learners without any modification.

These results are inconsistent with Brooks and Brooks (1999) who said that the knowledge should not be passively received from an outside source but it should be actively constructed by the individual learner. Teachers' instructions and comments contribute to the development of learners' mathematical ideas and scientific investigation of the problem with prior knowledge, determination, and creativity.

These findings are also incoherent with the constructivist view that the role of the teacher is not only to give instruction or to provide the learner with all materials but to help them develop critical thinking and creativity, and to construct the knowledge by themselves. Therefore, teachers must create a conducive learning environment for learners to construct knowledge and guide the learners through different classroom instructions.

*Learner-centered instructional practices:*Table 4.1 contains the items which aimed at verifying if the teachers' classroom instructions are learner-centered instructional practices. However, responses from mathematics teachers indicated that they are not using learner-centered instruction correctly. For instance, when responding to the statement *"The methods and activities I use reflect attention to learners' experience", the* majority of the teachers [74 participants (80.4%)] agreed while 18 participants (19.6%) of the teachers were neutral.

On the other hand, the majority of mathematics teachers [69 participants (75%)] indicated that they interact *with their learners, 2 participants (2.2%) disagreed while 21 participants (22.8%) were neutral. Furthermore, the majority of* mathematics teachers [80 participants (86.9%)] indicated that *"they encourage students to talk".*

However, classroom observation showed that some mathematics teachers asked learners to keep quiet and just look at the blackboard. This is in line with Mabula (2012) and Osaki (2007) who have shown that many teachers in schools tend to focus on covering the content stipulated in the syllabus by using teacher-centred instructional practices.

Furthermore, the majority of mathematics teachers [59 participants (64.1%)] disagreed with the statement which states that: *"I find out which parts students already understand and don't teach those parts"* by indicating that they almost never do it, only 10 (10.9%) teachers agreed while 23 participants (25%) remained neutral. This implies that teachers come in class to teach but they do not pay any attention if some students came back or not.

The majority of mathematics teachers [55 participants (59.8%)] disagreed with the statement which states that *"I teach each learner according to his/her needs",* only few [13 participants (14.3%)] agreed and 24 participants (26.1%) remained neutral indicating that they do it sometimes. This may mean that teachers teach learners using the same approaches regardless of their differences in learning orientation and capacities and background-which are actually crucial for learners' understanding of the content.

In addition, responding to the statement which states that*: "I encourage learners to make and discuss mistakes"* majority of mathematics teachers [64 participants (69.6%)] disagreed, 11 participants (11.9%) agreed while 17 remained neutral. With regard to the statement *"I encourage learners to work more slowly"* the majority of teachers [66 participants (71.7%)] disagreed by indicating that they almost never do, only 8 participants (8.7%) agreed while 18 participants (19.6) were neutral. This implies that the teachers do not leave the learners to try and make mistakes. Teachers' main concern is to finish the syllabus.

While the constructivist theory which is the theoretical framework of this study shows the importance of valuing students' involvement in constructing knowledge in mathematics learning, the findings of this study showed that mathematics teachers had varied perceptions on this aspect. The findings are also partly inconsistent with Vygotsky (1978) who maintained that social interaction is an important way in which learners learn the knowledge available in their classroom without needing to reinvent it themselves.

Consistently, these findings indicated that some mathematics teachers' views on their instruction don't reflect the learner-centered instruction. Even through interviews, mathematics teachers explained that they are not using learner-centred instructions; for example, the following statements were recorded from one of the teachers;

> *"I am informed and I know how to teach using the interactive method, however, I am not using it because of the time. As in this new program, I have the things to teach each week, once you don't do it you find yourself behind others, and consequently, you will not finish the program." (Mathematics teacher, 7th October 2020).*

This shows exactly that mathematics teachers are not using the learner-centered instructional practices. Some teachers do not use learner-centered practices due to lack of knowledge, but because they want to cover the content. Tebabal and Kahssay (2011) assert that teachers must apply teaching methods that involve pupils of different understanding abilities working together in small groups, usually to complete a specific task and participants striving for mutual benefits so that all group members gain from each other`s effort.

Furthermore, teachers are encouraged to use learner-centered approaches in their teaching to promote critical thinking, interest, and enjoyment among the learners. This would further enable learners to seek help or information from each other while building a sense of oneness, enhancing cooperation and developing communication skills, encouraging interaction between pupils and teachers.

4.2 Assessment practices used by mathematics teachers to assess learners

Table 4.2 Teachers' Responses regarding assessment practices used in mathematics

No	Practices	Participants' questionnaire's responses (N= 94)					
		Disagree		Neutral		Agree	
		Freq.	Perc (%)	Freq.	Perc (%)	Freq.	Perc (%)
1	I design my lessons to allow me to monitor student progress	2	2.2	8	8.7	82	89.1
2	My instructional methods and activities reflect attention to issues of access, equity and diversity for learners	1	1.1	8	8.7	83	90.2
3	I probe learner's reasoning	4	4.3	16	17.4	72	78.3
4	I provide time and structure for reflection	5	5.4	6	6.5	81	88.1
5	I give learners immediate feedback when they need directions to proceed	8	8.7	19	20.6	65	70.7
6	I take into account prior knowledge of my learners	2	2.2	14	15.2	76	82.6
7	I make sure the pace of the lesson is appropriate for the developmental level needs of the learners and the purpose of the lesson	4	4.3	5	5.4	83	90.2
8	My questioning methods are likely to enhance the development of learners conceptual / understanding or problem solving	1	1.1	5	5.4	86	93.5
9	My lessons progress based on learners' responses	2	2.2	14	15.2	76	82.6
10	They consolidate the main idea of the lesson in class activities	0	0	8	8.7	84	91.3
11	I identify students who have difficulties in understanding the main ideas of the lesson	0	0	17	18.5	75	81.5

Source: Field data (October-December, 2020)

Key: N stands for the total number of participants, Freq (frequency) represents the number of reponses and (%) represents the percentage.

As per table 4.2 the majority of teachers [76 participants (82.6%)] agreed, only 2 participants (2.2%) disagreed while 14 (15.2%) of them were neutral. Therefore, most of the mathematics teachers believe that generating knowledge is better than just completing curriculum content. A teacher stated that: "*My lessons progress based on learners' responses".*

In addition, the majority of mathematics teachers [82 participants (89.1%)] agreed with the statement which stated that "*I design my lessons to allow me monitor student progress",* 2 participants (2.2%) disagreed and 8 participants (8.7%) were neutral. This implies that mathematics teachers monitor students learning process through knowledge construction and thus able to know what kind of support the learners need at a particular point. This was also seen while mathematics teachers were responding to the statement which stipulates that*:"I make sure the pace of the lesson is appropriate for the developmental level needs of the learners and the purpose of the lesson"* . Where the majority of teachers [83 participants (90.2%)] agreed, 4 participants (4.3%) disagreed and 5 participants (5.4%) were neutral. This implies that mathematics teachers teach what they think that are appropriate for the need of the students.

On the statementS: *"I identify students who have difficulties in understanding the main ideas of the lesson"* 75 participants (81.5%) agreed and 17 participants (18.5%) were neutral. The statement*: "I take into account prior knowledge of my learners*", the majority of mathematics teachers [76 participants (82.6 %)] agreed, only 2 participants (2.2%) disagreed while 14 participants (15.2%) were neutral. These findings show that mathematics teachers before teaching new lessons they test and know the needs of the learners before going to a new lesson.

Furthermore, the majority of mathematics teachers [86 participants (93.5 %)] agreed with the statement: *"My questioning methods are likely to enhance the development of learners conceptual / understanding or problem solving*", only 1 participant (1.1 %) disagreed while 5 participants (5.4%) were neutral. The majority of teachers 72 participants (78.3%) agreed that *they probe learner's reasoning*, 4 (4.3%) teachers disagreed while 16 (17.4%) of them remained neutral about the statement. This means that teachers help learners develop critical thinking and a deeper understanding of the mathematical concepts they are taught. This shows that teachers check if students are following classroom activities and also ask some questions to find out if learners are following.

In addition, *the majority of teachers* [81 participants (88.1%)] *agreed that they provide learners time and structure for reflection.*5 participants (5.4%) disagreed and 6 participants (6.5%) were neutral. Similarly, the majority of teachers [65 participants (70.7%)] agreed with the statement that *they give learners immediate feedback when they need directions to proceed.* 8 (8.7%) of the teachers disagreed while 19 (20.6%) were neutral. This implies that mathematics teachers give enough to time to the learners while they are doing exercises, quiz, and exam. This enhances students' understanding of the concepts taught to them.

During classroom observation and interviews with selected mathematics teachers, it was found that the mathematics teachers have different views on how they assess their learners. A teacher stated that; "to be sure that learners understand the theory learned in class, I give them many class room exercises, quiz and home works. This shows that many mathematics teachers value formative assessment in learners conceptualization of mathematics (Mathematics teacher, 30th October 2020). This is why many mathematics teachers focus on formal assessment than informal assessment.

However, informal assessments like teachers' oral questions during teaching, monitoring, and listening to learners' answers are effective for enhancing motivation to learn, developing positive attitudes toward the subject, improving problem-solving skills, retention, and consequently improve performance. In view of Caruso and Woolley (2008) teachers must apply practices that could be effective to motivate pupils, encourage active learning and develop key critical thinking, communication, and decision-making skills.

In all the observed lessons, classroom practices were predominantly teacher-talk where teachers introduce new subject matter and present summaries or overviews but less time is spent on discussions. This means that learners are not given ample time to reflect on or share ideas on what they are about to learn. It was also observed that by the invitation of the teachers, learners spend a lot of time doing an exercise on the blackboard as well as writing and working out questions in their exercise books individually. Learners wait until the right answer is given and then copy that answer. Learners are not given opportunity to learn or practise the content learned.

Conclusion

From the findings of this study, it can be concluded that mathematics teachers use both teacher-centered and learner-centered teaching instruction. But teachers-centered instruction seems to be dominant. Teachers are more interested in completing the curriculum content rather than helping learners understand mathematics.

Mathematics teachers tend to focus more on formal assessment than informal assessment. Informal assessment enhances learners' motivation, develop positive attitudes toward the subject, improve problem-solving skills, retention and consequently improve performance. Teachers are supposed to use oral questions during teaching, monitor, and listen to learners own understanding and responses to the content. Teachers must use teaching practices which put the student in the center of the instruction. It is suggested that, mathematics teachers need some training on assessment strategies that would allow learners conceptualize mathematical content.

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