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Implementation of Learner-Centered Strategies in Teaching and Learning Mathematics in Rwandan Secondary Schools of Rulindo District: Challenges and Achievements

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Abstract: *Recently, the use of learner centered pedagogy was adopted to improve the teaching and learning process. However, its successful implementation is challenged by different factors. In this regards, this research was aimed at investigating the challenges encountered in using learner centered pedagogy for teaching mathematics secondary schools of Rulindo District in Rwanda and the possible strategies adopted by mathematics teachers. Both qualitative and quantitative data were collected both randomly and purposefully from a sample of 240 students and 16 mathematics teachers selected from 4 secondary schools. The above data was collected by using Likert scale questionnaire, interview guide and classroom observation. For ensuring the validity and reliability of data collection tools, they were piloted in secondary schools of Gicumbi District after which the Pearson correlation coefficient (r) and Cronbach Alpha (α) were computed. All questions were adjusted to have r>0.5 and data collection tool was reliable as α was 0.87 that is greater than 0.7. The obtained data were analysed both descriptively and thematically. Different challenges were realized in using learner centered pedagogy for teaching mathematics. These include, overloaded classrooms, overloaded syllabuses, poor student background, insufficient training and inadequate ICT tools. Different strategies including the use of groups of students with differentiated capacities, empowering CPD culture and peer learning within close schools were adopted. The use of effective strategies for effective implementation of learner centered pedagogy were recommended.*

Keywords: *Learner centered pedagogy, Mathematics, Challenges, Strategies, Group works*

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1. Introduction

Education has been defined as a process of renewing the meaning of knowledge probably occurring in the regular linkage with young people, may also occur in deliberate and institutionalized entities for social sustainability generation (Thangeda, Bakisanani & Thatoyamodimo, 2016). Based on its importance, learners should be provided with a learning environment to enable them to be engaged in the process of learning and help them to acquire the desired skills. Teaching and learning is the most relevant activity within any educational setting. It plays the

role of developing the mental capacity and behavioral change of learners. The activities within teaching and learning are shared responsibility between teachers and students. In this perspective teachers play a great role in completing the process or making student active learners (Kumar, 2016). Regardless of the importance of education in equipping people with required knowledge and skills, data from the recent studies indicated that some students from the Sub-Saharan Africa and South Asia spend many years at school without a sound progress on basics of mathematics (Westbrook et al., 2013).

Two methods of teaching are broadly used as a framework of instruction in different levels of educational. These include teacher-centered and learner-centered methods. A teacher-centered method is kind of teaching strategy in which learners place all their attention on the teacher capacity. It is an approach where teacher is considered as the only primary sources of knowledge during classroom activities. Contrary, in the learner-centered approach, students are provided with the opportunities to express meaningfully and actively involved in any issue and concerns of an academic subject (Cain, 2020). This type of learning facilitates students in shaping their own learning paths and places upon them the accountability to participate actively in improving their educational process.

Learner-centred pedagogy was found to be impeded by different challenges that may impact on students' performance. These challenges include the lack of adequate trainings, lack of adequate teaching and learning materials and big class size (Yilmaz, 2008). It is in this regards the present study was planned in terms of investing the challenges preventing the successful use of learner centered pedagogy in teaching mathematics since no documented research related to this issue was identified.

Specifically, this research was aimed at investigating:

1. The challenges faced by mathematics teachers while teaching mathematics
2. The strategies used by mathematics teachers to address the challenges faced while teaching mathematics.

2. Literature Review

Mathematics is always being treated as an important subject of general education specifically in science education. In this regards, effective teaching and learning methods for this subject is needed. To succeed in teaching mathematics, teachers should emphasize on different teaching methods related to learner centered approach so that they can stimulate students to understand the content in mathematics and perform well. Mathematics teaching and learning was agreed as ongoing process by which learners advance a solid understanding of adequate concepts in mathematics and procedures to be used in each academic level. Students have to be guided in developing sufficient confidence for discovering their mathematical problems and use critical thinking in solving them as well as their life problems (Surya & Putri, 2017).

If students do not learn the basic mathematics concepts at an early age, their performance in advanced curriculum may be low. In the African countries, including the Republic of Rwanda, different initiatives for improving the teaching and learning of mathematics and science have been developed. However, the UNESCO monitoring report showed adverse teaching practices and teacher-centred approaches persistence in most of sub-Saharan Africa countries (UNESCO, 2004). In terms of promoting the learner centered pedagogy, the Ministry of Education in Rwanda put in place a new curriculum known as Competence Based Curriculum (CBC) in Primary and Secondary schools. This new initiative was to start from 2016 (Ndihokubwayo, Nyirigira, Murasira, & Munyensanga, 2020). The CBC focuses much on creativity and helping learners to use the acquired skills and knowledge in their real life (Ngendahayo & Askell-williams, 2016).

Learner centred learning approach involves active, rather than passive learning, requires deep understanding, has increased responsibility and involvement of the student in their learning, involves respectful and sound relationships between the teacher and student, and requires both the learner and teacher to be reflective throughout the process (Lea, Stephenson, & Troy, 2003). The learner-centred learning approaches come from a constructivist epistemology knowledge and context remain connected and learners develop meaning by solving problems that develop their understanding. It is about constructing knowledge rather than passively receiving it, as it happens in learner- centred learning contrast, commonly used in teaching. Constructivist approaches in mathematics are generally student-directed; motivated by a view that students should discover their own ways to solve open-ended problems often through applied rather than abstract contexts as the primary means of understanding core principles and the relationships among them (Fahey & Bussell, 2021). In the Rwandan education system, learner-centred approach was assigned to have a number of characteristics, including discovery approach, students' active participation and engagement of students in experimentations and other science processes (Nsengimana, Habimana, & Mutarutinya, 2017).

Irrespective to the popularity of the learner-centred approach, several challenges were identified to prevent teachers from successful implementation of such innovative teaching approach. Based on the study of Yilmaz (2008), most of the challenges of learner centred approach are associated with high population density in class, absence of teaching and learning resources and time constraints. This is in line with the study of Christopher, Yarkwah & Arthur, (2020) stating that the inadequate teaching and learning materials (TLMs) impacted the understanding of certain mathematical concepts to the

students. On the other hand, the inadequate technology, shortage of time, and lack of standardized tests were also found to be key barriers, but their mean scores were relatively low Reigeluth (2011). During the study conducted by Schweisfurth (2011) concerning a meta-analysis of 72 articles from the International Journal of Educational Development to investigate why the learner-centered education was less effective in developing countries. Several major obstacles were found to prevent the successful implement of the learner-centered approach in education. Among these obstacles were the shortage of teacher training, difficult concepts for teachers to understand, practical and resources limits, discrepancies with national curricular and examinations, and cultural concerns were identified. Additionally, it was also noted that some teachers were not comfortable with their new role as a facilitator taking the independence of students as a threat to their identity (Robinson, 2015).

Studies conducted by different scholars come up with several challenges towards teachers from properly implementing this method of teaching that is regarded as more innovative in nature. These challenges include lack of adequate resources like science apparatuses, chemicals, classrooms, laboratories, science textbooks, among others as found in different countries, including Malawi, Nigeria, Ethiopia, Zambia, Kyrgyzstan, and Namibia (Chiphiko & Shawa, 2014).The inadequate competence in teaching, learning cultures and the belief of students and staff, as well as the lack of familiarity of students with the learner-centred instruction were also found to be the barriers of learners centered (Simon, 1999). The study of Edmore & Aneshkumar, (2020) stated that the teaching mathematics was challenged by the lack of in-service trainings, students' behaviour, lack of students' interest towards mathematics, shortage of teaching and learning resources, large class size and too long syllabi.

Similarly, Ossai (2004) identified that the lack of awareness on the new teaching strategies may be resulted from inadequate sensitisation carried out in schools while Owolabi & Adedayo (2012) provided inadequate teachers' trainings in areas such as improvisation, high populated classroom management and difficult concepts teaching as source of poor implementation of learner centered identified in Nigeria. On the other hand, Lea, Stephenson & Troy (2003) talk of poor or lack of understanding of the approach. The language used as medium of instruction, the culture, negative attitude towards student-centred approach were also found to be the barriers for effective implementation of learner centered pedagogy (Coburn, 2001).

Different challenges were also found to be obstacles for applying the learner-centered approach in teaching and learning mathematics. According to Paper (2019), the need for covering the syllabus content, lack of interest from students culminating from different reasons and the shortage of professional teachers challenge the application of the learner-centred strategies in teaching mathematics. The effect of lack of trainings on students' performance was also cited by (Ibañez, Subia, Medrano-allas, Mendoza, & Mina, 2021). It was claimed that teachers need to be trained on pedagogy, educational research, measurement and evaluation and classroom management (Dizon, Calbi, Cuyos, and Miranda, 2019).

In the context of Rwanda, it has been found that the implementation of learner-centered pedagogy was challenged by overcrowding in classroom (Ndihokubwayo, Mugabo & Byusa, 2019) and insufficient teaching and learning materials (Pearaer, Kabanda, Nzabalirwa, Nizeyimana, & Uworwabayeho, 2015). The teaching and learning resources have a significant effect on any achievement of student as they concretize learning. The poor understanding of learner centered strategies was also highlighted in some Rwandan teachers. This was concretised by Mugabo (2015), who contends that Rwandan teachers required common understanding of inquiry because many of them confused inquiry teaching method with some of its specific characteristics.

In terms of addressing such challenges Kishore (2016) advised that school leaders need to support in learner-centred management and provide the all necessary possible requirements for enabling both teachers and students to perform well.

3. Methodology

3.1 Research Design and Data collection

This study has adopted a cross-sectional survey research design in terms of assessing and comparing many different variables from sampled schools. A cross-sectional research design was used to select a number of secondary schools to represent the entire number of schools in Rulindo District. This research design was adopted because it is relatively faster and inexpensive. During this process, both quantitative and qualitative data were collected in terms of providing meaningful information. The quantitative data were collected from students while qualitative data were collected from mathematics teachers to complement the quantitative data provided. In addition, classroom observation was undertaken to better understand the real context of the use of learner centered pedagogy. During data collection, a sample of 240 students and 16 mathematics teachers were selected from 600 students and 20 mathematics teachers respectively. A sample of students to be involved was determined by using the Slovin's formula ($n = \frac{N}{1+N(e)^2}$) where: n is a sample size, N population size and e is margin of error or tolerance error which is 0.05 or 5%. On the other side, all 20 mathematics teachers within four selected secondary schools were expected to be involved in the research, but four were absent during the period of data collection.

Different data collection tools were used to obtain data within this research. These include Liker scale

questionnaire for teachers and students, interview guide for teachers and classroom observation. All questions were elaborated in relation to the challenges faced in learner centered application in teaching mathematics.

3.2 Validity and Reliability of data collection tools

To ensure validity and reliability of data collection tool, it was piloted in 2 secondary schools of Gicumbi District after which Pearson coefficient correlation (r) and Cronbach alpha (α) were computed by using SPSS software. For making the research questionnaire more suitable for data collection, the questions with Pearson correlation coefficient <0.5 have been eliminated while others have been adjusted. On the other side, the computed Cronbach alpha (α) for questionnaire was found to be 0.87 making it to be reliable as the questionnaire is reliable is Cronbach alpha is greater than 0.7. Moreover, Content validity was checked by research supervisor and other educational expert to ascertain whether all questionnaires' items were suitable for their purpose.

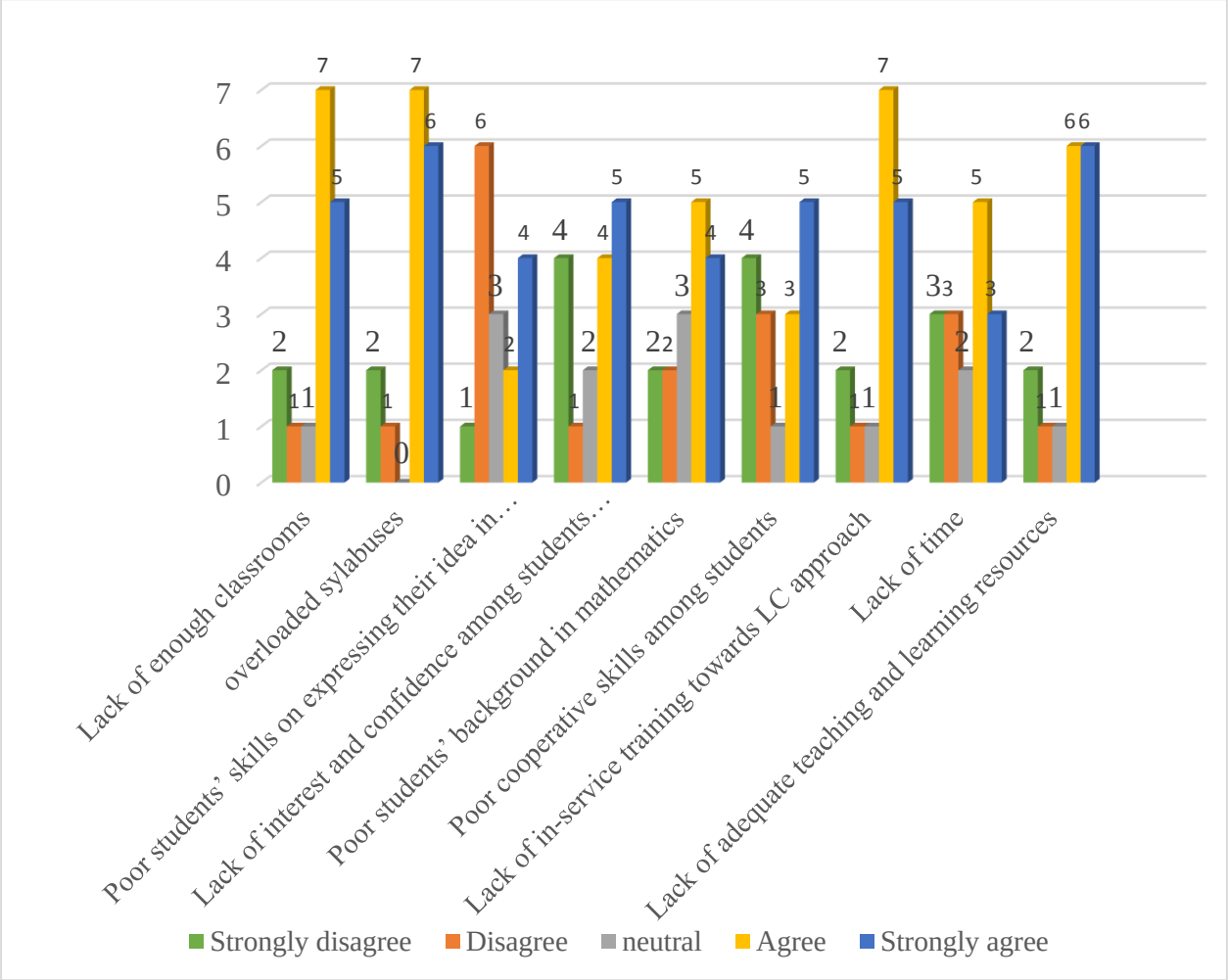
3.3 Data analysis techniques

After entering and coding data in SPSS software, descriptive statistics was used to analyse data. In this context, frequencies, percentage, mean and standard deviation were used to analyse data and figures and tables were used to present the findings. On the other side, qualitative data from interview and classroom observation were thematically analysed and presented in verbatim for supporting quantitative data during the discussion of findings.

4. Results and Discussion

4.1 The challenges faced by mathematics teachers during application of learner centered pedagogy

For understanding the challenges in teaching and learning mathematics, the researcher asked respondents to give their view on the challenges regarding the applications of some learner centered strategies in classrooms activities. The results were presented in the figure and table below.



***LC: Learner Centered**

Fig1: The challenges faced by mathematics teachers in applying learner centred pedagogy (Source: Primary data 2021)

Figure 1 above displayed the challenges preventing mathematics teachers to effectively use learner centered approach. Referring to the figure above, it has been identified that the main barriers to the effective use of learner centered pedagogy include the overloaded syllabus (13/16), lack of enough classrooms (12/16), lack of in-service training (12/16), and the lack of adequate teaching and learning materials (12/16). On the other side, there are other factors which have been recorded to be the barriers for learner centered implementation with a little impact. These include the poor students' background in mathematics (9/16), poor cooperative skills among students (8/16), the lack of interest and confidence among students towards mathematics (9/16), poor students' skills on expressing their idea in English (6/16) and lack of time (8/16).

Table 1: Mean and standard deviation for the challenges regarding applications of strategies used in teaching mathematics

Challenges	M	SD
Lack of enough classrooms	4.5	.700
Overloaded syllabus	4.0	.726
Poor students' skills on expressing their idea in English	4.5	.743
Lack of interest and confidence among students towards mathematics	3.35	1.023
Poor students' background in mathematics	4.16	.718
Poor cooperative skills among students	3.9	.6
Lack of in-service training towards learner centered approach	4.7	.7
Lack of time	4.1	.6
Lack of adequate teaching and learning resources	4.6	.5
Overall	**4.19**	**0.69**

***M=Mean, SD=Standard Deviation**
Source: Primary data, 2021

Based on the findings presented in table 1 above on the average of agreement on the challenges preventing the effective use of learner centered pedagogy in teaching and learning mathematics, it has been shown that the application of this approach is challenged by many factors **(M=4.19, SD=0.69**). Amongst these challenges include, the lack of enough classrooms (M=4.5, SD=0.7), overloaded syllabus (M=4.0, SD=0.726), poor students' background in mathematics (M=4.16, SD=0.718), lack of in-service training towards learner centered approach (M=4.7, SD=0.7), lack of time (M=4.1, SD=0.6), and lack of adequate teaching and learning resources (M=4.6, SD=0.5).

The impact of these challenges on the effective use of learner centered pedagogy in teaching and learning mathematics was discussed with teachers during interview.

4.1.1 Lack of enough classrooms

During the interview with mathematics' teachers, most them claimed that they lacked enough buildings for enhancing the implementation of the learner centered pedagogy. In this context, one respondent said "*in our school we have a limited number of infrastructures for facilitating learner centred pedagogy. We have a small library, inadequate number of classrooms, and the lack of laboratories. The lack of enough classrooms makes our class to be overpopulated which normally prevents the effective use of learner centered strategies like group works, so sometimes we opt to use teacher centered due to the high number of students in the classroom.*

These findings are supported by those from the study of Ndihokubwayo, Mugabo & Byusa (2019), showing that the use of learner centered in Rwandan education system was challenged by overcrowded classes. Similarly, Yilmaz (2008) has found that most of the challenges of learner centred approach are associated with large class size, lack of resources and time constraints. The same issue was observed during classroom observation where some classes were overcrowded (more than 45 students in one class), which hindered the use of some learner centred strategies like collaborative learning and group discussion. Based on this high number of students, the siting arrangement was also observed to be not convenient. The students were observed seating in rows facing teacher and blackboard. Such seating style was not convenient for students to participate in discussion during classroom activities. Maša & Mila (2017) argued that parents believe that teacher pay more attention to their children when they form a smaller class size compared to when they form a large class size. The results also conform to that of Msuya (2016), where it was found that the common challenges of learner-centred curriculum were shortage of teaching and learning resources including inadequate library space.

4.1.2 Overloaded syllabus

In terms of having a clear understanding on how the large volume of syllabus prevented the successful use of learner centered pedagogy, an interview was carried out with 16 mathematics teachers who participated in this research. During this interview, most of them claimed that mathematics syllabuses were too long to cover. One of the interviewed teachers said *"there is a problem in covering prepared syllabuses. The syllabus of Mathematics for senior three is too long. Therefore, it is difficult to use learner centered strategies and cover it within a planned time and other teaching commitments. In this regards, we mix both learner centered with teacher centered approaches*". These findings conform to that of Mwangi (2014) stating that the heavy teaching load and stress for covering the syllabus were among challenges facing

implementation of learner centered approach.

4.1.3 Poor students' skills on expressing their ideas in English

English language was adopted as the medium of teaching and learning in Rwandan education system from 2009 (MWISENEZA, 2015). However, during the interview with mathematics teachers in selected secondary schools, it was evidenced that students in these schools were struggling with English language. This can a barrier for effective implementation of learner centred pedagogy. In this line, some students cannot participate in group discussion for providing their ideas due to the language barriers. On the other side, the language barrier reduces the level of understanding of students as sometimes they don't grasp what the teacher explains.

During the interview, one of the teachers said: *"if I explain in English only, most of students in classroom are lost, so it requires to use more local language (Kinyarwanda) so that they can get something. On the other side, the students' discussions in groups are held in Kinyarwanda as a common language to them".* In the same vein, Coburn (2001) has found that language used as medium of instruction and the culture could negatively affects the attitude towards student-centred approach. The issue of language barrier was also identified during classroom observation where in most of observation carried out, students discussed in mother tongue (Kinyarwanda) during a given activity to work in group.

4.1.4 Lack of interest and confidence among students towards mathematics

Teaching and learning process can be influenced by the students' interest and confidences towards a certain subject. However, the interviewed mathematics teachers during this research have declared that majority of students in their schools lack interest and confidence towards this subject. Most of the interviewed teachers explained that students in their schools believed that mathematics is a difficult lesson and impossible to perform. This reduces their interest and confidence towards it thus a little emphasis on it. This has been noted during classroom observation, where a big number of students used to study other subjects than mathematics during their self-study time. It is in line with the findings of Paper (2019), outlining that the need for covering the syllabus contents, lack of students' interest resulted from different reasons and shortage of professional teachers challenged the implementation of the learner-centred approach in teaching mathematics.

4.1.5 Poor students' background in mathematics

During the interview, mathematics teachers declared that some students enrolled in advanced mathematics (in senior 4) were not well equipped with mathematics subject content hence their low performance in advanced level mathematics. One of the interviewed respondents said; "*In our school, we normally given students with low marks to join the combination with maths subject like Mathematics Economics and Geography (MEG), it should be better if students selected to study mathematics combinations have high aggregate scores at ordinary level like those of grade I and II. These at least can fit in mathematics combinations in advanced level. But if you take students with grade III and IV only, it will give a great task for teachers to make them good performers in the subject".*

The above narrative are in relation with that of Michael (2015) who have found that insufficient self-practice and poor mathematics background of students were the key challenges opposing students' performance. The low students' capacity was also revealed by (Makunja, 2016). In her investigation on the challenges preventing teachers to successful implement the competence-based curriculum in Tanzanian secondary schools, she found that low capacity of students who start secondary schools hindered the successful implementation of the learner-centred pedagogy. The same issue was noted during the classroom observation where some students were not able to solve the simple mathematics equations given.

4.1.6 Lack of in-service training towards learner centered approach

During this research, it was evidenced that lack of in-service training impeded the effective implementation of the learner centered approach. Some teachers stated that they had received learner centered skills during their study, however, a great number of mathematics teachers (9/16) participated in this research took their study before the emergence of this approach, however, they had received few of professional development trainings related to the effective methods of implementing the learner-centred teaching approach. The above findings are supported by the findings of Schweisfurth (2011) showing that several obstacles prevent the effective implementation of learner-centered education. Among these obstacles, he stated the lack of adequate training for teachers, the difficult concepts for teachers to understand, constraints pertained to practical and teaching materials, discrepancies with national curricular and examinations, as well as cultural issues.

In this context, one of the interviewed teacher said; **"***I have 5 years in this school but within this period of time, I have attended only one training prepared by Rwanda Basic Education Board. This training helped me to be updated on matters related to teaching and learning. In any case of introducing a new system in education, specific trainings are needed. In this regard, we need more trainings for better understanding of different strategies to be used in applying learner centred pedagogy".*

The same issue was identified in Nigeria, where Owolabi & Adedayo (2012) , found that learner centered was challenged by inadequate professional development heightened by total lack of teachers' training in capacities of improvisation, large classroom management and the teaching of challenging concepts. From the findings of Komba (2015), regular trainings for in-service teachers were recommended in terms of enabling them to acquire up-to-date teaching skills necessary within any changes introduced in the school curricula. In the same context, Nsengimana (2017) discovered the limited practical skills and the learner-centred techniques in different teachers. He found the capacity building for in-service teachers as the only strategy for addressing this problem.

4.1.6 Lack of time

It was found that successful implementation of learner centered approach required more time, which was not possible for the school planned timetable as interviewed teachers reported. The majority of the teachers complained that within a lesson of 40 minutes, it is not easy to use learner centered methods like group work. Teachers explained that within 40 minutes, they distribute materials and provide guidelines, some students claim for not getting the materials being distributed, and a 40 minutes-lesson ends without even having started the lesson. It concurs with the findings of Yilmaz (2008), stating that most of the challenges of learner centred approach are associated with large population in class, lack of teaching materials and time constraints. Similarly, the study of Reigeluth (2011) identified the lack of adequate technology, shortage of time and lack of standardized tests as the major obstacles for successful implementation of learner centered methods

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4.1.7 Shortage of adequate teaching and learning resources

For using learner-centred pedagogy in classrooms, different resources are required. Among these resources we may include books, laboratory apparatuses, computers and their accessories. However, mathematics teachers participated in this study reported the lack of enough teaching and learning resources in classrooms. One of the interviewed teachers of senior three responded *"Here we have few mathematics books only used in classroom lessons, no sufficient computers are available and we do not have any projector to be used in classroom for demonstrating some aspects of the topics. So, it is difficult for students to do more exercises to better understanding as no enough books are available"*. The same issue was detected during classroom observations where in some classrooms one book was shared by 8 to 10 students and in two of 4 observed schools, no computers to be used by students in their learning were available. It is in contrast with the findings of Anderson (2004) recommending the ICT tools, books and the improved physical environment as the components affecting the behaviour and attitudes of students towards classroom learning. Therefore, the availability of teaching and learning materials could improve the level of understanding of the learners. Similarly, it has been found that, students will perform better in general in Mathematics as long as they are given chance for interacting or participating actively in the teaching learning process in the presence of instructional materials (Adebule, & Ayoola, 2016). The lack of adequate instructional materials and resources leads students to remain as passive participants during teaching and learning process (Obeka, 2020).

4.1.8 Strategies used during implementation of learner-centered pedagogy in teaching and learning mathematics

Regardless of different challenges declared by mathematics teachers involved in this research, they have developed several strategies to overcome these challenges. Some of these strategies are summarized in the table 2 below.

Table 2: Mean and SD Scores of the common strategies used in applying learner centered Strategies

Statement	n	M	SD
Teachers assign homework after class completes the section as methodology	240	4.07	.549
Teachers use notice and provide a routine supports to students understanding the content and activate knowledge in a low-stakes way	240	4.17	.665
Teachers use number talks to support students to increase fluency by discussing and critiquing structure, patterns, and mathematical properties	240	3.57	.724
Teachers use representations and reasoning to provide a solid foundation for oral communication of ideas	240	3.78	.928
Teachers use group discussion method in classroom to present issues and have students talk about it	240	4.00	.576
Teachers use small groups methodology to for deep discussion among students	240	4.19	.762
Overall		**3.96**	**.70**

***n=Sample size for students, M=Mean, SD=Standard Deviation**
Source: Primary data, 2021

The findings in table 2 showed a moderate agreement of the students involved in this research towards the use of different leaner centered strategies in teaching mathematics. This is confirmed by the calculated average mean score and standard deviation. The findings showed the overall mean of 3.96 and standard deviation of 0.57 indicating the moderate agreement as the mean is around the neutral rating score (3). Regardless of the moderate agreement on the general application of learner centered methods, some strategies showed the expense use compared to others. These include, the assigning homework after class (4.07), the use of notice and routine supports (4.17), group discussion (4.00) and use of small groups (4.19).

These findings from students who learnt mathematics were supported by those from the interviewed mathematics teachers who stated that they tried to use learner centered approaches in teaching mathematics regardless of many challenges they faced during the process. One of the teachers interviewed said *"we normally use learner centered method in teaching mathematics, but the most commonly techniques used include question-and-answer, group discussion, and experimentation*". The group discussion plays a great role in improving important skills in students like problem solving skills and communication skills. It is in line with the study of McCombs & Whisler (1997) that found collaborative strategy as an authentic learning experience by which learners are helped in developing real life skills such as creativity, communication and critical thinking skills. Within this aspect, teachers have to encourage students to work together solving problems rather than being passive in the classroom. In the same context, the oral question-and-answer, group discussion and exercises were the common methods used in teaching mathematics as recorded during classroom observation.

In addition, some of them cited that *experimental and inquiry-based methods strategies are also used by Mathematics teachers*. For the question related to whether Mathematics and Science teachers were familiar with problem solving, open ended, closed ended, problem tree, discovery, project based, resource based, brainstorming in teaching mathematics, 10 teachers out 16 that they were familiar with all the above teaching strategies. On the other side, the remained 6 confessed that they know a few of the above strategies. Among these 6, one interviewed teacher said "*frankly, I am only familiar with open ended question, resource based and brainstorming, these are the only learner centered methods I find to be possible in teaching mathematic"*. However, majority of the interviewed mathematics teachers said that they have increased their knowledge through the continuous professional development within their schools and peer learning activities together with other close schools. This is line with the study of Sofianidis & Kallery (2021) who found that the formative assessment during the lesson allows teachers to record the level of their students' understanding. From the responses of the formative assessment, a teacher can adjust the teaching methodology based on students' needs.

5. Conclusion and recommendations

5.1 Conclusion

Learner centered pedagogy was found to play a great importance in teaching and learning process including the teaching of mathematics. However, its successful implementation was found to be prevented by different challenges. From the experience of secondary schools of Rulindo District, teachers of mathematics were interested in moving in this direction, but more effort is needed in terms of addressing different obstacles in this domain.

5.2 Recommendations

Based on the finding from this research showing how the use of learner centered pedagogy depends on different factors, the government and other educational institutions have to invest more in resource provision, preparations of teachers and increasing infrastructures for enhancing the effective use of learner centered pedagogy in teaching mathematics as well as other subjects. On the other side, more research is needed in terms of evaluating the strategy which is more efficient among all strategies used in learner centered approach.

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