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Implementing mathematics curriculum in primary schools in Botswana: Issues and challenges

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Abstract
The study investigated the implementation of the mathematics curriculum in primary schools in Botswana in terms of challenges faced, strategies used for effective curriculum implementation as well as the general conception of mathematics as a discipline by teachers. Studies show that the way teachers understand curriculum has an impact on how they participate in its implementation. A sample of 620 teachers selected from both public and private schools was selected using stratified random sampling procedure to participate in the study. A structured questionnaire that employed a 4-point Likert scale was used for data collection. Data was analysed using One-way ANOVA, Mann-Whitney U-test and HSD Post Hoc procedures. Results of the study showed that primary school teachers face a number of challenges that affect effective implementation of the primary school mathematics curriculum. Among such challenges include large class sizes, inadequate to poor professional training on mathematics, heavy workloads and a general fear and anxiety towards mathematics as a discipline. Results further showed that because of these challenges which leave them with low confidence levels to teach the subject, teachers tended to use teacher-centered teaching strategies instead of learner-centered strategies thus leading to what is called low epistemic quality of teaching mathematics. It was also shown in the results that teachers from private schools tended to implement the mathematics curriculum better than those in public schools and also that level of education has an influence on how effectively curriculum is implemented while gender does not have an influence.

Key words: Curriculum, mathematics, curriculum implementation, challenges, strategies, curriculum conception

Introduction

Mathematics is considered a very important subject in the lives of people because of its utility value in everyday processes and transactions. The above is alluded to by UNESCO (2012) which avers that there is a general understanding among people that mathematics is omnipotent (mathematical fallibilism in which mathematics is viewed as an everyday human activity) in today's world as evidenced by its application in everyday exchange and communication processes. However, the way it is sometimes taught has led some people to doubt this valuable role it plays and at worst, has made other people to have a negative attitude towards it. Kaptan and Timurlenk (2012) aver to the fact that there are two contradictory issues around the teaching and learning of mathematics and science. They argue that on one

hand, while mathematics as a science seeks to demonstrate its liberatory power through a combination of the excitement and thrill that comes with discovering new mathematical knowledge and insights that mathematics provides, on the other hand, the teaching methods used to achieve this aim often seem to rely on dogmatic and authoritarian approaches in which students must accept what they are taught as uncontested,unequivocal and unquestioned. Extant literature indicates that such a teacher-centered approach has caused even the most brilliant of students to start questioning whether mathematics is indeed their line of learning. Kadbey et al (2015) argue that to be able to motivate students to learn mathematics better and in a way that motivates and develops in them critical thinking skills, a shift from traditional didactic teacher-centered approaches to an approach that is active and learner-centered is needed. Rudhumbu (2014) and also Posamentier (2017) argue that motivating mathematics students to want to learn mathematics is one of the most critical elements of effective implementation of the mathematics curriculum.

Research objectives

This study is guided by the following research objectives:

1. To establish how primary school teachers perceive mathematics as a subject.
2. To investigate factors that affect effective implementation of primary school mathematics curriculum.
3. To identify factors that act as barriers to effective implementation of primary school mathematics curriculum.
4. To propose strategies that can be used to enhance the implementation of the primary school mathematics curriculum.

Hypotheses

H01: There is no significant statistical relationship between gender of teachers and effective implementation of the primary school mathematics curriculum.
H02: There is not significant statistical relationship between educational level of teachers and effective implementation of the primary school mathematics curriculum.
H03: there is no significant statistical relationship between type of school (private or public) the teacher comes from and effective implementation of the primary school mathematics curriculum.
H04: There is no significant statistical relationship between how teachers conceive mathematics and how they implement the mathematics curriculum.

Literature review

The concept of mathematics teaching

The origin of the word mathematics lies in the Greek word *mâthẽma*which means "what one learns," "what one gets to know" and hence it has been viewed as any of the following: "knowledge", "a study" or "a learning" (Appiahene et al (2014). These different ways of knowing and understanding mathematics show that the nature and meaning of mathematics is still highly contested. Effective mathematics teaching according to Barbeau and Taylor (2009) should help students to understand mathematics not as a static corpus of knowledge but rather as a dynamic and expanding part of their everyday existence. This means that effective teaching of mathematics across all educational levels, should take mathematics beyond basic numeracy, measurement and calculations to application in everyday lives of learners, that is, it should concentrate on mathematical literacy which involves skills such as application, comprehension, discovering and modelling (UNESCO, 2012). Okafor and Anaduaka (2013) aver that effectively taught mathematics can assist learners to think critically and engage in robust problem solving. Mastery of basic numeracy, measurement and calculations which for long constituted the rudiments of mathematical knowledge required for effective transactions in society no longer suffice

today owing to the digital culture where at the click of a button, even complicated mathematical problems are solved and resolved (UNESCO, 2012).

Hudson et al (2014) posit that the way mathematics is taught determines the nature of the epistemic quality of the subject. For example, high epistemic quality of mathematics involves a teaching approach that presents mathematics as a fallible, refutable and uncertain subject which promotes critical thinking, creative reasoning, the generation of multiple solutions and learning from trial and error thus evoking the idea of learner-centered approach (Hudson, 2013; Milik & Boylan, 2013). In support the idea of high epistemic quality, Mason et al (2010) argue that effective teaching of mathematics is defined by contradiction, tension and surprise that arise when learners are put in a problem-solving situation where they have to question, challenge and reflect on what they are learning. This according to Henderson and Hudson (2011) means taking answers to mathematical problems as resolutions rather than solutions. On the other hand, low epistemic quality of mathematics defines a teaching approach that presents mathematical concepts as infallible, authoritarian, dogmatic, absolutist, irrefutable and certain and that involves rule following and right and wrong, thus evoking the idea of teacher-centered approaches (Hudson et al, 2014).

In their separate studies on the integration of technology in the teaching of mathematics, Mbugua (2011), Halat and Peker (2011), Lin (2008) as well asDivaharan (2011) found that integrating technology in the teaching of mathematics improves learners' understanding of mathematical concepts and also that it increased their motivation to learn mathematics. Such teaching according to Barbeau and Taylor (2009) helps to develop operational knowledge in learners, that is, an ability to draw on appropriate mathematical tools to effectively deal with new and potentially problematic situations in their everyday lives. The above means that effective teaching of mathematics should not only lead to understanding of mathematical concepts but should, importantly, lead to the development of utilitarian aspects of the subject (Advisory Committee on Mathematics Education (ACME), 2011).For teaching to be effective in promoting the learning of mathematics, it must involve continuous interaction between the teacher and the learner instead one-way communication from the teacher to the learner (Kaptan & Timurlenk, 2012).

Demonstrating the fact that mathematics teaching continues to be a boring exercise in many of the classrooms, results of a study by the European Commission (2007) found five scenarios that highlighted ineffective mathematics teaching. First, the study found that the teaching of mathematics continues to be too formal and hence teacher-centered leading to memorization than critical thinking. Second, mathematics teaching continues not to be linked to the real-world of learners hence remains artificial and alienated to everyday occurrences in learners' worlds. Third, mathematics teaching continues in many classrooms, to use very little of projects, experimental and problem-solving practices to enable learners to discover new knowledge on their own. Fourth, rarely does mathematics teaching in classrooms use technology to enhance learning. Fifth, because mathematics teaching continues to be teacher centered in many classrooms, it gives learners very little autonomy over their learning. Supporting the need for a paradigm shift in pedagogy, to ensure a move towards constructivist methodologies, Lester (2007) as well as Tatto et al (2008) argue that by using constructivist methodologies such as problem solving, projects, experimentation and modelling among others, mathematics teachers all learners to perform critical tasks of investigation, experimentation, analysis and discovery all of which enhance critical thinking skills and helps them to understand and appreciate mathematics better. For teachers to be able to deploy constructivist teaching methodologies, literature shows that they need to be well trained and to continuously be involved in professional development programmes (Delaney, 2012; Leung et al, 2006; Clarke et al, 2006).

Challenges to effective mathematics teaching

A number of studies according to Kadbey et al (2015) identify a number of factors that affect effective teaching of mathematics in primary schools. A study on the barriers to effective teaching of mathematics conducted by Al Shammeri (2013) found that content difficulty, heavy workloads, lack of

teaching resources, inadequate professional development or training, inadequate time allocated to the teaching of mathematics as well as large class sizes were some of the major barriers to effective teaching of mathematics. In two other studies by Sengul, Cetin and Gur (2008) that sort to investigate causes of ineffective mathematics teaching in primary schools, results showed that lack of pedagogical knowledge as a result of poor teacher training, lack of physical resources and time constraints were some of the barriers to effective mathematics teaching. In yet another study on the teaching of primary school mathematics by Al Ghamdi and Al Saloudi (2012), results showed that inadequate instructional time, limited physical space, scarcity of teaching resources, and inadequate training were some of the causes of poor teaching of mathematics in primary schools. A study by Delaney (2012) found that a lack of mathematical and pedagogical knowledge by teachers as a result of inadequate professional training continues to be one of the major challenges in effective teaching of mathematics.

The above is also confirmed in two other studies by Aguele and Usman (2007) as well as Opara (2013) who found that a lack of relevant professional development programmes that upskilled teachers on current and new trends on the teaching of mathematics continues to be a major challenge to effective mathematics teaching in primary schools. Vorderman etal (2011) argue that teachers are key to determining the success of learners in mathematics hence the quality of mathematical knowledge of teachers is an important variable in effective mathematics teaching (Burghes, 2012; Royal Society, 2011; Norris, 2012; Ofstead, 2012). Another major challenge affecting effective teaching of mathematics in primary schools is the tendency by teachers istoo much short-term focus on teaching for examinations rather than teaching for understanding (Ofstead, 2012; Smithers, 2013).

Strategies for effective teaching of mathematics

Literature presents a number of strategies which mathematics can take advantage of for effective teaching of mathematics. One of such strategies according to Kaptan and Timurlenk (2012) is the use of formative assessment to periodically test students' understanding of concepts taught. Formative assessment which is done during actual teaching is seen as very critical in giving students immediate feedback about their performance and could be highly motivational to the learners. The second strategy is that by coming up with learning activities and questions that help students to develop and express their ideas, teachers promote classroom dialogue or positive interaction in the classroom (Erduran, Simon, & Osborne, 2004). This strategy evokes the idea of using learner-centered teaching methods. Third, the use of interactive feedback on learners' written work where the mathematics teacher uses comments that guide learners towards improvement as well as to see their work as a stepping stone towards greater achievement (Kaptan & Timurlenk, 2012; Black, Harrison, Lee, Marshall& Wiliam, 2003). This strategy means that teachers should always use comments which learners both understand and see as a push towards them performing better. Forth, the use of group work to promote horizontal learning, that is, sharing of ideas between learners is very important. Such a strategy according to Norris and Phillips (2003) helps learners to both assess each other in terms of understanding mathematics concepts and to share knowledge at their own level. The fifth strategy is integrating technology in the teaching of mathematics (Schuck, 2016). Using technology in the teaching of mathematics enhances learning as learners can gain access to current mathematical information, activities, videos at the click of a button (Burden & Kearney, 2016; Kearney, Buren & Kay, 2015; Norris & Soloway, 2013).

Methodology

Research design

The study employed a descriptive survey design that used a structured questionnaire for data collection. The study targeted both public and primary school teachers in Gaborone and surrounding areas in Botswana. The sample consisted of 620 primary school teachers from 40 public and 40 private primary schools selected using stratified random sampling procedure.

Instrumentation

A 44-item questionnaire here-in referred to as the Questionnaire on implementation of primary school mathematics curriculum (Q-IPSMC) designed by the researcher was used for collecting data from primary school mathematics teachers. The questionnaire used a 4-point Likert scale with the following scales: Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (DA) = 2, Strongly Disagree (SDA) = 1. The questionnaire was validated for face and content validity by professors in education and their comments were incorporated into the final instrument before administration. The instrument was also tested for internal consistency reliability using the Cronbach Alpha reliability index α and results showed α = 0.83 and this showed that the instrument was reliable enough to come up with reliable and valid results. 620 questionnaires were hand-delivered to selected teachers in primary schools in Gaborone and collected after two weeks. 523questionnaires were returned giving a return rate of 84.2%.

Data analysis

A criterion mean (CM) calculated as the average of the Likert scale measures (4+3+2+1)/4 = 10/4 = 2.5 was used for analysing descriptive data. Any mean score below 2.5 is viewed as signifying disagreement with a given assertion while any score between 2.5 and 4 is viewed as showing agreement to strong agreement. Testing of hypothesis was done using the Mann-Whitney U-test and One-way ANOVA at 5% level of significance.Turkey HSD Post Hoc Analysis was also done to show which pairs of categories of levels of education significantly differed in the effective implementation of the primary school mathematics curriculum.

Results

Analysis of Demographic variables

Table 1. Demographic variables (N = 523)

Demographic variable		Responses	Percent (%)
Gender	Female	315	60.3
	Male	208	39.7
Age (yrs)	20-30	110	21.0
	31-40	248	47.8
	Above 40	165	31.2
Educational level	Diploma	201	38.5
	Bachelor's degree	218	41.7
	Master's degree	104	19.8
Grade level taught	Lower primary	192	36.8
	Middle primary	204	38.9
	Upper primary	127	24.3
Type of school	Private	267	51
	Public	256	49

Table 1 shows that there are more female teachers (60.3%) in primary schools in Botswana than there are male (39.7%). Almost half of the teachers (47.8%) in primary schools in Botswana are aged between 31-40 years which mans the greater number of the primary school workforce in primary schools in Botswana consists of young adults. Most of the teachers (41.7%) in primary schools in Botswana have managed to acquire Bachelor's degrees and in total, 61.5% of the primary school teachers have a degree qualification which may mean that they should be capable enough to discharge their duties of teaching. Most of the primary school teachers (75.7%) teach in the lower and middle primary. Results also show that there are slightly more private primary schools (51%) than public schools (49%) in Botswana.

Understanding of the subject of mathematics

Table 2. Conception subject of mathematics (N = 523)

Statement	M	SD
Mathematics is about unquestioned truth	3.1	0.72
Mathematics is about strict procedures	3.0	1.18
Mathematics is about following rules strictly	3.15	0.66
Mathematics is about right and wrong answers	3.44	0.64
Mathematics is about testing	1.19	0.94
Mathematics is an abstract subject	1.29	1.15
Mathematics is a human activity	2.63	1.07

Notes: SD = Standard Deviation, M = Mean

Results in Table 2 show that teachers in primary schools in Botswana view mathematics in a traditional way as unquestioned truth (M=3.1, SD=0.72); as about following strict rules (M=3.15, SD=0.66), as about right and wrong answers (M=3.44, SD=0.64), and as about strict procedures (M=3.0, SD=1.18). This conception may have implications on whether the teachers use learner-centered or teacher-centered approaches to the implementation of primary school mathematics curriculum. The same teachers however believe that mathematics is not about testing (M=1.19, SD=0.94), is not an abstract subject (M=1.29, SD=1.15) but is a human activity (M=2.63, SD=1.07), that is, it is part and parcel of everyday human processed and transactions.

Confidence, competency, belief and attitude towards mathematics teaching

Table 3. Confidence, competency, belief and attitude towards mathematics teaching (N = 523)

Statement	M	SD
I am always confident when teaching mathematics	2.1	1.20
I enjoy teaching mathematics	2.4	0.81
My students enjoy learning mathematics	2.8	1.3
My students show high levels of success when learning mathematics	2.8	1.04
I have received adequate training on the teaching of mathematics	2.3	0.83
I am able to integrate technology to enhance students learning of mathematics	1.2	1.07
I regularly integrate technology in my teaching of mathematics	1.7	1.13
I frequently use teaching aids when teaching mathematics	3.8	1.08
I always relate mathematics to everyday lives of learners when teaching	2.9	0.93
I find mathematics teaching boring	2.3	1.11
I only teach mathematics because I have to not because I am capable of or enjoy to	3.1	0.91
The thought of teaching mathematics makes me fearful and anxious	3.3	1.05
I frequently use the project method (projects) to teach mathematics	1.6	0.57
I frequently use drill and practice to teach mathematics	3.4	0.96
I frequently use the discovery method to teach mathematics	1.8	1.05
I frequently use the guided inquiry method to teach mathematics	1.3	0.77
I frequently use the problem-solving method to teach mathematics	2.7	0.61

SD = Standard Deviation, M = Mean

Table 3 shows that primary school teachers are not very confident and comfortable to teach mathematics. Results show that teachers are not confident when teaching mathematics (M=2.1, SD=1.20), do not enjoy teaching mathematics (M=2.4; SD=0.81) and only teach it because they have to (M=3.1, SD=0.91). Most teachers also believe that they did not receive adequate training on the teaching of mathematics (M=2.3, SD=0.83), are not able to use technology to enhance the teaching of mathematics (M=1.2, SD=1.07) and hence do not regularly integrate technology in their teaching of mathematics (M=1.7, SD=1.13). Furthermore, most of the teachers are fearful and anxious when they think of teaching mathematics (M=3.3, SD=1.05), hence they do not frequently use learner-centered teaching methods such as project method (M=1.6, SD=0.57), discovery method (M=1.8, SD=10.5), and guided inquiry (M=1.3, SD=0.77) but mostly prefer to use practice and drill methods (M=3.4, SD=0.96). Most teachers also find the teaching of mathematics boring (M=2.3, SD=1.11) even though their students seem to enjoy learning mathematics (m=2.8, SD=1.3) and show some level; of success (M=2.8, SD=1.04).

Challenges in the teaching of primary school mathematics

Table 4. Challenges in the teaching of primary school mathematics (N = 523)

Statement	M	SD
Lack of adequate teaching resources	2.1	0.82
Weak knowledge of the subject	3.2	1.15
My negative attitude towards the subject	2.9	0.93
Students' negative attitude towards the subject	1.3	1.10
Content of the subject too loaded and difficult to complete	2.1	1.12
Inadequate time allocated to teach the subject	1.5	0.91
I have got a fear of the subject	3.1	1.03
Limited training on the subject	3.5	1.15
High workloads that take off time for effective planning	1.2	0.95
Large classes which are too difficult to manage	3.4	1.03
Not comfortable to use learner-centered teaching methods as they are time consuming	3.1	0.88
I just find the subject too abstract and difficult to teach	3.2	1.10

Notes: SD = Standard Deviation, M = Mean

Table 4 shows that most teachers face a number of challenges that is affecting their effective implementation of the primary school mathematics curriculum. Among some of the major challenges are weak knowledge (M=3.2, SD=1.15), general negative attitude towards mathematics (M=2.9, SD=0.93), fear of the subject (M=3.1, SD=1.03), limited training on the subject (M=3.4, SD=1.03), Large classes (M=3.1, SD=0.88), and mathematics being too abstract and hence too difficult to teach (M=3.2, SD=1.10).

Strategies used for effective implementation of primary school mathematics curriculum

Table 5. Strategies used for effective mathematics curriculum implementation (N = 523)

Statement	M	SD
I frequently invite mathematics experts to teach mathematics	1.7	1.03
I frequently use computers to teach mathematics	1.3	0.91
I always introduce my mathematics lessons by relating content to students' everyday lives	2.9	1.07
I always breakdown complex mathematical concepts and procedures into simpler ones for easy understanding by learners.	3.1	0.92

I frequently use games, projects and puzzles when teaching mathematics	2.3	1.12
I use demonstrations frequently when teaching mathematics	3.3	0.88
I frequently use pictures, graphs and other related aids when teaching mathematics	3.1	1.10
I regularly use tests to motivate my students to learn mathematics	3.4	0.69

Notes: SD = Standard deviation, M = Mean

Results in Table 5 show that most teachers fairly frequently introduce their mathematics lessons using examples from learners' everyday lives (M=2.9, SD=1.07), breakdown complex concepts into simpler ones when teaching mathematics (M=3.1, SD=0.92), frequently use demonstrations to teach mathematics (M=3.3, SD=0.88), use graphs and pictures when teaching mathematics (M=3.1, SD=1.110), and use tests as a means of motivating learners to learn mathematics (M=3.4, SD=0.69). Results in table 5 also show that teachers hardly integrate technology in their teaching of mathematics (M=1.3, SD=0.91), rarely use puzzles, games and projects to teach mathematics (M=2.3, SD=1.12), and also hardly use expert guest teachers to help them teach mathematics (M=1.7, SD=1.03).

Hypothesis testing

H01: There is no significant statistical relationship between gender of a teacher and effective implementation of the primary school mathematics curriculum.

Table 6. Relationship between gender and effective implementation of primary school mathematics curriculum

	Gender	N	Median	Range	Mean rank	Mann-Whitney U	P
Score_B	Male	208	2.61	2.53-2.61	67.41	536.00	0.07**
	Female	315	2.53	2.44-2.53	65.83		

**Significant p<0.05

Results in Table 6 show that Mann-Whitney U-test = 536.00, p = 0.07, p > 0.05, hence results indicate that there is no significant difference between how male and female teachers implement the mathematics curriculum. From the mean rank scores, it can be seen that there is very little difference hence both male and female teachers implement the primary school curriculum the same.

H02: There is no significant statistical relationship between educational level of teachers and effective implementation of primary school mathematics curriculum

Table 7. Relationship between educational level and effective implementation of primary school mathematics curriculum.

ANOVA	Sum of squares	df	Mean of squares	F	Sig
Between Groups	1205.37	13	92.721	4.537	0.00**
Within Groups	10422.51	510	20.436		
Total	11627.91	523			

**significant p<0.05

Results in Table 7 show that there is a significant statistical relationship between educational level and effective implementation of the primary school mathematics F(13, 510) = 4.537, p = 0.00, p < 0.05. Educational level therefore has an influence on how teachers implement the primary school mathematics curriculum.

Table 8. Turkey HSD Post Hoc Analysis: Primary school mathematics curriculum implementation

Highest Level of Education:	N	Subset alpha = 0.05	
Master's Degree	104		59.3188
Bachelor's Degree	218	32.4370	
Diploma	201	35.2585	
Sig		0.990	1.000

Table 8 shows that master's degree scored significantly higher (59.3188) on the mean score when compared to bachelor's and diploma holders. This therefore may mean that higher levels of education may have a significant influence on how primary school teachers implement the mathematics curriculum with a notable difference been seen between bachelor's and master's degree holders and not between diploma and bachelor's degree holders.

H03: There is no significant relationship between school type (public and private) and effective implementation of primary school mathematics curriculum.

Table 9. Relationship between school type and effective implementation of primary school curriculum

	School type	N	Median	Range	Mean rank	Mann-Whitney U	P
Score_D	Private	267	2.71	2.45-2.71	74.31	837.00	0.000**
	Public	256	2.45	2.32-2.45	66.59		

**significant p<0.05

Results in Table 9 show that there is a significant statistical relationship between school type and effective implementation of the primary school mathematics curriculum (Mann-Whitney U-test = 837.00, $p = 0.00$, $p < 0.05$). School type has an influence on effective implementation of primary school mathematics curriculum. Private schools scored a median score of 2.71 and a mean rank score of 74.31 while public schools scored a median score of 2.45 and a mean rank score of 66.59 which shows that private schools implement the mathematics curriculum better than private schools.

H04: There is no significant relationship between how teachers conceive mathematics as a subject and effective implementation of primary school mathematics curriculum

Table 10. Relationship between conception of mathematics as a subject and effective implementation of primary school mathematics curriculum

ANOVA	Sum of squares	df	Mean of squares	F	Sig
Between Groups	305.41	14	21.815	8.897	0.01**
Within Groups	1247.93	509	2.452		
Total	1553.34	523			

**significant p<0.05

Table 10 shows that $F(14, 509) = 8.897$; $p = 0.01$; $p < 0.05$ hence there is a significant statistical relationship between conception of a curriculum and effective implementation of the primary school mathematics curriculum. The way teachers perceive mathematics has an influence on how they implement the primary school mathematics curriculum.

Discussion of findings

Results of the study showed a number of pointers on how the mathematics curriculum is being implemented in primary schools in Botswana. With regards to how primary school teachers perceive mathematics, results showed that most of the teachers view it as a boring, abstract and highly procedural and rule-based subject. Results also indicated that teachers further perceive mathematics as a frightening subject due to their weak knowledge of the subject due to limited training received on it. As a result, results showed that by conceiving mathematics as a frightening subject, teachers tend to use drill and practice rather than use constructivist strategies to implement the curriculum. These results confirm earlier findings that showed that the way teachers conceive mathematics define how they teach it to the learners (UNESCO, 2012). According to Okafor and Anaduaka (2013), teachers who view mathematics narrowly as basic numeracy, measurement and calculations tend to teach the subject narrowly to these concepts thus leading to what Hudson et al (2014) called low epistemic quality while teachers who view the teaching of mathematics as an opportunity to develop critical thinking skills in learners promote what is called high epistemic quality by using learner -centered constructivist approaches. Lester (2007) as well as Tatto et al (2008) argue that by using constructivist methodologies such as problem solving, projects, experimentation and modelling among others, mathematics teachers all learners to perform critical tasks of investigation, experimentation, analysis and discovery all of which enhance critical thinking skills and helps them to understand and appreciate mathematics better.

Results of the study also showed that primary school mathematics teachers face a number of challenges in the teaching of the subject chief among which are large classes, inadequate to poor professional training in the subject, and high workloads. These results confirm results of earlier studies which found that heavy workloads, inadequate professional training, and large class sizes are some of the major challenges affecting effective implementation of the primary school curriculum (Al Shammeri, 2013; Kadbey et al, 2015; Delaney, 2012; Opara, 2013).

The study further showed that primary school mathematics teachers hardly integrate technology to enhance their teaching of the subject yet technology in viewed as a critical component of modern day teaching. The importance of using technology to enhance curriculum implementation is echoed by Schuck (2016). Other studies also found that using technology to implement a mathematics curriculum enhances learning as learners are able to gain access to current mathematical information, activities and educational videos at the click of a button (Burden & Kearney, 2016; Kearney, Buren & Kay, 2015; Norris & Soloway, 2013). In their separate studies on the integration of technology in the teaching of mathematics, Mbugua (2011), Halat and Peker (2011), Divaharan (2011) as well as Lin (2008) found that integrating technology in the teaching of mathematics improves learners' understanding of mathematical concepts and also that it increased their motivation to learn mathematics.

Results further showed that educational level has a very high influence on how teachers implement the primary school mathematics curriculum. This confirms studies by Salleh, Yaakub and Dzulkifli (2011) whose study found that people who possess higher levels of education have a tendency to succeed in their tasks because of superior task knowledge. Meyer et al (2011) in their study also found that people with higher levels of education possessed superior cognitive abilities to effectively come up with creative approaches to implementing curriculum.

Results also showed that private primary schools perform better than public primary schools in the implementation of the mathematics curriculum. This result confirms results of earlier studies that showed that teaching in private schools is far more superior in general to that in the public schools. In a study by LaPonsie (2015), it was found that teaching in private primary schools is far much superior than in public schools because there is better student discipline, class sizes are generally small, the learning environment is much superior, there is more individual attention to learners and there is improved student safety. In yet another study, Cloud (2007) found that private schools tend to develop in learners critical thinking skills due to the resources they have for effective teaching when compared to public schools.

Conclusions

Based on the results of the study, a number of conclusion can be made. First, a number of mathematics teachers in primary schools lack strong professional knowledge of mathematics to be able to effectively implement the primary school mathematics curriculum. The consequence of this is that teachers lack confidence, begin to view mathematics as an abstract and difficult to teach subject and become fearful of it. Second, effective implementation of curriculum is also curtailed by large class sizes, heavy workloads and inability to integrate technology into the teaching of mathematics. Third, teachers in primary schools have a negative attitude towards mathematics as they view it as too abstract, procedural and rules-laden. Fourth, primary school teachers prefer teacher-centered teaching methods as compared to learner-centered teaching methods as they consider learner-centered teaching methods time consuming. Fifth, private primary schools implement the mathematics curriculum more effectively than public primary schools owing to the abundance of resources they have as well as the fact that they use small class sizes that allow teachers to give students more individual attention. Sixth, educational level of teachers has an influence on how effectively the primary school mathematics curriculum is implemented while gender has no influence.

Recommendations

For effective implementation of the primary school mathematics curriculum, the following recommendations are given. First, teachers need upskilling through periodic refresher courses on the teaching of mathematics. This will help them to gain a better understanding of mathematical concepts and how to teach then thus making them to become less fearful and also helps them to teach it more confidently. Second, teachers need more grounding on how to integrate technology in the teaching of mathematics so as to enhance how learners learn it. Third, knowledge of the different teaching strategies to use for teaching mathematics needs to be developed in the teachers as they seem to lack on this. This again could be done through periodic refresher trainings internally and externally.

Implications for effective teaching of primary school mathematics

Effectively taught mathematics can help develop in learners, mathematical literacy which involves the development in learners of critical thinking skills such as application, comprehension, discovering and modelling. This can only happen when constructivist teaching strategies that include problem solving, projects and experimentation and integration of technology are used.

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