Reclaiming the Missed Opportunities in the Teaching of Mathematics in Zambia: Exploring the blame game on the Poor performance of learners in mathematics

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ABSTRACT
Improving learner performance in mathematics countrywide is a task which must not be carried out by an individual but something that calls for collaborative efforts from various stakeholders. Based on local and international studies, this paper sought to explore various factors that had led to unsatisfactory performance of learners in the teaching and learning of mathematics. The reviewed literature indicated that several factors led to the poor learner performance in mathematics in Zambia such as; learners' negative attitude and beliefs towards mathematics, inappropriate teaching by teachers of mathematics and many more others which resulted to some sort of a blame game amongst key stakeholders in the education system. Consequently, it was recommended that learners' parents needed to keep an eye on how their children were spending time at home as well avoiding passing negative sentiments on school subjects irrespective of the challenges they encountered when they were in school as learners.

Keywords: Continuing Professional Development, Mathematical Knowledge for Teaching, Ethno Mathematics, Teacher Education.

1.0 Introduction
Mathematics is one of the most interesting and developmental subjects that should be enjoyed by both the subject teacher as well as the learner as human life is never short of basic application of mathematical concepts. Fatima (2012) affirmed this assertion by citing an English Franciscan Friar, Philosopher, Scientist and scholar of the 13th century Roger Bacon (1214-1294) who in his wisdom argued that "neglect of mathematics works is an injury to all knowledge, since he who is ignorant of it cannot know the other sciences or the things of the world." Despite this being the case, the Examinations Council of Zambia (ECZ) (2016) report indicated that the performance of learners in mathematics countrywide had continued deteriorating. Table 1.1 shows the provincial ranking according to performance in the four selected subjects.

Table 1.1: *Provincial Ranking According to Performance in the four Selected Subjects (2015 and 2014)*

Province/ National	Mean Score in %					
	English	Mathematics	Biology	Science	Average	Average
Southern	38.7	19.41	23.75	18.61	25.12	24.19
Lusaka	38.83	18.25	22.99	18.76	24.71	24.64
Eastern	34.75	21.16	22.6	19.61	24.53	23.41
Central	35.95	17.49	21.73	18.41	23.39	23.11
National	35.16	17.42	21.59	17.66	22.96	22.78
Muchinga	32.47	18.67	21.99	18.5	22.91	22.36
Northern	33.46	18.89	21.68	17	22.75	21.82
Luapula	32.02	16.51	20.34	16.98	21.46	22.77
Copperbelt	33.52	15.62	20.22	16.18	21.38	21.37
Western	31.93	15.61	20.32	15.92	20.95	20.47
North	30.68	14.78	19.97	17.11	20.64	21.58

Source: *Highlight of the 2015 Grade 12 Examinations Results Statistics from ECZ*

From the statistics shown in table 1.1, it is clear that learners have not been performing very well in mathematics and science countrywide. Some scholars have taken this issue very seriously which has resulted in conducting studies in order to try to establish what could have led to the continuous poor learner performance in mathematics. It is from this background where the authors of this paper got motivated to look at different literatures based on the studies done both within Zambia and outside Zambia on what could have led to the unsatisfactory learner performance in mathematics and possibly suggest what could be done to improve learner performance.

2.0 Mathematics and Learner Performance

The importance of mathematics worldwide cannot be overemphasised as it is one of the subjects that has a direct implication and application to all business related, science and engineering programmes in post-secondary school education programmes. The lack of people who are well grounded in mathematics implies the lack of effective scientists, engineers and economists in the country in the near future. Despite the importance of mathematics in human life, several studies done in Zambia by scholars such as; Mwape and Musonda (2014), Kafata and Mbetwa (2016), ECZ (2012, 2016) and Sakayombo (2018) as well as studies that have been done outside Zambia by Mbugua *et al*., (2012), Mutai (2010) as well as Yara and Otieno (2010) have all indicated that learner performance in mathematics was poor. Among the factors that led to poor learner performance in mathematics were; high teacher to pupil ratio due to overcrowded classes, negative

attitude and beliefs of learners towards the subject, lack of appropriate teaching and learning materials in schools and inappropriate acquisition of ethno mathematics amongst the learners. In addition, Sakayombo (2018) further argued that the language that was used in mathematics was very difficult for some learners to understand making mathematics to be an abstract subject. This means that the finding by Sakayombo was in agreement with Davison (1990) who contended that a language deficit in the teaching and learning of mathematics leads to a mathematics deficit.

In addition, Yara and Atieno (2010) were concerned about the poor performance of learners in mathematics in Bondo district of Kenya and they wanted to establish the extent to which teaching/learning resources affected the performance of learners using descriptive survey design. The findings of the study were that; government financial support ($B= 0.182$, $t = 2.469$; $p< 0.05$), trained teachers ($B = 0.341$, $t = 3.489$; $p< 0.05$), classroom/laboratories ($B = -0.347$, $t = -4.173$; $p < 0.05$) and textbooks/student-ratio ($B = 0.413$, $t = 4.186$; $p < 0.05$) could be used to predict academic performance in mathematics. The results in this study can be translated to what is prevailing in the Zambian education system where the country has continued to record low academic achievements amongst learners in mathematics. This is quite worrisome more especially that in Zambia currently the Ministry of General Education has embarked on implementing the competence-based curriculum in the midst of inadequate and inappropriate teaching and learning resources in schools. This situation led to Mulenga and Kabombwe (2019) to express some fear on how the competence-based curriculum would be implemented in the country where the National budgetary allocation to the education and skills sector has been reducing since 2015 as follows; 2015 (20.2%), 2016 (17.2%), 2017 (16.5%) and 2018 (16.1%).

In addition, ECZ (2016) report had indicated that the poor performance of learners in mathematics at all levels could be partly accredited to the way teachers mark classroom work and provide feedback to the learners. Having brought out some of the factors that led to poor learner performance in mathematics, one would then wonder whether the way teachers of mathematics were prepared to teach mathematics could in a way affect the way classroom mathematics was taught and eventually lead to the results the country was recording in the recent past. As a way of collecting empirical data over this assertion, Changwe and Mulenga (2018) did a study at one of the Zambian Universities where they analysed the mathematics teacher education curriculum in which they sought to find out whether student teachers had acquired the appropriate competences for teaching secondary school mathematics. Among the key findings that came out of this study were that the mathematics teacher education curriculum did not adequately prepare teachers of mathematics for effective teaching of classroom mathematics. 80 percent of the respondents which included lecturers of mathematics, student teachers of mathematics who were in their final year of study and they had done their school teaching experience as well as teachers of mathematics who had gone through the same teacher education curriculum and were teaching mathematics in Zambian secondary schools were of the view that the mathematical knowledge for teaching in the mathematics teacher education curriculum was greatly ignored.

The respondents also emphasised that the way the mathematics teacher education curriculum was structured, made it very difficult for teachers to confidently teach secondary school mathematics topics such as; Linear Programming, Geometrical Transformations, Constructions and Loci,

Mensuration, Earth Geometry and many more others and that they were not taught to the student teachers during their teacher education programme.

Although the study by Changwe and Mulenga (2018) had brought out possible causes of poor learner performance such as; negative attitude and beliefs of learners towards mathematics, high teacher pupil ratio in Zambian schools and lack of appropriate teaching and learning materials as revealed by Mbugua *et al*., (2012), Mutai (2010), Yara and Atieno (2010), Mwape and Musonda (2014) and Kafata and Mbetwa (2016), the study also revealed that the mathematics teacher education curriculum too contributed to the problem which the country was experiencing. If well diagnosed, it is outwardly clear that there has been an aspect of what could be tamed as a blame game on the countrywide poor learner performance in mathematics. But one thing that must be made very clear is the point that if there is full government financial support in terms of appropriate teaching/learning resources and if the teacher education curriculum could be well structured and designed that could possibly be the appropriate panacea to most of the problems the country was facing in terms of learner performance in mathematics. In the next section, the author brings to the fore some of the missed opportunities in the teaching and learning of classroom mathematics.

3.0 Missed Opportunities

Subject specialisation is one of the best practices for effective classroom delivery at every level of education. In Zambian primary schools, there is no subject specialisation. One teacher is expected to teach all the subject areas to his/her learners. This means that even teachers who are not well grounded in mathematics would still be expected to teach mathematics. If the results are to improve in the teaching and learning of mathematics at school certificate level, one would not undermine the importance of having a good foundation through effective teaching of mathematical concepts at primary school level (Changwe, 2017). In a situation where learners are wrongly taught basic mathematical concepts, it becomes very difficult for them to grasp higher mathematical concepts and this may affect their performance in mathematics later in their higher education system.

According to the study by Luangala and Mulenga (2011) the lesson or lessons are said to be taught if learning has taken place amongst the learners. The results of well taught and learnt lessons can be seen through learners' change in behaviour which may be in terms of: values, attitudes, knowledge, skills as well as performing well in various modes of assessments. This means if primary school teachers cannot specialise in specific teaching subjects, they would be just claiming to have taught even when no learning has taken place at all. With the competence-based curriculum which is been implemented in Zambian schools, Mulenga and Kabombwe (2019) emphasised the need for teachers to be well prepared for them to transmit worthwhile skills, appropriate attitudes and applicable knowledge into the learners for them to become relevant to their respective societies.

One area that has been overlooked for a long time is the failure by curriculum designers as well as curriculum implementers to relate mathematics to real life experiences of the learner. This has led to most of the Zambian learners to look at mathematics as an imported subject area from abroad who would simply learn and pass it to meet the requirements of the country's education system (Sakayombo, 2018). This has serious repercussions on the teaching and learning of mathematics as

noted by Gerdes (1988) when he argued that when learners and teachers believe that the mathematics does not have any roots in their culture, a cultural-psychological blockage resurfaces that hinders the teaching and learning of mathematical thinking-a blockage that turns the realisation of the full development of the mathematical potential of the learners impossible. The solution to this problem is the appropriate linkage of the mathematics that is taught at every level of education, starting from teacher education up to the classroom mathematics to real life situations. This would in turn make learners to learn mathematics with full conceptual understanding rather than with rote learning. Garnett (2015) reaffirmed this assertion when he explained that high attainment in the teaching and learning of classroom mathematics can be achieved by an ethnomathematics approach to the curriculum where there is a clear link between culture and mathematics where learners would be able to clearly see the real value of the mathematics that they learn in classrooms.

Indeed, if competence-based curriculum is to be effectively implemented, there is need for whatever goes on in classrooms to reflect learners' own experiences. It is impossible for this to be realised if learners cannot see the value and applicability of knowledge in what they are learning as well as if no subjective teaching is employed in the teaching and learning of mathematics. All in all, missed opportunities such as lack of subject specialisation at primary schools, application of mathematical concepts to real life situations so that learners may not look at mathematics as an abstract subject which may lead to lack of appreciation of the concepts learnt should be addressed. In addition, there is also need to align the mathematics teacher education curriculum to the curriculum that is taught in schools.

4.0 Rethinking the Mathematics Teacher Education Curriculum

Instead of stakeholders pointing fingers at negative attitude and beliefs of learners towards mathematics, lack of teaching and learning materials in schools, overcrowded classes and many more as what leads to poor learner performance in mathematics, the authors are of the view that if teacher education curriculum can be reconsidered it may lead to great transformations in the teaching and learning of mathematics which would eventually result in good learner performance. If there is good quality teacher education, the products of such a programme would know the importance of having appropriate teaching and learning materials, they would know the consequences of teaching very big classes of learners and they would also learn how to mitigate the negative attitude and beliefs of various societies about mathematics through learning of different courses namely; Sociology of Education, Education Psychology, Philosophy of Education, Curriculum Studies, both advanced and classroom mathematics content courses as well as through effective learning of methodology courses.

Darling-Hammond (2004) and Mulenga (2015) explained that in every teacher education programme, Sociology of Education, Education Psychology and Philosophy of Education should be among the vital courses to be offered to student teachers. The researchers were very right because apart from students being competent in their subject matter, the cited courses would help them to understand the society very well where their learners come from. Student teachers would also understand how children learn by learning from various theories and human behaviour as well as inculcating the aspect of critical thinking in student teachers.

With regard to content, several studies that have been conducted in different colleges and universities in United States of America as well as Europe have revealed that teacher education programmes had been criticised for equipping student teachers with content knowledge that had little or no bearing on the real classroom situation (Korthagen, *et al*., 2006; Grossman and McDonald, 2008; Ball and Forzani, 2009; Ball and McDiarmid, 2010; Lampert, Beasley, Ghousseini, Kasemi and Franke, 2010). The findings of these studies coincided with the study that Changwe and Mulenga (2018) did who argued that both mathematics content and methods courses that student teachers were exposed to had deficiencies in terms of relevance for teaching secondary school mathematics. It was established that the mathematical knowledge for teaching was missing because the university did not have a specific mathematics content course for those students who were to become teachers.

The authors were of the view that teachers of mathematics needed to know more than the learners he/she would be teaching. Thus the teaching of student teachers higher level mathematics was not a bad idea but what was not appropriate was the complete failure to introduce student teachers to the actual mathematics that they were expected to teach in classrooms upon graduation. If we are to reclaim some of the missed opportunities in the teaching and learning of classroom mathematics, the authors felt that there was urgent need to introduce student teachers to the school mathematics at the level where they could analyse, justify as well as criticise as to why certain mathematical laws and concepts are the way they are. This would make them teach classroom mathematics with full conceptual understanding. Besides, Ball, Hill and Bass (2003) and Chapman (2005) argued that there is a strong relationship between teachers' mathematical content knowledge and their ability to teach well in classrooms. Khan (2012) revealed in his study that when student teachers are not exposed to the actual material that they are expected to go and teach upon graduation, then their teaching would be based on academic qualification at the expense of professional qualifications.

In addition, Avong (2013) and Okafor and Anaduaka (2013) also contended that teachers' qualifications and ill-prepared teachers make teachers ineffective to appropriately teach secondary school mathematics which eventually affect learner performance. It would be interesting at this juncture to speculate how many patients would die if medical doctors or nurses were taught things that were at variance with what is actually found in hospitals and clinics and how many lawyers would effectively win cases for their clients if they are not exposed to issues found in courts during their training. Based on the preceding discussions, it would be of great value to the education system particularly to the teaching and learning of mathematics if the mathematics teacher education curriculum could be reconsidered by bringing on board the mathematical knowledge for teaching.

5.0 Implications and Conclusion

The quality teaching and learning of classroom mathematics can only take place at a school where there is adequate infrastructure and appropriate teaching and learning materials including well qualified teachers. This can be addressed through adequate funding to the education sector by the government as well as aligning of the mathematics teacher education curriculum to the school curriculum. With the increasing number of mushrooming colleges and universities in Zambia, it is

important for the Ministry of Higher Education to scrutinise the teacher education curricula that are being used in colleges and universities as well as to adequately monitor the teaching and learning processes. Failure to keep a critical eye on the mushrooming colleges and universities as well as some government colleges may lead to schools having teachers with credentials who might be professionally unqualified to teach. It would also help if teachers and school administrators could try to educate members of the community (learners' parents/guardians) on how they can positively or negatively influence the performance of their children in mathematics and other school subjects. The authors of this paper are of the view that once teachers are exposed to relevant courses that can easily be applied in schools and society, there would be better teaching and learning of mathematics in schools. Teachers would be able to put themselves in the shoes of their learners who already have misconceptions and negative attitude and beliefs about mathematics in order to find a better way of not only teaching them but helping them to learn mathematics. It is such kind of practices that could improve learner performance in mathematics.

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