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The Effects of Teachers' Content Knowledge of Mathematics on Grade 6 Learners' Performance in South Africa

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ABSTRACT: Mathematics is one of the most important subjects rooted in many fields of study but has also been one of the greatest challenges for learners in every country, most especially in the Republic of South Africa. There have been attempts to curb the challenges that have bedeviled the success of mathematics education by governments, the Department of Education and many other stakeholders in the district of East London in South Africa. Most of the introduction of mathematics content and how they are taught by mathematics teachers affect learners' achievement outcomes adversely. Therefore, this study examines the effects teachers' content knowledge of Mathematics on Grade 6 learners' performance in East London District, South Africa. The instruments used in collecting data were structured questionnaires, semi-structured interviews to elicit information from grade 6 learners, teachers and observations. Information gathered from the learners and teachers including biographical information, factors affecting teaching and learning of mathematics and suggestions. The findings of the study revealed that some teachers were not specialized in teaching mathematics, inadequate teaching and learning resources, poor time management by teachers. For performance in mathematics to improve in the primary schools in East London Education District in South Africa, the study made some recommendations from the findings to the stakeholders in education such as learners, educators, parents and the department of education. These recommendations might virtually assist in finding lasting solutions to grade 6 learners with mathematics challenges.

***KEYWORDS**: Mathematics, Learner, Poor performance, Teacher, Teacher turnover, Grade 6, Paradigm, Annual National Assessment, Trends in International Mathematics and Science Studies.*

I. INTRODUCTION

Mathematics Education is very vital in all countries because of the numerous contributions it offers such as developments in technologies. Adu, Galloway, and Olaoye (2014) asserted that it is not an overstatement to say that mathematics is an indispensable tool in the march towards a technological breakthrough. Mathematics cuts across all the fields of human endeavors in its wide application and mind development. However, despite its wide applicability, many students still cannot find their feet in the subject. Governments and educational systems around the world recognize the need for students to be skilled, creative and confident users of a wide range of Information Communication Technology of which the knowledge of mathematics is required. Furinghetti, Matos, and Menghini (2013) are of the view that from the first half of the twentieth-century mathematics education was mainly the business of professional mathematicians.

The International Association for the Evaluation of Educational Achievement (IEA) conducted the Teacher Education Study in Mathematics (TEDS-M) in 2012 in 17 countries to provide data on the knowledge that primary and lower-secondary school teachers acquire during their mathematics teacher education. Mathematics learning has a distinct character, thereby reflecting the developmental and educational needs of different age groups. For teachers, this structure has meant that different types of preparation are required to teach each level. Most elementary teachers are prepared to teach all subjects, while teachers in other places are prepared as specialists in a particular content area.

In Sub-Saharan Africa, teachers have a huge task in improving the scholastic outcomes of students who come from different social backgrounds. Spall and Kotze (2015) confirmed that the average performance of mathematics in African countries appears much poorer than elsewhere in the world. For instance, five African countries namely; South Africa, Botswana, Ghana, Morocco, and Tunisia that participated in the Trends in International Mathematics and Science Study in 2003 were ranked in the last seven of the 45 participating countries (Kastberg, Roey, Williams & Gonzales, 2006). However, it is notable that there exist wide variations in the quality of Education within African countries which underlines the need to consider the situation at the country level.

Teachers' content knowledge is justified by the performance of the learners they have taught. Recently, the Department of Education saw the need to give attention to grades 3, 6, 9 and 12 with regards to Annual National Assessment (ANA, 2011). Of all the nine provinces in South Africa, Eastern Cape has been the lowest-performing province as far as performance in education at primary and secondary levels are concerned (Bantwini, 2010). Studies have shown that in South Africa, there is a high rate of poor performance in mathematics. The Department of Basic Education (DBE) (2014) released the ANA report which revealed a picture of students' achievement in mathematics that is extremely worrying. Table 1 below shows the level of scoring in mathematics as used in the national codes, together with percentages or descriptions for recording and reporting learner performance in the intermediate phase.

Table 1: The Scoring of Mathematics for grade 4 – 6 (Intermediate phase) by the Department of Basic Education (2014)

Rating	**Percentage**	**Description**
Level 1	0-29	Not achieved
Level 2	30-39	Elementary achievement
Level 3	40-49	Moderate achievement
Level 4	50-59	Adequate achievement
Level 5	60-69	Substantial achievement
Level 6	70-79	Meritorious achievement
Level 7	80-100	Outstanding achievement

Source: (DBE, 2014)

Table 2: Average percentage scores after re-marking in 2011

	GRADE 3		**GRADE 6**	
Province	Literacy	Numeracy	Languages	Mathematics
EC	39	35	29	29
FS	37	26	23	28
GP	35	30	35	37
KN	39	31	29	32
LP	30	20	21	25
MP	27	19	20	25
NC	28	21	27	28
NW	30	21	22	26
WC	43	36	40	41
SA	**35**	**28**	**28**	**30**

Source: (DBE, 2014)

Table 2 provides a summary of ANA for the province from the stage it was piloted from Grade 1 to 6, to a fully-fledged assessment that includes Grade 6 (Grade 3 and 6). The results in Table 2 show that the Mathematics pass rate decreased as learners progressed to higher Grades from 41% to 25% in Grade 6 and 36% to 19% respectively in 2011. Although there was a decrease in the performance of learners in languages from Grade 3 to Grade 6, the situation was worse in mathematics.

Spaull (2013) analyzed the report of the Department of Basic Education (DBE) (2011) and found that the quality of basic education is still well below what it should be. The percentage of learners reaching the "achieved" level of performance varies from 12% to 31%. Even the best provincial figure in this regard, 46% for Grade 3 literacy in Eastern Cape, is well below what can be considered acceptable. East London education district within the Eastern Cape Province was listed among poorly performing districts in mathematics in grade 6 and is an issue of concern (ANA, 2011). The continuous under-performance in this subject poses an unending question which both the government and academics are trying to answer and has few studies conducted on. It is therefore important to investigate the effects teachers‟ content knowledge of mathematics has on grade 6 learners' performance in East London Education District.

II. OBJECTIVES OF THE STUDY

The objectives of this study are:

1. To determine how subject content is introduced and taught by mathematics teachers in East London Education District
2. To assess how teachers' qualification impact on learners' performance in mathematics

III. RESEARCH QUESTIONS

In addressing the research problem, this study seeks to provide answers to the following research questions;

1. How do mathematics teachers introduce and teach subject content?
2. What is the impact of teacher's qualifications on learners' performance in mathematics?

IV. LITERATURE REVIEW

Content knowledge (CK) is the driving force that teachers use to enhance a better understanding of learners. A teacher must develop much knowledge concerning the content to be taught. Tay, Lim, and Ho (2017) in their study on preparing mathematics teachers in Singapore discovered that some teachers "do not teach mathematics" but that they "teach children". This was wrongly used and downplayed the importance of a subject matter in the education of a child. We should be "teaching mathematics to children". To this end, any self-respecting and child-respecting teacher should never short-change children by being deficient in the CK that he/she is supposed to develop in the child. One way of improving the quality of education is through quality teaching and empowering teachers with the required content knowledge to teach a subject like mathematics.

Wright (2017) argued that excellence in teaching should be the primary focus of all teacher preparation institutions. The training of teacher trainees is critical to the success of schools. Darling-Hammond (2010) noted that "the traditional elements of the profession are formal preparation, licensure, certification, and accreditation" (p. 36). Monroe, Blackwell, and Pepper (2010) maintained that "teacher education programs have the task of developing thoughtful and socially progressive educators who can teach effectively" (p. 1). Research documents the importance of teacher preparation in other countries such as South Korea, Finland, and China, where top high school candidates are chosen to attend universities, where they are trained in theory, as well as pedagogical practices. However, American colleges and universities are under attack because of student achievement concerns.

Currently, with four million teachers in the United States, teaching is the largest profession that continues to grow to address the high attrition rate, teacher shortage and the preparation of students to be ready for a complex and changing world. The question of how to produce the most effective teachers continues to have dialogic tension among educators and policymakers. Darling-Hammond and Powell (2015:27) stated that "substantial research evidence suggests that well-prepared teachers have the largest impact on student learning". Many researchers have sided on teachers' preparation of the knowledge they have acquired before teaching their learners. The classroom is a world on its own. Therefore, teachers should plan effectively to ensure the success of learners with various challenges in the classroom. Learners have different educational needs or challenges which call for teachers to apply their planning tailored to the needs of the learners. Dunn, Craig, Favre, Markus, Pedota, Sookdeo, Stock and Terry (2010) emphasized that educators talk about differentiated instruction, individualization, multiple intelligences, and responding to learners' learning styles, but how many teachers implement these instructional strategies to any extent? In the field of education, general lesson plans are used to

guide a teacher's classroom instruction. In public schools or government-funded education programs, a State department defines the standards and curriculum guidelines to be followed. At the next level down in the education system, the local administration and board of education specify age-appropriate curriculum and particulars that meet the State's minimum standard guidelines. Each teacher then creates lesson plans that satisfy the curriculum set forth by the local administration (Dunn et al., 2010). In specialized school programs, lesson plans need to be customized per student, and if the school program is federally funded, lesson plans need to meet governmental requirements in terms of curriculum standards.

There is widespread agreement that the knowledge teachers require for teaching Mathematics is more than sound content knowledge of mathematics itself. While some (Krauss, Brunner, Kunter, Baumert, Blum, Neubrand & Jordan, 2008) referred to this additional knowledge as pedagogical content knowledge (PCK) following Shulman, others (Ball, Thames & Phelps, 2008) have attempted to disaggregate content knowledge (CK) or subject matter knowledge (SMK) and PCK further. The scholars indicate these proxy measures may hold some applicability for contexts such as South Africa, where teachers‟ mathematical knowledge bases are generally poor, and where, based on anecdotal evidence from our project schools, too many teachers who are teaching Mathematics at lower secondary level, have little, if any, training as Mathematics teachers. In such cases, the number of post-school Mathematics courses taken does matter and maybe a predictor, albeit a poor one, of learner attainment. In South Africa, the SACMEQ III study was extended to include testing of Grade Six teachers' mathematical knowledge on items typical of Grade Six level (and lower), where 15 items were common to both the teacher and learner tests. Richards (2010) reported that teachers and learners performed well on only two simple items but that both teachers and learners performed poorly on eight items. This suggests that some Grade Six teachers do not know much of the mathematics they teach and not well enough to teach it. In the US and Germany, large research projects have developed sophisticated measures that attempt to disaggregate different components of teacher knowledge (Krauss et al., 2008). In the Study of Instructional Improvement, Richards (2010) found that the mathematical knowledge-for-teaching of Grade One and Grade Three teachers was a stronger predictor of learner attainment than were proxy measures, such as number of courses taken in Mathematics or Mathematics Methodology, or years of teaching experience, or average daily length of maths lessons. Teachers' knowledge matters in all learning contexts. However, it matters more in contexts of poverty and low achievement. The problem of how professional development can be designed to improve learners' attainment is not confined to developing countries like South Africa. More recently, in a review of the literature Gersten, Taylor, Keys, Rolfhus, and Newman-Gonchar (2014) identified 643 studies of professional development relating to school Mathematics. Of these, only five met the „What Works Clearinghouse' evidence standards. Laura, McMeeking, Orsi, and Cobb (2012) reported the effects of a study in which middle school teachers in the US participated in one or two university summer courses in Mathematics, lasting two to three weeks. The courses consisted of 80% of mathematics content and 20% mathematics pedagogy. They found a discernible effect size on learner attainment for those teachers who had attended two courses, but not for those who had attended only one course. This effect size is reported by Gersten et al. (2014). The scholars described the content, structure, and approaches of Wits Maths Connect Secondary (WMCS) professional development courses, and thus to describe what Marriage and family therapy (MFT) was offered to teachers.

The Transition Maths Intervention Most mathematics professional development programs in South Africa can be described as taking either a repair approach or a conceptual approach to mathematics in their offerings. Repair approaches focus on teachers redoing school Mathematics in the same ways as their learners would learn it. Here, teachers rehearse the steps necessary to solve typical tasks from the school curriculum. Conceptual approaches frequently work from the assumption that teachers' mathematical knowledge is procedural, and thus inadequate, and that interventions should provide them with a deep conceptual understanding to complement their procedural knowledge. Both approaches have limitations. A repair approach tends to position teachers as school learners, which stands in stark contrast to generally-held principles of professional development (Clarke, 1994) and does not go beyond a narrow knowledge of the mathematics of the curriculum to address mathematics for teaching more broadly. Conceptual approaches focus extensively on developing conceptual insight, often through extended problem-solving tasks. While we value conceptual insight and challenging tasks, our concern is that often such programs adopt an exclusively conceptual approach with little regard for the role of procedures or procedural fluency (Riccomini, Smith, Hughes & Fries, 2015) in mathematical proficiency, and the place of procedures in typical tasks in secondary school Mathematics. Much of school Mathematics is characterized by applying familiar procedures, and it is thus important to deal with such features of school Mathematics in professional development, and to do so in principled ways, and thus constructive for teachers and learners. The Transition Maths (TM) courses form the backbone of the professional development work of WMCS, and were designed with the assumption that focusing on teachers' MFT leads to better teaching, which ultimately translates into increased learner attainment. We thus assume a direct effect on teacher knowledge and an indirect and delayed effect on learner attainment. The courses focus on mathematics content (75%) and aspects of mathematics teaching (25%) and thus are structured in a similar ratio to Sample McMeeking et al.'s

(2012) program. Each course comprises eight two-day contact sessions over a year, with independent work between these sessions, which includes tutorials on the mathematics content, and tasks related to teaching. While the courses have distinct foci, both focus on learning MFT through revisiting known mathematics and learning new mathematics (Pournara, 2013). The goals of revisiting are to deepen teachers' grasp of the content, frequently by exploring extreme cases or by problematizing aspects that may be taken for granted rather than redoing to improve procedural fluency. Revisiting builds on, strengthens and extends teachers' existing knowledge of mathematics at hand.

Researchers have claimed that qualifications are very important and they show that the qualified persons give assurance to people that whatever service to be rendered will be undoubtedly a good one. Berry, Depaepe and van Driel (2016) averred that even though there are debates on how to define a qualified teacher, teachers with qualifications mostly have a grasp on the subject matter and this has been long considered an important influence on teaching and learning.

There is a growing interest in the professional development of educators as the demands, expectations, and requirements of teacher education increasingly come under scrutiny (Louhran, 2014). What the teacher does influences the whole process of learning. Effective teachers mostly have qualifications and produce better performing students (Akiri, 2013). Curwood (2014) argued that the professional development of teachers can be effective and sustainable if certain conditions are met. Koster, Bouwer and van den Bergh (2017) suggested that the implementation of educational reforms, including reforms associated with technology integration and literacy education, are often dependent upon teachers' skills, values, and cultural models, which means the hiring of qualified teachers is encouraged for improvement of academic performance.

Unanma and Unanma (2013) examined the relationship between teachers' academic qualifications and academic achievement of Senior Secondary school students in mathematics and discovered that there is a positive relationship between the variables. Lopes, Boyd, Andrew, and Pereira (2014) discovered that improvement in teacher qualifications, especially among the poorest schools, appeared to have resulted in improved student achievement.

V. METHODOLOGY

5.1.1 Research Approach

The mixed-methods approach is adopted in this study which opens the door to multiple methods, different worldviews, and different assumptions, as well as different forms of data collection and analysis in the mixed methods research (Creswell, 2014).

"We believe that a broad interpretation and use of the word methods (in mixed methods) allows inclusion of issues and strategies surrounding methods of data collection (e.g., questionnaires, interviews, observations), methods of research (e.g., experiments, ethnography), and related philosophical issues (e.g., ontology, epistemology, axiology)". (Johnson & Onwuegbuzie, 2004:22; Johnson, Onwuegbuzie, Tucker & Icenogle, 2014:557).

5.1.2 Sample/sampling selection

The study population comprised nine (9) public secondary schools and three (3) private schools were purposively selected from each circuit for the qualitative phase and twelve (12) educators and three hundred and forty-five (345) learners were quantitatively selected based on the percentage of the total population in East London Education District.

5.1.3 Validity and reliability of research Instrument

This study adopted concurrent triangulation which was used to validate and substantiate findings of the study. Creswell (2014) averred that content, external and construct validity were ensured that the research instrument measures what it is intended to measure, and that it measures this correctly so that the study will produce the similar results if the same study was conducted in other zones by another researcher (Hoffman, Kennedy, LoPilato, Monahan & Lance, 2015).

5.2 Data analysis

The researcher used descriptive statistics of percentage from the responses of teachers and learners for quantitative data. The quantitative analysis was done by using excel 2010 to formulate data into percentages and qualitatively, voice recordings from the respondents' semi-structured interviews were reduced through thematic analysis.

5.3 Findings

Table 4: The racial participants of learners and educators across twelve selected schools.

Race	No. of learners	Percentage	No. of educators	Percentage
African	255	74	6	50.0
Coloured	59	17	3	25.0
Indian	21	6	1	8.0
Asian	0	0	0	0.0
White	10	3	2	17.0
Total	**345**	**100**	**12**	**100**

Source: *Field study (September 2018)*

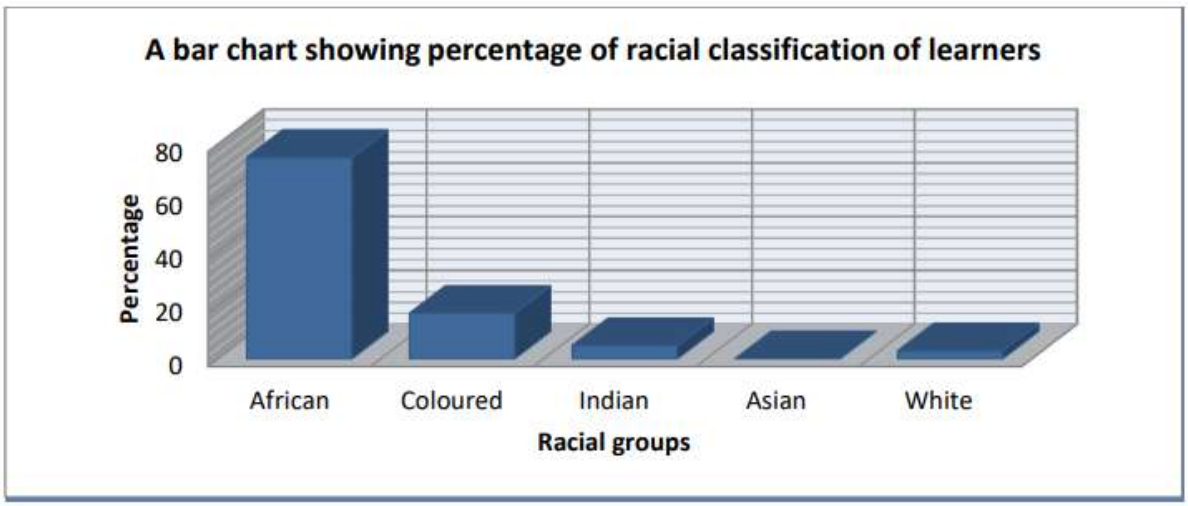

Figure 2: *The racial classification of learners*

Source: *Field study (September 2018)*

From Table 4 and Figure 2, it can be ascertained that the African learners from the majority which is two-hundred and fifty-five (255) of the respondents translating to 74%. This is followed by the Coloured group with fifty-nine (59) representing 17%. Twenty-one (21) learners representing 6% are Indians and ten (10) respondents representing 3% are Whites. None of the respondents was Asian and all the respondents indicated their race.

Table 5: **The number of questionnaires distributed and the number returned**

Stratum	No. of questionnaires distributed (Circuit 1 – 9 Public schools & Circuit 10 – 12 Private schools)	No. of questionnaires returned (Circuit 1 – 9 Public schools & Circuit 10 – 12 Private schools)	Response rate in percentage (%)
CIRCUIT 1	30	29	96.7
CIRCUIT 2	30	30	100
CIRCUIT 3	30	30	100
CIRCUIT 4	30	28	93.3

CIRCUIT 5	30	29	96.7
CIRCUIT 6	30	30	100
CIRCUIT 7	30	25	83.3
CIRCUIT 8	30	28	93.3
CIRCUIT 9	30	30	100
CIRCUIT 10	25	25	100
CIRCUIT 11	25	25	100
CIRCUIT 12	25	25	100
TOTAL	**345**	**334**	**96.8**

Source: *Field study (September 2018)*

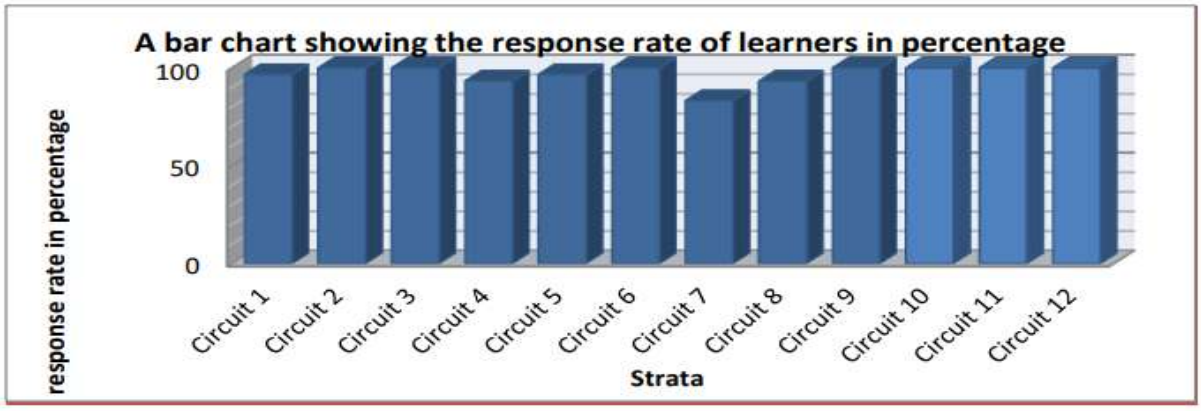

Figure 3*: The response rate of learners*
Source: *Field Study (September 2018)*

The selected respondents comprise the larger population but did not return all the distributed questionnaires as expected. It could be that some respondents did not know what to write or might deem it not necessary to write anything, thus affecting the response rate. Even when a response rate is reported it may have been defined in several ways, usually according to the choice of the denominator. For example, response rate has been define traditionally as the total number of participants who were interviewed divided by the total number who were eligible; it has also been defined as the total number of completed interviews divided by the total number of participants with whom contact was made (or the number of all possible interviews). These may be substantially different, and the reason for these differences is often related to the methods used for data collection (Fan & Yan, 2010).

From Figure 3, it can be seen that circuit 2, 3, 6 & 9 had the highest response rate of one hundred percent (100%) for the public schools. It could be that the respondents understood what was expected of them and had adequate information to give. To add, Circuit 10, 11 & 12 had one hundred percent (100%) for the private schools, and this could be attributed to not having challenges in providing for information; this was followed by circuits 1 and 5 with ninety-six point seven percent (96.7%), and the third group circuits 4 and 8 with ninety-three point three percent (93.3%), while circuit 7 had eighty-three point three (83.3%) response rate respectively.

Some scholars have suggested a minimal level for a response rate of 50% while others have suggested 80%. Again, Patten (2016) asserted that a response rate of fifty percent (50%) is sufficient for analysis of data, a response rate of sixty percent (60%) can be said to be "good", seventy percent (70%) is classified as "very good", eighty to ninety percent (80% - 90%) response rate is said to be "excellent". It can, therefore, be seen that the response rate for this research was an excellent one.

Table 6: How learners evaluate educators' methods of teaching mathematics

Evaluation	No. of learners	Percentage
Excellent	**23**	**6.8**
Very good	**78**	**23.4**
Good	**192**	**57.5**
Fair	**31**	**9.3**
Poor	**10**	**3.0**
Total	**334**	**100**

Source: Field study (September 2018)

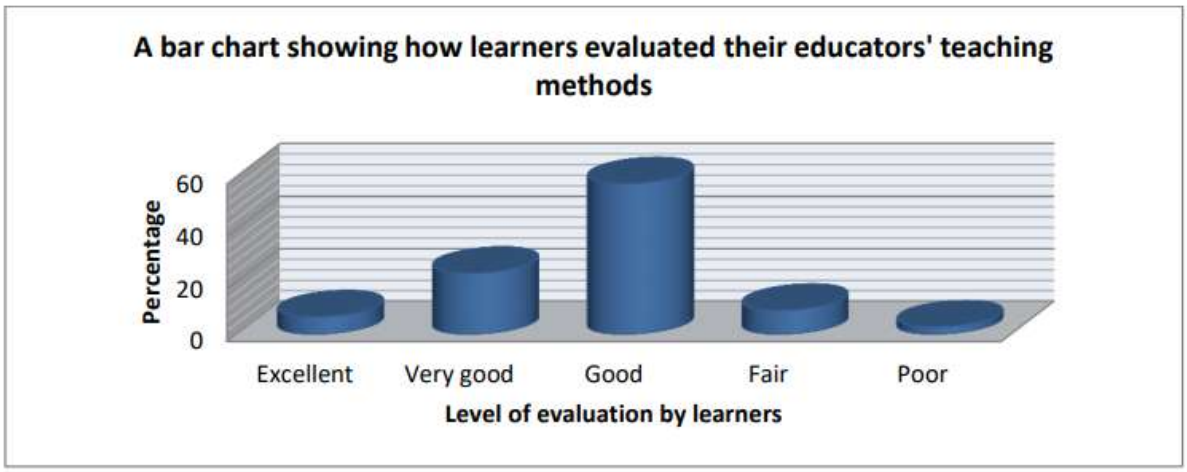

Figure 4: *Evaluation of the method used by the mathematics educator.*

Source: *Field study (September 2018)*

From Table 6 it can be noted that one-hundred and ninety-two (192) learners (57.5%) evaluated the methods the mathematics educator uses in teaching as "good", seventy-eight (78) learners (23.4%) evaluated the methods the mathematics educator use as "very good", thirty-one (31) learners (9.3%) evaluated the methods the mathematics educator uses as "fair", ten (10) learners (3%) were of the view that the methods are "poor" and twenty (23) learners (6.8%) evaluated them as "excellent". This observation shows that the majority of learners were averagely acquainted with the methods that Mathematics educator uses in teaching mathematics.

Table 7: The confidence level of learners in answering mathematics questions

Level of confidence	No. of learners	Percentage
Very high	**25**	**7.5**
High	**47**	**14.0**
Low	**112**	**33.5**
Very low	**150**	**45.0**
Total	**334**	**100**

Source: *Field study (September 2018)*

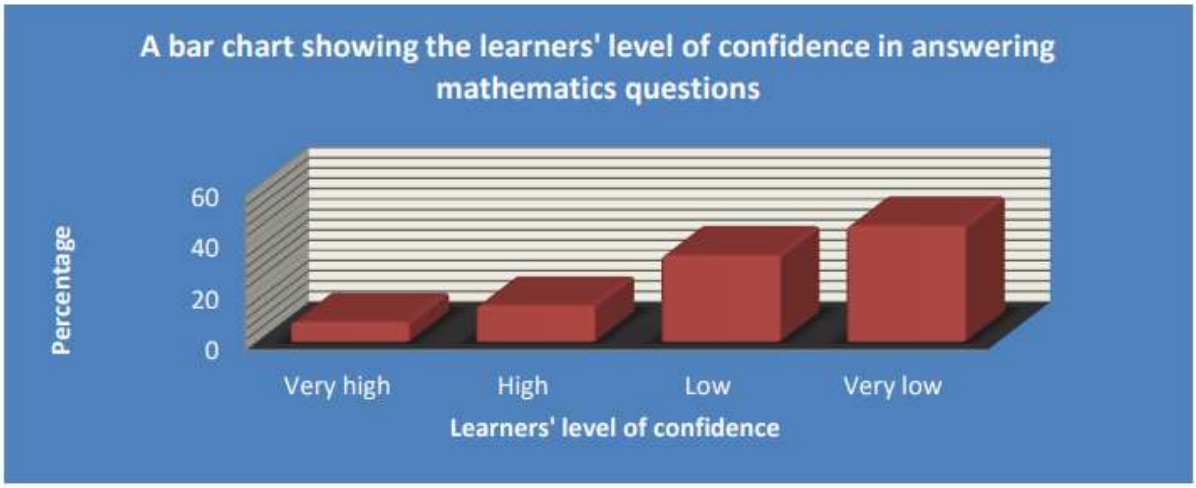

Figure 5: *The learners' level of confidence in answering mathematical questions.*

Source: *Field study (September 2018)*

Table 7 above revealed that one hundred and fifty (150) learners‟ (45%) level of confidence in solving mathematics is "very low", one hundred and twelve (112) learners‟ (33.5%) level is "low", forty-seven (47) learners‟ (14%) level of confidence is "high" and twenty-five (25) learners‟ (3.7%) level of confidence in solving mathematics questions is "very high".

The level of confidence in solving mathematics questions generally is "very low" as deduced from Table 4.11 above. Confidence in mathematics is vital because it creates an awareness of the learners' preparedness in solving mathematics questions. Lack of confidence would affect the performance of learners in mathematics eventually when the content taught is not meaningfully delivered for the learner to understand.

In the study of Ku, Chen, Wu, Lao and Chan (2014), they supported that low confidence is one of the critical reasons that make students face challenges in learning Mathematics. Such a negative feeling may consequently make a student give up learning mathematics (Brown, Brown, & Bibby, 2008).

VI. Summary of findings and discussion on why educators' content knowledge of Mathematics has effects on grade 6 learners' performance

The findings from the participants revealed that several factors were responsible for how educators‟ contents were taught in grade 6 Mathematics in the East London district.

6.1 Unqualified teachers

A good content knowledge by educators is mostly achieved through subject specialization. It was discovered from this study that 25% of educators were not qualified to teach mathematics. Generally, almost all the educators have the minimum qualification of a degree certificate which the South African Council of Educators has enforced over the years. This information is consistent with Bernstein (2011) whose study emphasized that teachers who are qualified to teach certain subjects, including scarce subjects such as mathematics, do not teach those subjects. Many teachers of mathematics are not qualified to do so, and many of those who are qualified are not teaching mathematics. In 2005 the Department of Education found that 44 percent of teachers who were qualified to teach an identified scarce subject (e.g. mathematics) were teaching other, non-scarce subjects. This can significantly impact adversely on the learners‟ performance in mathematics.

6.2 Lack of teaching materials and learning aids

The study also revealed that there is a lack of teaching materials and learning aids in schools. There cannot be effective in teaching without the needed teaching materials. The knowledge that educators have is abstract and can be made real or concrete or tangible when those teaching materials are used effectively for the learners to understand what is being taught. Almost all schools the researcher visited have basic teaching aids such as chalkboard, chalk, rulers, measuring instruments and few pictures. In the 21st century, the world has evolved quickly where traditional teaching aids are fading out in the replacement of technology. None of the schools that

the researcher visited used projectors to display pictures and even show learners the real-life videos of the topic that was treated. Mostly because of the large class sizes, educators were not able to show pictures to all the learners manually and where they did, it cost them much time. In a situation where the educators have to show about 4 or 5 different pictures to 45 learners, there wasn't enough time to teach. In one case, one of the pictures got torn whiles learners were trying to look at them.

According to Eee Ah Ming (1997) (cited in Zin and Zain (2010)), traditional teaching focused on the lecture method in delivering the content to the students and they used one-way communication to explain the idea or principle. The students become passive participants in the class. This situation will lead the students to become bored to learn and finally will influence their academic performance adversely. An alternative to the traditional way of teaching is edutainment which means that the education that has been placed within the framework of entertainment with software that is designed and developed to target parents and educators and is specifically designed to focus on academic subjects.

These are some the verbatim excerpts from the interview on both educators and learners:

"The topic fraction in mathematics has always been very difficult for me in my thirteen years of teaching to make the learners understand. Not that I don't know it but my problem is how to make them understand the topic thoroughly" (Respondent, A3).

"I have difficulty in teaching some topics such as fractions and number patterns for learners to understand. For instance, how do you use concrete to explain the multiplication of a fraction or a geometric pattern to a grade 6 learner?" (Respondent, A2).

"I don't understand topics like fractions, divisions, number patterns, etc. I don't know if my teacher is not teaching me well. It is very hard to pass mathematics. I don't know maths and I get scared of it" (Respondent, B3).

6.3 Time management

There is another major contributory factor to learners poor performance in mathematics which was due to poor time management by educators. The researcher by observation recorded how time was managed by both learners and educators in some of the selected schools. Time is very important when it comes to teaching and learning routines. The class time table spells out what should be done at any point in time in the classroom. The researcher observed that some few learners arrived at school late in the morning at the time of the survey. The educators were in school in time but the starting time of most of the schools was delayed. This could be that some learners and educators took more time to settle before starting the lessons. Some schools started late from a minimum of 3 minutes late to a maximum of 9 minutes. An assumption of 5 minutes late a day could cost 120 minutes or 2 hours (5 minutes x 24 (average working days in a month) = 120 minutes) which is 2 teaching periods of 1 hour each or teaching periods of 45 minutes each. It is shocking to note that schools that started 5 minutes late lost 5 working days or a week in an academic year (5 minutes x 206 school calendar days) = 1030 ÷ 60 hours = 17.16 hours. This means that those schools lost over 17 teaching periods of 1 hour each in a year. Niemic and Frederic (1994) (as cited in Saloviita (2013)) made a distinction between allocated, engaged, and productive time. Allocated time is the time assigned by curricula for learning. Engaged time means time on task. Productive time is the proportion of engaged time in which the student is learning with high success. Both learners and educators must consider time management as a success in achieving good performance in mathematics.

VII. CONCLUSION / RECOMMENDATION

Stakeholders in the education sector are responsible for improving the teachers knowledge in Mathematics. Based on the findings of this study, the following strategies for building positive content knowledge of teachers in Mathematics are recommended.

Learners should create an environment that is conducive when the educators are teaching them mathematics. Making extreme noise, disruptions, distractions, fighting, etc. can affect the quality of teaching and learning as well. Slow learners need no distractions to make them concentrate on what is being taught in the classroom. Mathematics can be studied and practiced well when the learners are attentive to follow steps of calculations and know how it is done.

Also, learners must have adequate relaxation for the refreshment of their minds so that they can absorb enough information given to them by their educators. They must sleep early to maximize rest for them to be energized for the next day at school. The saying goes "a sound body has a sound mind" relates to a situation where some

learners are not able to cope with school work because they play all day and watching television and being on phones at late hours. They get extremely tired and never prepared for extra tuition or assistance they may receive after school. This results in mathematics homework not done and no revision is done on what they are taught at school.

Educators should adhere to the time table of the class to avoid starting lessons very late. Learners are indirectly denied teaching time which accumulates many teaching periods in a year. 5 minutes out of 60 minutes delay per lesson by the mathematics educators could be 17 lessons lost in a school academic year. Also, educators should know the strengths and the weaknesses of their learners in the classrooms so that they can offer remedial teaching to learners by focusing on which content areas the learners need help. This will help cater to all types of learners with different learning difficulties in mathematics class. Effective remedial lessons should be on a few selected learners whose challenges are below the standard of the class where their needs can be met. Where there are available human resources (educators), then one-on-one tuition would be suitable by the mathematics educator to enable learners who are shy to ask questions in class the opportunity to do so privately. The fast learners can also be concentrated on the lesson when corrections are done in the classroom and a friendly environment should be created for the learners to ask questions on where they find so challenging. Also, Mathematics educators must take in-service training and workshops seriously to update their teaching methods and skills in mathematics. Educators who have been in the teaching field for many years can benefit from in-service training and workshops on new methods of calculations, the use of technology in the classroom and effective teaching styles to assist some learners with special learning needs. Common topics that educators find challenging for the learners to understand must be communicated to the subject advisors within the district, so all pieces of training to be given to the educators would be needful.

Parents should not leave their children's mathematics education solely in the hands of educators but must be actively involved in the work given to their children both in school and at home. They must visit the school periodically to know how active their children are and get feedback from educators on salient issues that parents must note about their children.

Department of Education The Department of Education should conduct training that is tailored to the needs of educators so that they will be able to impart the right and modern knowledge to the learners. Some of the training is becoming obsolete which will not be relevant in some few years to come. For instance, training educators to teach content abstracts would not be adequate for the learners to apply their skills in mathematics because they lacked the knowledge of "know-how" or practical way of doing it. Training should inform educators about the importance of some topics like fractions, number patterns, measurements, etc. in real-life situations and not to the only center on how to teach it. Training educators on technology will go a long way to make the topic being taught easily to the leaners. Most of the learners are taught to calculate manually but know a little on how to use the calculator to do the same task.

REFERENCES

Journal Papers:

[1] Adu, E.O., Galloway, G. and Olaoye, O., 2014. Teachers‟ Characteristics and Students‟ Attitude towards Economics in Secondary Schools: Students‟ Perspectives. *Mediterranean Journal of Social Sciences*, *5*(16), p.455.

[5] Akiri, A.A., 2013. Effects of teachers‟ effectiveness on students‟ academic performance in public secondary schools; Delta State-Nigeria. *Journal of Educational and Social Research*, *3*(3), p.105.

[2] Bantwini, B.D., 2010. How teachers perceive the new curriculum reform: Lessons from a school district in the Eastern Cape Province, South Africa. *International Journal of Educational Development*, *30*(1), pp.83-90.

[5] Curwood, J.S., 2014. Between continuity and change: identities and narratives within teacher professional development. *Teaching Education*, *25*(2), pp.156-183.

[3] Darling-Hammond, L., 2010. Teacher education and the American future. *Journal of teacher education*, *61*(1-2), pp.35-47.

[4] Darling-Hammond, L., 2015. *The flat world and education: How America's commitment to equity will determine our future*. Teachers College Press.

[2] DBE, R., 2014. Annual National Assessment 2014: Report on the ANA of 2014.

[2] DoE (Department of Education). 2011. *Annual National Assessments Results*. Pretoria: National Library Auditorium.

[4] Dunn, R., Craig, M., Favre, L., Markus, D., Pedota, P., Sookdeo, G., Stock, J. and Terry, B., 2010. No light at the end of tunnel vision: Steps for improving lesson plans. *The Clearing House*, *83*(5), pp.194-206.

[1] Furinghetti, F., Matos, J.M., and Menghini, M., 2013. Third International Handbook of Mathematics Education.

[5] Gersten, R., Taylor, M.J., Keys, T.D., Rolfhus, E. and Newman-Gonchar, R., 2014. Summary of Research on the Effectiveness of Math Professional Development Approaches. REL 2014-010. *Regional Educational Laboratory Southeast*.

[6] Hoffman, B.J., Kennedy, C.L., LoPilato, A.C., Monahan, E.L. and Lance, C.E., 2015. A review of the content, criterion-related, and construct-related validity of assessment center exercises. *Journal of Applied Psychology*, *100*(4), p.1143.

[5] Johnson, R.B., Onwuegbuzie, A.J., Tucker, S. and Icenogle, M.L., 2014. Conducting mixed methods research using dialectical pluralism and social psychological strategies. *The Oxford handbook of qualitative research*, pp.557-578.

[1] Patten, M.L., 2016. *Questionnaire research: A practical guide*. Routledge.

[2] Kastberg, D., Roey, S., Williams, T. and Gonzales, P., 2006. Trends in International Mathematics and Science Study (TIMSS) 2003.

[4] Krauss, S., Brunner, M., Kunter, M., Baumert, J., Blum, W., Neubrand, M. and Jordan, A., 2008. Pedagogical content knowledge and content knowledge of secondary mathematics teachers. *Journal of Educational Psychology*, *100*(3), p.716.

[10] Ku, O., Chen, S.Y., Wu, D.H., Lao, A.C. and Chan, T.W., 2014. The effects of game-based learning on mathematical confidence and performance: High ability vs. low ability. *Journal of Educational Technology & Society*, *17*(3), p.65.

[4] Laura, B., McMeeking, S., Orsi, R. and Cobb, R.B., 2012. Effects of a teacher professional development program on the mathematics achievement of middle school students. *Journal for research in mathematics education*, *43*(2), pp.159-181.

[5] Lopes, A., Boyd, P., Andrew, N. and Pereira, F., 2014. The research-teaching nexus in nurse and teacher education: contributions of an ecological approach to academic identities in professional fields. *Higher Education*, *68*(2), pp.167-183.

[5] Loughran, J., 2014. Professionally developing as a teacher educator. *Journal of Teacher Education*, *65*(4), pp.271-283.

[5] Pournara, C., 2013. *Mathematics-for-teaching in pre-service mathematics teacher education: The case of financial mathematics* (Doctoral dissertation).

[5] Riccomini, P.J., Smith, G.W., Hughes, E.M. and Fries, K.M., 2015. The language of mathematics: The importance of teaching and learning mathematical vocabulary. *Reading & Writing Quarterly*, *31*(3), pp.235-252.

[4] Richards, J.C., 2010. Competence and performance in language teaching. *RELC Journal*, *41*(2), pp.101-122.

[13] Saloviita, T., 2013. Classroom Management and Loss of Time at the Lesson Start: A Preliminary Study. *European Journal of Educational Research*, *2*(4), pp.167-170.

[1] Spaull, N. and Kotze, J., 2015. Starting behind and staying behind in South Africa: The case of insurmountable learning deficits in mathematics. *International Journal of Educational Development*, *41*, pp.13-24.

[2] Spaull, N., 2013. South Africa¨s education crisis: The quality of education in South Africa 1994-2011. *Johannesburg: Centre for Development and Enterprise*, pp.1-65.

[6] Unanma, A.O. and Unanma, A.O., 2013. Relationship Between Teachers Educational Qualifications And Student's Achievement In Chemistry: A Case Study Of Owerri West LGA. *IOSR Journal of Research & Method in Education*, *1*, pp.5-10.

Chapters in Books:

[11] Bernstein, R.J., 2011. *Praxis and action: contemporary philosophies of human activity*. University of Pennsylvania Press.

[5] Berry, A., Depaepe, F., and van Driel, J., 2016. Pedagogical content knowledge in teacher education. In *International Handbook of Teacher Education* (pp. 347-386). Springer Singapore.

[5] Creswell, J.W., 2014. *Research Design: Qualitative, Quantitative and Mixed Methods Research.* (4th Ed.). Los Angeles: SAGE.

[8] Fan, W., and Yan, Z., 2010. Factors affecting response rates of the web survey: A systematic review. *Computers in human behavior*, *26*(2), pp.132-139.

[5] Koster, M., Bouwer, R. and van den Bergh, H., 2017. Professional development of teachers in the implementation of a strategy-focused writing intervention program for elementary students. *Contemporary Educational Psychology*, *49*, pp.1-20.

[3] Tay, E.G., Lim, S.K. and Ho, W.K., 2017. Preparing Mathematics Teachers in Singapore: The Issue of Mathematics Content Knowledge. In *Teacher Education in the 21st Century* (pp. 107-132). Springer Singapore. teacher Education, 27(1), pp.3-9.

Theses:

[3] Wright, C.D., 2017. *The effect of a teacher preparation program on teacher preparedness from the perspective of first-year teachers and their principals* (Doctoral dissertation, Eastern Kentucky University).