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Original Paper

Teacher Qualification Characteristics and Secondary School Students' Mathematics Achievement: A Qualitative Study

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Abstract

Many Grade 12 CSEC Mathematics registrants are consistently underperforming at their Mathematics examination due to their inability to grasp basic mathematical concepts. Teacher Qualification Characteristics appear to be related to students' achievement in Mathematics. This qualitative study incorporated the Grounded Theory (GT) approach which generated a substantive theory that explained how five Teacher Qualification Characteristics were related to Grade 12 students' 2016 CSEC Mathematics achievement in the British Virgin Islands. There were 33 participants involved in semi-structured individual and focus group interviews. The data revealed that teachers' competence and content knowledge dictate that teachers should have at least a Bachelor's Degree in Mathematics. Teachers' professional certification allowed them to help their students transfer their mathematical knowledge. The more years of teaching experience a teacher has, the more likely their students will be successful at CSEC Mathematics. Professional development sessions should be subject-specific and relevant. Preparing students for life, fostering communication for understanding and making Mathematics simple are hallmarks in the academic coaching experiences. This qualitative study yielded 17 themes. These themes are evidence that saturation was reached that allowed for the development of the GT—Mathematical Mastery Maximization is not vacuous; it hinges on five teacher qualification characteristics.

Keywords

certification, coaching, experience, Mathematics, professional development, teacher qualification

1. Introduction

Mathematics education is critical, and the question of the winning Teacher Qualification Characteristics (TQCs) for improving students' academic gains in Mathematics is still relevant. Maximizing students'

learning capacity in the Mathematics classrooms has been a growing concern for many educators (McLymont, 2000). Our world is constantly becoming more academically competitive, hence, the way Mathematics is taught and the characteristics that Mathematics teachers demonstrate can make a substantial difference in students' achievement.

Mathematics education is to a nation that which protein is to a human organism (Bassey, Joshua, & Asim, 2003). Wilson (2012), a practicing medical doctor of many years, suggested that proteins are the most remarkable group of molecules in the human body. The same way protein is essential to the development of the human organism, Mathematics education appears to develop and sustain a nation that is continually evolving. Mathematics is a subject common to every continent, yet it appears to be one of the most challenging to pass. This challenge is seen in the Caribbean Secondary Education Certificate (CSEC) Mathematics Examination results published annually by Caribbean Examination Council (CXC) in their annual technical report (2006-2016). This annual technical report (2006-2016) has caused educators, from across the Caribbean region, to engage themselves in collaborative discussions and research geared towards improving students' mathematical achievement.

Improving students' mathematical achievement has been the most hotly debated topic in many learning institutions (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2008). These intense but meaningful debates are centered on the best practices for preparing teachers to improve outcomes for the students they teach (Boyd et al., 2008). The ultimate need of the education system is to equip teachers with the required Content Knowledge (CK) and Pedagogical Content Knowledge (PCK) with the aim of making a positive difference in students' mathematical achievements. The education system should ensure, as well as teachers themselves, that teachers are equipped with the TQCs that can make a profound impact on the mathematical experiences of the students at the Grade 12 level.

The aim of this qualitative research design was to generate a substantive theory that explained how five TQCs were related to Grade 12 students' 2016 CSEC Mathematics achievement in the British Virgin Islands. This research is extremely important to the current educational discourse on students' achievement since students are under-performing at their CSEC Mathematics examination. To meet these challenges effectively, teachers are expected to undertake a greater responsibility that would contribute positively to students' success. The remaining main sections of this article were discussed under the following headings: (1) methodology, (2) results, and (3) discussion followed by a conclusion.

1.1 Background of the Study

This research study has been influenced by the consistent level of relatively high performance of Grade 12 CSEC Mathematics candidates within the BVI. This can be credited to a number of factors observed by the researcher but not limited to (a) selecting students to write the examination, (b) teacher employment criteria, (c) planned subject oriented professional development sessions, (d) academic coaching of students during and after school hours, (e) teachers' route of certification, (f) teacher's Mathematics teaching experience, (g) personal academic development, and (h) in-field Mathematics

teaching financial benefits, but it appears that no study has ever been conducted to determine whether this is the case. However, the consistent underperformance of students within the overall Caribbean region, has been a growing concern of many educators for more than a decade. For these reasons, this research is critical in the history of the Caribbean and can be the catalyst for positive changes.

Students are generally selected to write the Mathematics examination, which may not be unique to the BVI. It is the general practice within the BVI education community that only students whose attitude towards Mathematics is wholesome and also showed the proclivity to receive an acceptable grade (Grades *I, II, & III*) are allowed to sit the examination. In addition, the employment criteria for secondary school teachers in general and Mathematics teachers in particular, have been exemplary. The requirements for teaching does not suggest that only mathematically qualified and trained teachers are employed to teach Mathematics. Teachers within the BVI are exposed to regular professional development sessions, sponsored by the Ministry of Education and Culture, in their content area and general classroom management skills. Within the local schools, of the BVI, teachers are encouraged to seek continuous development in their content area. To facilitate this academic growth, some teachers attend evening or online classes to upgrade their academic qualification.

Mathematics teachers are given additional financial benefits, over their counterparts from other subject areas, and therefore teachers do their best to maintain their employment. It has been the general practice of many secondary schools preparing students for CSEC examinations, to engage in teaching beyond the regular school day, with no additional financial burden to their parents or financial gain to the teacher.

To engineer a change in students' academic achievement, teachers need to have a shift in perspective and view Mathematics as a beautiful experience and not as something mechanic, difficult, and boring (Chu-Carroll, 2009). The process of effective change starts with teachers who are competent coaches in Mathematics education, qualified, certified, have experience teaching secondary school Mathematics, and attend regular professional development sessions tailored to address the academic needs of students.

1.2 Statement of the Problem

The statement of the problem for this research is, many Grade 12 CSEC Mathematics registrants are consistently underperforming at the CSEC Mathematics examination due to their inability to grasp basic mathematical concepts (Caribbean Examinations Council, 2006-2016). Educators face major problems in the classroom and the teaching profession as a whole. There are some opinions about the probable indications in the literature about the causes of poor mathematical achievement, but the literature explored does not reveal any study that existed prior to this one that explored potential indicators of poor CSEC mathematical achievement in the Caribbean region. Numerous recent studies have examined teacher qualification and students' Mathematics achievement (Woolridge, 2003; Keith, 2004; Gould, 2010; Stanford, 2014; Stewart, 2013) but it appears that no single study has comprehensively combined the five TQCs established in this research. The five TQCs in this research

are (a) teachers' qualification, (b) teachers' certification, (c) teachers' experience, (d) professional development, and (e) academic coaching.

1.3 Purpose of the Study

The purpose of this grounded theory research was to develop a substantive theory that explains how the five Teacher Qualification Characteristics (teacher qualification, teacher certification, teacher Mathematics teaching experience, professional development, and academic coaching) are related to Grade 12 students' 2016 CSEC Mathematics achievement at two secondary schools in the British Virgin Islands. At this stage of the research, Teacher Qualification Characteristics is generally defined as the attributes of the Mathematics teachers of Grade 12 that contributed to the mathematical achievement of their Grade 12 students at the 2016 CSEC Mathematics examination.

1.4 Research Questions

(a) How did teachers' in-field and out-of-field Mathematics teacher training contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination?

(b) How did the teachers' professional certification (traditional, alternative, or untrained) process contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination?

(c) How did teachers' Mathematics teaching experience according to the number of years (1-3 years, 7-9 years, and 10+ years) contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination?

(d) How did professional development sessions teachers attend, according to the total number of hours (at most 25 hours, 26-50 hours, greater than 50 hours), contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination?

(e) How did academic coaching of students by their Mathematics teachers according to the number of hours, (at most 60 hours, 61-100 hours, and 101-140 hours), contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination?

2. Methodology

A research design is a specific plan or guide for studying a research problem (Joyner, Rouse, & Glatthorn, 2013). Similarly, Richey and Klein (2007) postulated that a research design is a blueprint geared to guide the researcher to a successful completion of the research. Finally, Creswell (2009) concurred that a research design is a plan or procedure for research that spans the broad spectrum of data collection and analysis. From all indications, a research design is a tool that is employed to engineer the successful progression and completing of a research. The Classical/Glaserian GT approach was utilized which allowed the researcher to focus on the participants' experiences by collecting data in the form of spoken and written words and through observations. Creswell (2013) stated that this GT research approach was intended to generate or discover a theory grounded in the data collected. Strauss

and Corbin (1990) posited, "The grounded theory approach is a qualitative research method that uses a systematic set of procedures to develop an inductively derived grounded theory about a phenomenon" (p. 24).

This approach was most appropriate since one of the primary purposes, of this research, was to generate or develop a substantive theory that emerged from the identification of the core categories grounded in the data (Merriam, 2009), and the fact that, all the participants involved in this qualitative approach were selected because of the common characteristics that they share (Creswell, 2013).

In this research, each teacher was exposed to the same CSEC Mathematics syllabus (2010-2016), they prepared students for the 2016 CSEC Mathematics examination, they all have a Bachelor's degree, they are equipped with at least 4 of the 5 TQCs, they were exposed to similar Content Knowledge (CK) and Pedagogical Content Knowledge (PCK) since many professional development sessions were organized and held by the Ministry of Education and Culture, BVI, and they reside and work in the BVI. Similarly, the students were all former 2016 CSEC Mathematics students, from within the BVI territory, who registered and sat the same examination and were exposed to the identical grading scheme.

2.1 Population and Sample

This study focused primarily on the academic achievement of Grade 12 students as measured by the 2016 CSEC Mathematics examination and their Mathematics Teachers' Qualification Characteristics. The two research sites that were involved in this study are Elliot Princes High (EPH) and Georgian Moore Secondary (GMS) (Pseudonyms). These two secondary schools, one public and one private, together with the participants were purposefully sampled because the researcher believed that their former Grade 12 CSEC Mathematics students and their teachers could supply the much-needed information that would answer the research questions established as a guide to this research. A total of 27 students and six teachers voluntarily consented. Hence, the sample size for this qualitative research was 33 participants. According to Creswell (2013), it is recommended that 20 to 30 persons be involved in a GT design, to ensure the development of a well-saturated theory.

Devers and Frankel (2000) said that purposive sampling strategies are designed to enhance understanding of selected individuals or for developing a theory or concept. If the goal of the research is not to generalize but to gain a comprehensive understanding into the phenomenon, as is the case in this qualitative research, then the researcher purposefully selects individuals (Onwuegbuzie & Collins, 2007).

2.2 Making Initial Contact with Teachers

The researcher first made an appointment with the vice principal responsible for monitoring the research activities at the school/research site (EPH). This meeting was held on February 03, 2017, one week prior to the initial meeting with the Mathematics faculty who taught Grade 12 students during the 2015-2016 academic school year. At this meeting with the vice principal, the researcher shared an overview of the research. The vice principal gave the researcher permission to meet with the Mathematics teachers of Grade 12. The researcher met with 5 of the 7 teachers of EPH on February 10,

2017, while the remaining two teachers were met on February 15, 2017. The researcher met the eighth teacher from the second school/research site (GMS), on February 22, 2017.

The researcher shared with each potential participant the purpose of the study, the estimated number of interviews (approximately three), sensitivity to the demand on their time, the high level of confidentiality and respect for the interview process, and the voluntary nature of their participation. After the sharing of this information with each Mathematics teacher of Grade 12, they were allowed to ask questions and seek clarification. At the end of the interactive session, the researcher asked each potential participant to indicate their commitment and willingness on the information sheet that was provided. The information sheet asked participants to provide their name (pseudonym), home and email addresses, telephone numbers, and best time to call and when not to call.

2.3 Initial Meeting with Students from Public School (EPH)

In 2015, the government of the BVI introduced an additional year at the end of the public secondary school system. These public school students who sat the 2016 CSEC examinations were mandated to complete an additional school year, 2016-2017. Hence, it was not challenging to make contact with these students as potential participants.

The vice principal gave the researcher permission to meet with the students during their assembly session since they were all in one location. During this initial contact visit, the researcher shared the purpose of the study, the estimated number of interviews (approximately three), sensitization to the demand on their time, the high level of confidentiality and respect for the interview process, and the voluntary nature of their participation. After the sharing of this information, they were allowed to ask questions and seek clarifications. The researcher responded to each question asked as well as clarified mis-conceptions. At the conclusion of this initial meeting, each student was given a cover letter and two informed consent forms; one addressed to the student and the other addressed to his/ her parent or legal guardian. Only those students, who returned their signed consent form, were allowed to be part of this research. The public school students returned their signed consent forms to the vice principal's office.

2.4 Initial Meeting with Students from Private School (GMS)

The researcher made contact with seven (47%) of the 15 private school students through telephone conversations and email. These students were either attending the Hampton College, employed, or unemployed, therefore the researcher met with them individually. At the conclusion of each meeting, each student was given a cover letter and an informed consent form, for his/ her parent or legal guardian to sign. Each student returned his/her signed informed consent form. Even though, the parents or legal guardians consented, the students gave assent (Seidman, 2013).

2.5 Data Collection Sources and Procedure

Joyner, Rouse and Glatthorn (2013) mentioned interviews, observations, surveys, test and measurements, and documents as qualitative data collection sources. However, the researcher incorporated the three-round interview protocol, as postulated by Seidman (2013), for teachers' individual interviews, students' individual interviews, and students' focus group interviews. The

first-round interview focused on establishing a context for the participants' historical experience interacting with Mathematics, prior to Grade 12. The second-round interviews focused on the participants' ability to reconstruct the details of their Grade 12 experience, and the final-round interviews encouraged the participants to reflect on the meaning of their Grade 12 experience. Seidman (2013) stated that at the root of in-depth interviewing is the researcher's ability to understand the phenomenon being studied rather than the researcher's ability to answer the research questions.

Documents were also utlized, as the data collection sources for this research. These documents represented the students' Mathematics notebooks for the 2015-2016 school year and the teachers' signed appraisal forms for the same period. These data sources represented the voices of each participant and therefore were used to develop the substantive GT.

2.5.1 Individual Interviews

Semi-structured interviews were utilized for teachers and students since, "Interviews in qualitative research are more open-ended and less structured" (Merriam, 2009, p. 90). Six teachers and seven students were interviewed individually using the three-round interview protocol. These interviews were held at least twice weekly, over six weeks. The interview process continued until the researcher was fully satisfied that there was an in-depth understanding of the phenomenon being studied and there was a point of information saturation (Creswell, 2013). Berg (2009) cautioned that it is inaccurate to suggest that all interviews must be lengthy if they are to yield useful information. Seidman (2013) said that the age of the participants must be taken into consideration when setting the length of an interview. Hence, the average time spent interviewing both teachers and students lasted for approximately 75 minutes in total. The "*Digital Voice Recorder, eBo Trade Portable Rechargeable 16GB USB Audio Dictaphone, MP3, FM Player*" was used to record all interviews, both individual and focus group.

2.5.2 Focus Group Interviews

A focus group is an excellent way of collecting information from approximately six to eight unrelated participants under the guidance of the moderator who skillfully guides the discussion (Berg, 2009). For this research, four focus group interviews were held with a total of 27 students. There were three groups of seven students each and one group of six. Each focus group met on one occasion. Prior to the focus group interviews, each participant was allowed to sign, "A Group Agreement for Maintaining Confidentiality" form as recommended by Berg (2009). The researcher then affixed his signature to the form, on the line provided. The average duration of each focus group interview was 70 to 75 minutes.

During these focus group interviews, the researcher made keen observations of those students whom he believed had the proclivity to supply additional rich description for the study's phenomenon. These students were identified for individualized interviews since individual interviewing styles permitted more detailed pursuit of content information than is possible in a focus group session (Berg, 2009). The interviews were audiotape recorded to enable the researcher/moderator to focus more on the meaning the participants were sharing (Seidman, 2013).

2.5.3 Documents-Teachers' Appraisal**s**

Qualitative information was gathered from the 2015-2016 teachers of Grade 12 end-of-year signed appraisal forms. These appraisal forms specifically addressed the teachers' professional development and academic growth over the, 2015-2016, academic school year. Under these two headings: professional development and academic growth, there were interview questions that were specifically related to whether or not teachers were engaged in continuous learning and professional development sessions.

2.5.4 Students' Notebooks

The content of seven 2015-2016 former Grade 12 students' Mathematics notebooks, were analyzed. This was not challenging, because of the extra academic school year (2016-2017) that was added to the life of every public secondary school student. As a result, these students did not graduate from the institution, after writing their 2016 CSEC examinations, but were still bona fide students. On the other hand, students from the private institution graduated and were either attending the community college, employed, or unemployed.

The researcher purposefully selected a total of seven students from both schools/research sites (EPH and GMS) and engaged them in a dialogue concerning their understanding of specific content areas in their notebooks. Some questions that were asked are: (1) Why were some homework/classwork corrected while others were not? (2) What was your understanding of the homework/assignment that has been corrected as against the homework/assignment that has not been corrected? and (3) Did your teacher use different teaching strategies to help you understand the mathematical concepts? These questions assisted the researcher in the understanding of the level at which students grasped the content knowledge, whether teachers were qualified in the content being taught, and to what extent they were engaged in alternative teaching strategies. After each analysis, the researcher made written observations and reflections, in his journal.

2.6 Data Analysis Strategies

Joyner, Rouse and Glatthorn (2013) posited that qualitative data analysis is more challenging to analyze as the data are not numerical, but textual. Merriam (2009) suggested, "All qualitative research data analysis is primarily inductive and comparative" (p. 175). Gay, Mills and Airasian (2009) concurred that the collection and analysis of qualitative data could occur simultaneously. This current study engaged in an iterative data collection and analysis procedure (Creswell, 2013; Gay, Mills, & Airasian, 2009; Merriam, 2009).

Data from the focus group interviews and individual interviews were collected. A Digital Voice Recorder, eBo Trade Portable Rechargeable 16GB USB Audio Dictaphone MP3 FM Player, was used throughout the interview process. The researcher made detailed transcriptions of all interviews. These transcribed notes from the recorded interviews were saved on an 8 GB Kingston flash drive and a Seagate External USB 2 TB device, according to date, time, data source, data collection strategy, and research site. When the researcher was satisfied through member checks that the information received

was what the participants wanted to convey, then it was uploaded into QDA Miner 4.0.

2.6.1 QDA Miner 4.0

QDA Miner 4.0 is a qualitative data analysis software package for coding textual data, graphical, annotating, retrieving, and reviewing coded data and documents. It provides a wide range of exploratory tools that identify patterns in coding and relationship between assigned codes and other numerical or categorical properties. These documents can be edited at any time without affecting the existing codes. QDA Miner 4.0 can import and export documents, data, and results in numerous file formats (MS Word, WordPerfect, RTF, PDF, HTML, XML, MS Access, Excel, SPSS, Paradox, dBase, QSR N6, Nvivo, Atlas.ti, HyperResearch, Ethnograph, Transana, and Transcriber).

2.7 Validation Concerns

Merriam (2009) postulated that internal validity is a definite strength in qualitative research when the researcher is the sole instrument in collecting and analyzing data and the best way to shore up internal validity is through triangulation and member checks. In addition, Merriam (2009) posited that adequate engagement in data collection and peer review are also internal validity strategies.

Triangulation, according to Creswell (2013), is a process of corroborating evidence from various sources that inevitably lead to a comprehensive understanding of the phenomenon being studied. This research involved a combination of different collection data strategies: students' focus group interviews, students' individual interviews, and teachers' individual interview. The reason for these three different sets of information was mainly to ensure there was the internal validity of the findings.

Merriam (2009) used the term member check, to suggest taking your preliminary analysis back to the respondents for verification and clarification, while Creswell (2013) used the term member checking. The researcher, being the sole data gathering instrument, returned to the participants to verify and clarify data and interpretation. Member checks were done throughout the research where the researcher met individually with respondents whose information shared was unclear and sought clarification.

Creswell (2009) said that adequate engagement with participants in the data collection process develops the researcher's in-depth understanding of the phenomenon under study. For the 18 weeks duration of this study, the researcher visited the schools/research sites on 14 occasions to have conversations with both teachers and students.

Merriam (2009) said that peer review could be conducted by a person familiar with the topic or not familiar with the topic. For this research, two members from within the researcher's study group at Northern Caribbean University (NCU) reviewed this document and shared their feedbacks. These feedbacks were examined and incorporated into the research, where applicable.

According to Gay, Mills and Airasian (2009), reliability in qualitative research also known as consistency is the degree to which the study data consistently measure whatever they set out to measure. In this research, the researcher ensured that specific procedures for data collection and analysis were outlined in detail to provide a high level of consistency. The researcher ensured that both the individual and focus group interview protocols met reliability status by having them pilot tested.

The power of qualitative research is in the relevance of the findings to the researcher or the audience of the research although the findings may have some applicability or transferability to other similar settings. Merriam (2009) purported that the most common generalization in qualitative research is the reader or user generalizability. This is where the person who reads the study decides whether the findings can be applied to their particular situation. Merriam (2009) established that to cater for transfer to another situation, the researcher must ensure a rich, thick, description of the research and its processes as well as, there must be maximum variation of research sites and/or participants.

Merriam (2009) mentioned that when rich, thick, description is used as a strategy to enable transferability, it refers to a description of the setting, participants, and findings of the study presented in the form of quotes from the participants. In this research, there was a comprehensive description of the research designs, research sites, and participants.

Merriam (2009) posited that maximum variation in research sites or participants provides a greater range for transferability. In this research, the focus groups comprised of students who received different grades at the 2016 CSEC Mathematics examination. There was a mixture of students who received acceptable grades and those who received non-acceptable grades. Even though they were from the same research site, they had varying appreciation for Mathematics. This type of heterogeneous composition enabled a wider range of views for the same phenomenon.

2.8 Ethical and Legal Issues

The ethical and legal issues are hallmarks of any research venture. It is critical that each participant be aware of what will transpire and not be caught by surprise (Seidman, 2013). Each gatekeeper and participant, involved in this research, were given adequate notice, engaged in ongoing discussions, and asked questions for clarification. Each participant was informed continually of the high level of confidentiality and ethical and legal issues about the study.

Access to students was possible through making contact with their teachers and parents. The parents' last known telephone numbers and email addresses, recorded at their former school was used as a reference point of contact. As a result 27 students we involved. Each parent allowed the researcher to share the purpose of the study, the estimated number of interviews (approximately three), sensitization to the demand on their child's time, the high level of confidentiality and respect for the interview process, and the voluntary nature of the child's potential participation.

Seidman (2013) advised that participants sign their informed consent forms prior to their first interview. The researcher decided to keep these informed consent forms in a secured location for at least five years before they are destroyed (Berg, 2009) by shredding. Before the actual signing of the informed consent forms, the researcher first ensured there was ethical research clearance from NCU Institution Review Board.

Participants, as well as their schools/research sites, were assigned pseudonyms for the sole purpose of withholding their identity. This was in keeping with ethical issues and concerns that guided this research.

3. Results

There were five qualitative research questions that guided this research. Each research question was explored which contributed to the current body of knowledge. There were 17 themes that emerged from the contribution of the 33 participants.

3.1 Grounded Theory Identified

The GT emerged from this research has advance one's understanding of the TQCs and how students' academic achievement at subsequent CSEC Mathematics examination can be enhanced. After a careful and systematic analysis, the GT derived from this qualitative research orientation is: ***Mathematical Mastery Maximization (3M)*** is not vacuous; it hinges on five Teachers' Qualification Characteristics. This suggests that students' mathematical performance can be improved when school administrators are informed by teachers' qualification characteristics.

3.2 Qualitative Research Question #1

How did teachers' in-field and out-of-field Mathematics training contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination? The data sources used to answer this research question were: students' focus group interviews, teacher individual interviews, and students' individual interviews. The two major themes captured are teachers' competence and content knowledge as well as additional teacher professional qualification.

Analysis of the data revealed that teachers' competence and content knowledge dictate that teachers should have at least a Bachelor's degree in Mathematics (in-field) content knowledge, be competent to respond to students' questions adequately, fill the gaps in their knowledge, and prepare students well for the CSEC Mathematics examination. Also, additional teacher professional qualification (out-of-field) includes expertise in teaching strategies, to enable students to understand the mathematical concepts as a result of the teacher being a people person.

A Bachelor's degree in Mathematics (in-field) is critical for students' success at the CSEC Mathematics examination. Having a Bachelors' degree in Mathematics adds to the teachers' content knowledge and competence as a Mathematics teacher. However, being a people person and utilizing various teaching strategies (out-of-field) can complement a teacher's academic and professional qualification.

3.3 Qualitative Research Question #2

How did the teachers' professional certification (traditional, alternative, or untrained) process contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination? The data sources used to answer this research question were: students' focus group interviews and students' individual interviews. The three major themes generated from the data that provided a response for the research question were: application and knowledge transfer, equipping teachers with skills and techniques to address students' learning needs, and developing skills in classroom management.

Teachers' professional certification /training allow them to help their students to transfer their mathematical knowledge and make application to other situations. This training equips teachers with

skills to address students' learning needs, but it is not a necessary requirement for employment for the teaching of Mathematics at the CSEC level. Teacher certification programmes allow teachers to be flexible in teaching strategies and to develop the skills to manage their classrooms.

Teachers' engagement in professional certification programmes is meaningful especially in a CSEC Mathematics classroom. It helps in preparing students not only to be successful at the examination but also to make practical applications to real-world situations.

3.4 Qualitative Research Question #3

How did teachers' Mathematics teaching experience according to number of years (1-3 years, 7-9 years, and 10+ years) contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination? The data collection sources involved in this research question were: individual interviews and focus group interviews. The three major themes generated from the data that provided a response for this research question are: effective teaching strategies, maximizing students Mathematics success through teacher mathematical experience, and showing relevance between mathematical concepts and the real-world.

The data indicated that student-participants believe that regardless of their aptitude and learning differences, teachers should meet their learning needs through their teaching strategies. The more number of years of teaching experience a Mathematics teacher has, the more likely are students to perform better at the CSEC examination thus maximizing their success. Teachers should not only be concerned with the teaching of Mathematics content but also showing its relevance to and making connections with the real-world.

Teachers' effectiveness can enhance students' mathematical achievement in the classroom. In addition, teachers' effectiveness can also be determined by their ability to transfer mathematical content knowledge to real-world scenarios for students to understand.

3.5 Qualitative Research Question #4

How did professional development sessions teachers attend, according to total number of hours (at most 25 hours, 26-50 hours, greater than 50 hours), contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination? The data collection methods used for this research question are: individual interviews and focus group interviews. The three major themes generated from the data that provided a response for the research question are: developing new teaching strategies through collaboration, broadening the scope and focus on Mathematics content knowledge during professional development, and professional development should be subject specific, relevant, and provide practical engagement

Collaboration between the school administration and Mathematics teachers in planning for professional development sessions is necessary to address teachers' and students' needs. Broadening the scope and focus on professional development sessions can benefit students in their Mathematics classroom. These benefits are unlimited, therefore professional development sessions should be subject specific, relevant, and be able to provide practical engagement that caters for the needs of students and their teachers.

Professional development sessions are informative avenues that can benefit teachers and by extension, students. However, teachers must perceive that what transpires at these sessions is meaningful and relevant.

3.6 Qualitative Research Question #5

How did academic coaching of students by their Mathematics teachers according to number of hours, (at most 60 hours, 61-100 hours, and 101-140 hours), contribute to Grade 12 students' academic achievement in Mathematics as measured by the 2016 CSEC Mathematics examination? The data collection methods used for this research question are: individual interviews and focus group interviews. The six major themes generated from the data that provided a response for this research question are: addressing students specific issues through academic coaching, positive attitude of students and teachers enhance understanding, preparing students for life, communicate for understanding, Mathematics made simple, and Mathematics is fun.

Addressing students' specific issues through academic coaching leads to the development of a positive attitude of students and teachers, and this enhances understanding. Preparing students for life, fostering communication for understanding, making Mathematics simple, and students experiencing fun while learning are hallmarks in the academic coaching experiences.

Effective learning can be accomplished through effective communication. Teachers and students must be able to express themselves clearly, and this forms the basis for the effective transfer of knowledge. The benefits of academic coaching transcend the acquisition of content knowledge and students' grade level. It can benefit students for life.

4. Discussion

The qualitative data collection strategies that led to these results consisted of semi-structured interviews for both teachers and students, and focus group interviews for students only, and documents. Six teachers (18%) and 27 students (82%) voluntarily participated in this research.

4.1 Discussion of Findings for Teacher Qualification

The findings revealed that students who have teachers with an in-field Mathematics major are likely to outperform students who have teachers without an in-field Mathematics major. This appears to be the reason more students, approximately twice as many, were taught by in-field Mathematics majors. The greater number of students who were successful at the CSEC Mathematics level was contingent on teachers' in-field majors. Students' level of performance in CSEC Mathematics is dependent on the major the teacher has.

4.2 Discussion of Findings for Teacher Certification

Teacher certification helps the beginning teachers to become aware of the many challenges they may face in the classroom. While teacher certification is essential, it is not essential for students' success at the CSEC Mathematics level. Teacher certification was viewed as a tool for flexibility in teaching strategy rather than a contribution to students' academic gains in CSEC Mathematics. Being uncertified

does not suggest incompetence in the subject area being taught. However, teachers should be encouraged to receive professional training (traditionally or alternatively), since trained teachers can lay the foundation, at earlier grade levels, for students writing their examination at Grade 12.

4.3 Discussion of Findings on Teacher Experience

Teachers' experiences play an indispensible role in the lives of Mathematics students particularly at the CSEC level. They are able to almost naturally enhance their students' learning by showing the connection between the classroom content knowledge and the real world. This is an essential aspect that is embedded in Mathematics teachers' daily classroom activities. Students' academic development must be polished; only the best in students' development must be the ideal. This suggests that teachers Mathematics lessons should move away from mere classroom content knowledge and be blended with appropriate applications to the real world.

4.4 Discussion of Findings on Professional Development

Learning is a social activity. Collaboration among teachers does not only satisfy the mental faculties, but it encourages emotional support. When faculty members can share ideas about content knowledge and pedagogical content knowledge, it does not only benefit them but also their students. Every Mathematics teacher should be part of a learning hub. Professional development sessions have produced astute students in the field of mathematical success. However, teachers must perceive that what transpires at these sessions are meaningful and relevant. Collaboration between and among teachers during Mathematics sessions can foster improvement in classroom instructions. In other words, both teachers and students benefit as a result of well-planned and ongoing professional development sessions.

4.5 Discussion of Findings on Academic Coaching

Teachers should take into consideration the many learning styles that are present in a single classroom. Unless these learning styles are advanced, learning would not be an exciting experience. The needs of each student must be met through differentiated instruction. Academic coaching is a powerful teaching alternative that is highly recommended for students' academic achievement in Mathematics. It can impact a student's life holistically. Academic coaching provides an addition to the list of teaching strategies available in the Mathematics classroom.

5. Conclusion

The GT approach was utilized in this qualitative research design. There were a total of 33 participants (27 students and 6 teachers) who volunteered to be a part of this research. This research needed to be focused and therefore the researcher incorporated five research questions, each dealt with a specific TQC. This research was relevant to be studied since there was a growing concern for the high level of under-performing registrants at the CSEC Mathematics examinations, and something urgent needed to be done. The BVI registrants have a consistently high level of performance at these examinations and therefore, this research was conducted in the BVI so that other CSEC territories can apply some of the

findings to their specific setting. Analysis of data indicated that a Bachelors' degree in Mathematics (in-field) is critical for students' success at the CSEC Mathematics examination. Having a Bachelors' degree in Mathematics adds to the teachers' content knowledge and competence as a Mathematics teacher. However, being a people person and utilizing various teaching strategies (out-of-field) can complement a teacher's academic and professional qualification. Teachers' engagement in professional certification programmes is meaningful, especially in a CSEC Mathematics classroom. It helps in preparing students not only to be successful at the examination but also to make practical applications to real-world situations. Students' mathematical achievement can be enhanced by their teachers' Mathematics teaching experience. This is evident in the teacher's ability to transfer mathematical content knowledge to real-world situations. Professional development sessions are informative avenues that can benefit teachers and by extension, students. However, teachers must perceive that what transpires at these sessions is meaningful and relevant. The benefits of academic coaching transcend the acquisition of content knowledge and students' grade level. It can benefit students for life.

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