THE EFFECTS OF TEACHER CERTIFICATION AND EXPERIENCE ON STUDENT ACHIEVEMENT ON PRIMARY SCHOOL EXAMINATION IN BELIZEAN PRIMARY SCHOOLS

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CHAPTER I

INTRODUCTION

Belize is located in the heart of Central America. Bordered in the north -west by Mexico, south west by Guatemala, and the east by the Caribbean Sea. The country is geographically divided into six districts (Appendix A). The Mestizo, Creole, Maya, Garifuna, and Mennonite remain the five largest ethnic groups in Belize. At 50% the Mestizo is the largest ethnic group. Twenty one percent of the population is the Creole, the Maya and Garifuna population in the year 2010 was at 10% and 4.6% respectfully. Roman Catholicism is the single largest religion in Belize. The country's population is 312,698 with 138,796 of its people living in the rural areas and 171,827 in urban areas. The statistics also revealed that about 88 thousand persons were enrolled in formal education: 63,700 at the primary level, 17,200 at the secondary level, and 7,400 at tertiary (Statistical Institute of Belize, 2010).

Over the years, Belize's Ministry of Education (MOE), policy makers, and educators have worked diligently to ensure that students in primary schools across the country receive a quality educational experience. English is the country's official language, yet 97% of the children enter school speaking a language other than English. Primary schools are managed by the government, religious denominations, and private individuals or entities. Regardless of the type of management, Belizean schools have local managers at the district level and general managers at the national level. Thus, while the MOE is responsible for policies and procedures that govern school services, the school managements are the ones responsible for the management and operations of the schools. Those responsibilities include, hiring and terminating teachers and school administrators and determining the religious curriculum.

Fifteen percent of the schools in the entire country are government schools and the other 85% are denominationally managed schools. The system of education in Belize is a church-state partnership in which the government pays the full salaries of all the teachers and administrators and provides assistance with infrastructure while the denominational management manages the school. The Ministry of Education is cognizant of the issues with teacher training and its implication on teaching and learning and has, therefore, continuously initiates proposals to provide greater access for teachers to develop themselves.

Increased development of teachers may provide the foundation for better classrooms environment and higher student scores on the Primary School Examination (PSE). The quality of education offered in Belize differs by schools. Some schools offer high quality educational opportunities to their students while others do not. Belize's system of formal education has three levels:

- primary (Infant I – Standard six)
- secondary (first form – fourth form), and
- tertiary (Junior College and to the University).

Primary education plays a vital role in establishing the foundation necessary for students to matriculate into secondary schools. The fundamentals of the major subjects tested on the PSE are of great importance to be acquired so as to increase retention and graduation rate at the secondary level. Brown (2000) noted that with so many children achieving minimally in the early grades, there is little hope that they will successfully advance through the school system and into productive careers and fulfilling lives. The acknowledgement of students' success in school has implications on the quality of the work force and the standard of living in Belize. As with any system, there are many factors that produce an outcome.

History of Teacher Education in Belize

The policies and procedures that govern schools services in Belize do not require teachers to be certified prior to entering the classroom, resulting in many teachers being secondary school graduates and very few teachers holding an associates and bachelors degree in primary education. Prior to 1965 there were many efforts by the state to ensure that the education system in Belize was improved. This included the establishment of education legislations to overhaul the system, British Aid to education, and the initiation of decolonization of education. The most active year in the history of teacher education in Belize was 1965. Many of the recommendations made by UNESCO pertaining to the improvement of the quality of education at all levels were implemented by the government of Belize. The three separate teacher training institutions, (The Intermediate Training Centre, The Government St. George's Training College and Roman Catholic St. John's Teacher's College) were merged to form the Belize Teacher's College (Bennett, 2008, Rosado, 1991).

According to Bennett (2008), the 1980 state goal of having all primary school teachers trained was still not achieved. Pastor (1995) noted that there were two forms of training for primary school teachers in Belize. The first generally involved practicing teachers taking in-service classes to qualify for annual examinations set by Ministry of Education. The second committed teachers to two years of intramural studies followed by one year of internship done at the Belize Teachers College (Pastor, 1995; Rosado, 1991). In 1981 the Belize Teacher's College found itself under the direct control of the Belize College of Arts, Science and Technology (BELCAST) and was renamed the BELCAST School of Education (Rosado, 1991). In 1986 BELCAST was dismantled and the Belize Teacher's College resumed its independent operations (Rosado, 1991).

According to Bennett (2008) "The Belize Primary Education Development Project focused on increasing the percentage of fully trained teachers, by making teacher training its main priority". (p. 156). The two-year, full-time training and one-year internship were restructured to a one-year Level 1 training, which allowed those teachers who completed one year of training to move up one grade on the pay scale. It also allowed them to return to the classroom to practice before advancing to the Level 2 program, which prepared them to be fully certified (Bennett, 2008). After the dismantling of BELCAST, a new institution was formed known as the University College of Belize (UCB).

There were several changes of government which eventually led to the amalgamation of UCB, Belize Teachers College, The Bliss School of Nursing, the Belize Technical College and the Belize School of Agriculture to form the new national university, The University of Belize (Bennett, 2008). Presently, the University of Belize offers teacher training programs from its three campuses located in Belize City, Belmopan and Toledo. The programs include associate's and bachelor's degrees in primary education. In addition, Belize Adventist Junior College, Corozal Junior College, Sacred Heart Junior College, St. John's Junior College, and Stann Creek Ecumenical Junior College also offer associates degrees in primary education programs.

Problem Statement

In Belize, there has been a concerted effort among the MOE, policy makers and educators to improve education. However, in spite these efforts, research indicates that expected learning outcomes are not achieved in most schools, resulting in many schools not performing adequately on the standardize examination, Primary School Examination (PSE). One way to analyze these discrepancies in providing quality education may be through studying the variables of school

location, school type, teacher certification, teacher experience, content knowledge, pedagogical knowledge and pedagogical content knowledge.

Purpose of the Study

The purpose of this study was to evaluate whether or not there was a significant difference in school location, school type, teacher certification, and teacher experience on student achievement on PSE. In addition, this study will seek to examine if there exist a relationship among the following: teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge and student achievement on PSE scores.

Research Questions and Hypotheses

The study investigated the following research questions and hypotheses:

1. Are there differences in students' PSE achievement scores between urban and rural Belizean primary schools?
2. Are there differences in students' PSE achievement scores between multi-grade and mono-grade Belizean primary schools?
3. Are there differences in students' PSE achievement scores among teachers' with various level of training in Belizean primary schools? Three levels were examined:
    - Bachelor's Degree or Higher
    - Associates Degree
    - Others
4. Are there differences in students' PSE achievement scores among teachers' with various years of experience in Belizean primary schools?
5. Is there a relationship between students' PSE achievement scores among teacher's knowledge? Three areas were examined:

- content knowledge,
- pedagogical knowledge
- pedagogical content knowledge

Several hypotheses were developed based on these research questions. Each hypothesis was written as a null. The following were the research questions followed by the null hypotheses.

Research Question 1

Are there differences in students' PSE achievement scores between urban and rural Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There were no mean differences in PSE achievement scores between standard six students who attend urban or rural primary schools.

Research Question 2

Are there differences in students' PSE achievement scores between multi-grade and mono-grade Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There is no mean difference in PSE scores for standard six students in multi-grade or mono-grade schools.

Research Question 3

Are there differences among teachers with different levels of training in Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There are no mean differences in PSE scores between standard six students and teacher with different levels of training in Belizean primary schools.

Research Question 4

Are there differences in students' PSE achievement scores among teachers with various years of experience in Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There are no mean differences in PSE scores between standard six students and teacher experience in primary schools.

Research Question 5

Is there a relationship among teachers' knowledge and students PSE achievement score? Three areas were examined:

- Content Knowledge
- Pedagogical Knowledge
- Pedagogical Content Knowledge

The following null hypotheses were developed based upon this question:

H_{o1}: There is no relationship between students PSE achievement scores and teachers' content knowledge.

H_{o2}: There is no relationship between PSE achievement scores and teachers' pedagogical knowledge.

H_{o3}: There is no relationship between PSE achievement scores and teachers' pedagogical content knowledge.

Theoretical Framework

Preparation of teachers in the educational uses of technology appears to be a key component in almost every improvement plan for education and educational reform efforts. Results of empirical investigations suggest that Technology Pedagodical Content Knowledge

(TPCK) is a distinct body of knowledge that can be developed and assessed. This body of knowledge goes beyond mere integration or accumulation of the constituent knowledge bases, toward transformation of these contributing knowledge bases into something new (Angeli & Valanides, 2009).

Since the 1980s, Shulman's model of teacher knowledge incorporating the construct of Pedagogical Content Knowledge (PCK) has had an important impact on teacher education (Tsui & Treagust, 2002). Angeli and Valanides (2008) explained that the extended view of PCK is offered as a framework for revitalizing the study of teacher knowledge and for collecting and organizing data on teacher cognition about technology integration.

According to Valanides (2009) the transformative view concludes that TPCK is a unique body of knowledge that is constructed from the interaction of its individual contributing knowledge bases, namely, content, pedagogy, technology, learners, and context. TPCK is conceptualized as an extension of Shulman's pedagogical content knowledge and is described as the ways knowledge about tools and their affordances, pedagogy, content, learners, and context are synthesized into understandable concepts.

Angeli and Valanides (2009) stated that the integrative view is rejected and the transformative view is adopted. They conclude that TPCK is a unique body of knowledge that is constructed from the interaction of its individual contributing knowledge bases. ICT-TPCK is introduced as a strand of TPCK. TPCK described as the ways knowledge about tools and their affordances, pedagogy, content, learners, and context are synthesized into an understanding of how particular topics that are difficult to be understood by learners or difficult to be represented by teachers can be transformed and taught more effectively with technology in ways that signify its added value.

Procedures

This research is quantitative in nature and used a causal-comparative approach. Causal-comparative research or ex post facto research where by the researcher attempts to determine the cause, or reason, for existing differences in the behavior or status of groups or individuals (Gay, Mills & Airasian, 2006). The purpose of this study was to evaluate whether or not there was a significant difference in students' PSE achievement and (a) school location, (b) school type, (c) teacher level of training and, (d) teacher experience. In addition, the study examined the relationship between students' PSE achievement score and teachers' content knowledge, pedagogical knowledge, and pedagogical content knowledge.

The instrument used to collect data from the teachers who participated in this study was the (TPCK) developed by Schmidt and associates (2010). The survey instrument was made up of two sections. Section one gathered information on the teachers' demographic data; educational background and teaching experience and section two included a series of statements that examined teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge. The achievement scores used for the students were their PSE scores.

There are 294 primary schools in Belize. The population of this study was sixty schools. The surveys were issued to teachers who have been teaching standard six for the school year 2009-2010. Ten teachers were identified by the education officers in every six district to participate in completing the survey by convenient sampling. The dependent variable was the students' scores on (PSE). PSE test concepts and skills in Mathematics, Science, Social Studies and English. Students are given individual scores for each subject area and a cumulative score. Analysis of Variance (ANOVA) was used to determine if there were differences among the variables for research questions and hypotheses from one through to four. Research question

five and hypotheses utilized Linear Regression to examine if there was a relationship among the variables and student achievement.

Significance of the Study

This study is expected to help educators to better understand the many factors such as school location, school type, teachers' experience, teacher certification, and teachers' content knowledge, pedagogical knowledge, and pedagogical content knowledge that may influence students' achievement. The findings will contribute to research on student achievement and how teacher quality interacts to improve student achievement. In addition, one attempt of this study is to add significantly to the availability of literature in Belize on student achievement.

All parents expect that their children will pass the PSE after attending primary school for eight years. MOE, tertiary institutions, policy makers, school managers, local managers, and principals can benefit significantly by having access to additional information on student achievement and factors such as school location, school type, teachers' experience, teacher certification and teachers' content knowledge, pedagogical knowledge, and pedagogical content knowledge.

Assumptions and Limitations

This study is guided by four assumptions. The first is that all students in Belizean primary schools who sat the PSE school year 2009-2010 were in standard six. Secondly, the PSE score is an accurate reflection of the students' academic ability. The third assumption is that the items on survey instrument were understood by the teachers. The fourth assumption is that the time of the year the survey was completed did not affect the results of the study. Some participants did not return completed survey on a timely manner this made it difficult to collect the survey instrument

from some of the participants before going off for summer vacation. In addition, the sampling method and sample size chosen by the researcher limits the generalisability of the study to the entire population.

Definition of Terms

Student Achievement: a passing rate on the PSE.

Primary School: a school recognized by the Ministry as providing instruction and training suited to the ages, abilities and aptitudes of children between the ages of five years and fourteen years (Education and Training Act, 2010).

Teacher Certification: the academic preparation and competency testing required of teachers (Sparks, 2004).

Teacher experience: the total number of years a teacher teaches.

Mono-grade school: the school with classrooms in which students within the same grade are assumed to be more similar in terms of age and ability (Little, 1995).

Multi-grade: the schools with classrooms that accommodate students of different ages, grades and abilities in the same group (Little, 1995).

Primary School Examination (PSE): refers to a national standardized examination administered by the Ministry of Education to students at the end of primary education to determine achievement in relation to the primary school curriculum (Education Rules, 2000).

Small school: a school with fewer than 100 students.

Large school: a school with more than 100 students.

Level 1 Trained Teachers certificate: a certificate awarded for successfully completing the first part of an associate degree in teaching (Wright, 2006).

Level 2 Trained Teachers' Certificate: a certificate awarded for the successful completion of an associate's degree in teaching (Wright, 2006).

2+1 Trained Teachers' Certificate: a certificate which is equivalent to an associate degree in teaching (Wright, 2006).

Trained Teacher: teacher who has successfully completed a continuous course in a recognized training college, lasting two years or as a special measure for one year (Pastor, 1995). Trained teachers in primary education are the percentage of primary school teachers who have received the minimum organized teacher training (pre-service or in-service) required for teaching in their country.

Untrained Teacher: teacher who have not successfully completed a continuous course in a recognized training college lasting two years or as a special measure, for one year. (Pastor, 1995).

LCP: Licentiate College of Preceptors is equivalent to a Master's Degree.

ACP/AA: Associate College of Preceptors is equivalent to a Bachelor's Degree.

1st Class: includes series of qualifying examinations that MOE had administered to unqualified teachers to meet minimum requirement to teach.

2nd Class: Qualifying exams taken by prospective teachers

High School or secondary education: a school recognized by the Ministry of Education as providing education and training suited to the ages, abilities and aptitudes of students between ages of twelve years and eighteen years (Education and Training Act, 2010).

Content Knowledge (CK): is the knowledge about actual subject matter that is to be learned or taught. Teachers must know about the content they are going to teach and how the nature of knowledge is different for various content areas (Schmidt et al., 2010).

Pedagogical Knowledge (PK): refers to the methods and processes of teaching and includes knowledge in classroom management, assessment, lesson planning development, and student learning (Schmidt, et al. 2010).

Pedagogical Content Knowledge (PCK): refers to the content knowledge that deals with the teaching process. PCK is different for various content areas, as it blends both content and pedagogy with the goal being to develop better teaching practices in the content areas (Schmidt, et al., 2010).

Summary

The purpose of this study was to evaluate whether or not there was a significant difference in school location, school type, teacher certification, teacher experience, content knowledge, pedagogical knowledge, pedagogical content knowledge and student achievement on the PSE. This study was organized in the following format. Chapter 1 introduced the need for the study including; history of teacher education in Belize, statement of the problem, the purpose of the study, the research questions and hypotheses, assumptions, definition of terms, and the significance of the study.

Chapter 2 provides a review regarding national organizational structure of Belizean education, student achievement and testing in Belizean education, transformative pedagogical content knowledge and Belizean education, and national examination for primary school students in Belize. Chapter 3 presents the research questions and hypotheses, participants, data collection, protection of human participants, instrumentation, and data analysis. Chapter 4 presents the methodology and findings of the research and chapter 5 presents the discussion, conclusion, and recommendations of the study.

Chapter II

REVIEW OF LITERATURE

Introduction

This chapter examines church state system of management, student achievement in urban and rural schools , mono-grade an multi-grade schools and student achievement, teacher certification and student achievement, teacher experience and student achievement, student achievement , teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge and student achievement, and national examination for primary school student in Belize.

Additionally, a percentage of those same teachers are not adequately equipped to ensure that learning takes place no matter what the circumstance. According to Berry, Fuller, and Williams (2008) over the last two decades researchers have presented convincing evidence that teachers are an important key to school improvement and to closing the student achievement gap. According to Levine (2006) the quality of tomorrow will be no better than the quality of our teacher force. Research indicates that the trend of high (adequate) students' achievement by location and school type due to teacher certification is not exclusive.

The review of literature is organized as follows: national organizational structure of Belizean Education will provide insight into the church- state system of education in Belize; student achievement in urban and rural schools; mono-grade and multi-grade and student achievement; teacher experience, and teacher certification. In addition, it will provide insight into student achievement and testing in Belizean primary schools and transformative Pedagogical Content Knowledge in Belizean Education.

National Organizational Structure of Belizean Education

Church-state system of Education in Belize

The church-state system of managing schools in Belize was not by accident. According to Thompson (1991) the first school to be established was the Honduras Free School in 1816 which was funded by voluntary subscription and managed by committee. This system of management arises as a result of the colonial system of managing schools in Britain and their colonies. Thompson (1991) explained that a Board of Education was established in 1850 to control and manage all government or government assisted schools since, around this time the greater share of running the schools fell into the hands of the government. Government continues to contribute salaries for the teachers and a grant for the operational cost of the schools (Thompson, 1991). Under the Ordinance of 1962 the government-aided schools receive 100% of teachers' salaries, a supplementary grant fixed per pupil enrolled and 50% of the total cost to run the school with respect to construction, equipment, supplies and maintenance (Thompson, 1991 & UNICEF, 2005). The Roman Catholic Church, because of its financial and cultural independence from Britain, was able to maintain a powerful hold on its broad ethnic base throughout rural communities (Hitchen, 2000) therefore it manages the largest number of schools within the partnership. While this is so, the managing authority must follow the rules and regulations set out in the *Handbook of Policies and Procedures* which governs education in the state. Regrettably, several of these denominational managements continue to act against some of the regulations especially in areas of teacher employment. Thompson (1991) added that the partnership management with the state provided the remaining 50% of the capital and recurrent expenditure. The church was still responsible for the general administration of the school

including hiring and firing of teachers (Bennett, 2000) though the state mandated the curriculum to be utilized in all primary schools in the country from Infant I to standard six. Achtem (2010), claims that in reality, the church has too much control over the implemented curriculum and teacher placement. According to Wright (2006) in many cases, parents' religious affiliation determines the school that students attend, although recently parents' selection of school have been based more on the schools' reputation for high achievement than for religious purposes. The dual system which arises from having two schools in some of the villages at the time showed a significant point of conflict between the church and the state in rural communities (Hitchen, 2000).

The Easter Report of 1935 and UNESCO reports of 1964 and 1983 recommended that the church-state partnership continue in the management of schools (Thompson, 1991). Much has changed since then and there are many critics of the church – state partnership who question the possibly negative effect it has on the quality of education provided to the children of the nation. Bennett (2008) in his report "An Enquiry into the Educational system of British Honduras 1933-1934", provides an analysis of the church state partnership in his commentaries of B.H. Easter, on the issue of the church-state management:

- The system prevailed because it was the tradition and wishes of the people of Belize to associate religion and moral teaching with education.
- The whole system of education was built by missionaries who were still pioneering in the colony
- Even if it could be argued that a purely government system was best for a settled and modern state, the colony could not be said to come with this category.

- The salaries paid to teachers could not attract well-qualified teachers from abroad, while teachers in the colony devoted themselves to educational work from a religious prospective.
- The churches contributed well to the provision of schools and the denominational school managers did duties, which would otherwise have to be paid by the government.
- The government for its part contributed to school buildings which the churches use of for church activities (p.4).

Bennett (2008) also alluded to the recommendation of B.H. Easter about the shortcomings of the church-state system of education.

- The churches should collaborate with the government to avoid over-lapping and wastage.
- In the selection of teachers paramount consideration should be given to their competence and not to their value as church workers or missionary agents.
- The appearance of giving undue time to religious instruction or devotions at the expense of other subjects should be avoided.
- The easy transfer of scholars from one school to another should be avoided.
- Government should frankly recognize that the religious denominations were relieving them of much work that would otherwise fall upon their shoulder and involve additional expenditure (p.5).

O. Reyes (personal communication, June 15, 2011) noted that the role of each district education center is to provide much needed support, training and supervising of schools to ensure that schools operate in alignment with the expectations of the ministry.

Student Achievement in Urban and Rural Schools

Teachers and principals in rural schools are generally younger, are less well educated and less likely to have completed advanced degree than those in non-rural schools. Rural principals were found to be younger than non-rural principals, and the qualities of size, homogeneity, and link to community serves to satisfy a large portion of the principals (Stern, 1994). In a study conducted by McCraren and Barcinas (1991) revealed that urban and rural students differed on the background characteristics of ethnicity, grade-point average, curriculum of enrollment, socioeconomic status (SES), and educational level of parents. According to McCraren and Barcinas (1991) urban and rural schools differed, as expected, in size, cost per pupil, size of staff, and breadth of curricular and extra-curricular offerings.

The failures of the education system in Belize have been properly documented in terms of inequitable access and affordability. The failure has been described as follows:

> " The education system of Belize is highly inequitable. Its historical development has resulted in unequal distribution of resources and a situation which actively favors the advantaged. Children from lower socio economic backgrounds generally attend schools with fewer trained teachers, fewer resources and less financial support from the ministry. The majority of these are rural schools. The urban/rural divide is of great concern to many stakeholders. Rural schools, especially those in remote settings, have fewer trained teachers (teachers prefer to work in town); less support, reduced resources; are often in low socioeconomic areas and have poorer infrastructure…" UNICEF, 2005.

In the National Report and Test Analysis produced by the Examinations' Unit presented a comparison between urban and rural schools on the Primary School Examination in 2004 which

consistently shows that the national mean performance in all areas for rural schools was lower than that of urban schools (Examination Unit, 2004). According to Gillett (1999) there is much inequity in the urban/rural deployment of teachers. Bennett (2008) added that in-service training was done mainly in urban areas with minimal effort for upgrading rural teachers.

Some critics reveal that all is not well at urban schools. The deleterious condition of underachievement, student and teacher alienation, and high dropout rates are also prevalent in urban schools. The school, community and family problems facing students in urban cities present a formidable challenge to educators who need to try to provide high-quality educational opportunities to all of these students (Waxman & Huang, 1997). A study was conducted by Waxman and Huang (1997) to investigate student gender, subject area, and grade level differences in student perception on classroom learning environment. The study revealed that there were very few differences by subject area, but there were many statistically and educationally significant differences by grade level. In general, middle school classes had less favorable perceptions to their learning environment than did either elementary or high school classes.

The Ministry of Education in Belize has embarked on many initiatives to improve the conditions of schools in both rural and urban primary schools across the country. They are a total of 294 primary schools in Belize of which 83 are located in urban areas and 211 in rural communities (Abstract of Education Statistics, 2008/2009). Only 41.5% of all the urban teachers were fully trained and 35.9% of the rural teachers were fully trained having a total of 38.5% fully trained teachers in Belize in both urban and rural schools.

Mono-grade and Multi-grade Schools and Student Achievement

Berry(n.d.) mentioned that multi-grading is often associated with 'small' schools in remote and sparsely populated areas. In such schools, there may be only one, two or three teachers, yet they offer a complete cycle of primary education. Multi-grade classroom is a response to uneven school enrolment. Multi-grade classroom are characterized according to Blum and Diwan (2007) by low enrolment, too few teachers to cover the required grade levels (resulting in multi-grade teaching and learning) and a scarcity of resources and support. This often leads to poor educational quality, student disillusionment, and attendant high rates of drop-out and low rates of retention. In much of Africa according to Berry a major rationale for multi-grade education is probably its potential to increase access to the full cycle of primary education in areas where this is currently not available. Mariano and Kirby (2009) noted that the dominant classroom organization in U.S. schools is the mono-grade classroom, containing students of a similar age range, assigned to a single grade level, but with a range of abilities.

Leading education and social research contributed that access to multi-grade classes, and the quality of teaching and learning in them, are central strategies in the worldwide fulfillment of education for all and the Millennium Development Goals for education. If the teachers in small schools have had a sound schooling and an adequate professional training, Sigsworth and Solstad (2001) added that they should be more than able to cope with the demands of the basic primary curriculum. Furthermore, in large schools with single age-grade classes, it is common practice in many countries that the class teacher has his/her pupils for only one year. A study conducted by Santau, Maerten-Rivera, and Huggins (2011) on fourth graders in science achievement on English Language Learners (ELL) indicate that ELL students improved achievement on science

test was as a result of effective inquiry-based science instruction as promoted in the professional development intervention.

Little (2007) reflected on statistics regarding the extent of multi-grade realities in different countries:

- Australian in 1988, 40% of schools Northern Territories has multi-classes.
- In Burkina Faso in 2000, 36% of the schools and 20% of classes were multi-graded.
- In Ireland in 2000/01, 42% of all primary school classes comprised two or more grades.
- In the Peoples' Democratic Republic of Laos in 2003/4, 64% of all primary schools has multi-grade classes, 24.3% of all classes were multi-graded.

Very little or no attention before a 1993 research on multi-grade teaching was given to the multi-grade situation in Belize (Wright, n.d.). Wright's study also found that the most common approach to common subject was the teacher working with one class while the other classes were given seatwork. Many teachers preferred to use materials that they made as resources for their multi-grade teaching. Approximately, 54% of teachers in multi-grade schools made use of peer tutoring to assist them in their teaching.

A 1998 count of Belize's primary schools revealed that of the 284 schools 125 of them were considered fully or partly multi-grade schools. As such it is imperative that a conscious effort is made to provide continuous training in multi-grade teaching. The number of multi-grade schools that still exists, the constant transfer of teachers in the system and the demand for trained teachers in remote areas make it necessary for multi-grade training to remain an integral part of teacher training (Wright, n.d.).

The Ministry of Education through partnership with other organization like the Commonwealth provides meaningful training to continuously improve the quality of teaching in multi-grade schools. Minister of Education and Youth Honorable Patrick Faber echoed the following:

> "We are trying to train teachers in general. The problem of not having teachers trained is not limited to multi grade schools. It is a problem that is facing us in general so we have a general drive in the ministry to get our teachers properly trained. The multi-grade situation is one that is really giving us a serious challenge because of the predominance of multi-grade schools in our system. For the benefit of those may not know a multi-grade school is a school where a teacher teaches more than one level at one time. It can pose a real problem if the teachers to not have the real strategies. To that end we have teamed up with the commonwealth secretariat and we will be putting off this workshop for the next five days to train those people who are key to the ministry and key to our education system in a strategy for multi-grade education so that they can go back to their respective districts and do training with other teachers and principals. We hope that this will help us to administer schools, especially multi-grade schools, in a better way. But of course it is not limited to that, our ministry continues to do other things in order to make sure that our teachers are well qualified and give our students the best quality education that they can offer". Love FM News (2009).

Quality Assurance and Development Services (QADS) of the Ministry of Education is responsible for the national curriculum and has recognized the need to tailor the curriculum to suit the demanding need for multi-grade classrooms. Presently, Toledo District has the most

multi-grade schools a total of 37 of the 49 schools in the country and consistently demonstrates low performance on the PSE each year. The Ministry of Education and the Commonwealth Secretariat have teamed up to provide training for teachers in multi-grade schools. Pre-service and in-service training for teachers in multi-grade class according to Little (2004) is vital for improved student achievement.

Teacher Certification and Student Achievement

In today's information economy, education has become the engine driving the future of the country and of our children. Children need higher levels of skills and knowledge more than ever before to obtain a decent job to sustain and support a family. The nation teachers have in their hands the future of our children (Levine, 2006). New statistical research Goldhaber and Anthony (2003) explained shows that teachers play a significant role in explaining student achievement.

In 38 of the 50 states there are specific requirements such as beginning teachers having field experience such as student teaching in the United States. Individual states regulate the teaching profession through teacher certification programs that serve as gateway into the teaching profession. The commitment of No Child Left Behind 2001 Act (NCLB) to school accountability and to improving educational outcomes for all students together will improve monitoring of student achievement (Boyd, Goldhaber, Lankford & Wyckoff, 2007). According to Boyd, et al. (2007) there is many evidence that helps educators, managing authorizes and policy makers to understand certification on many aspects of the effectiveness of teachers. The following are some summary of research done:

a. One reliable way to identify the effects of certification and teacher preparation on students' educational gains is through experiments in which teachers are randomly assigned to students.

b. Unless other factors are taken into account, analysts might mistakenly conclude that students' achievement is being affected by certification.

c. Many studies find that the students of teachers with a graduate degree perform no better than those of teachers with only a bachelor's degree. Other studies find both positive and negative effects of teacher's graduate degrees on student achievement.

d. Although research suggests that knowledge and skills regarding how teachers can influence student achievement, no study identifies either which of these skills are important on the best way for aspiring teachers to develop them.

e. Only limited research documents any relationship between field experiences and student achievement and none sort out duration.

f. In general research finds that exam scores are positively linked to teacher effectiveness, but the size of the effectiveness varies widely.

g. Three recent studies address issues of certification and find that performance on required certification exams is predictive of teachers' abilities to increase student achievement, especially in math.

Hammond (2010) emphasized that unlike other industrialized nation, especially those that are the highest-achieving, the United States lacks a systematic approach to recruiting, preparing, and retaining teachers. With few governmental supports for preparation or mentoring, teachers in the U.S. enter:

- with dramatically different levels of training -- with those least prepared teaching the most educationally vulnerable children,
- at sharply disparate salaries- with those teaching the neediest students earning the least,
- working under radically different teaching conditions – with those in the most affluent communities benefiting from class sizes under 20 and a cornucopia of materials, equipment, specialists, and supports, while those in the poorest communities teach classes of 40 or more without adequate books and supplies,
- with little or no mentoring or on-the-job coaching in most communities to help teachers improve their skills.

According to Hammond (2010) unlike most high-achieving nations, however, the United States has not yet developed a national system of supports and incentives to ensure that all teachers are well prepared and ready to teach all students effectively when they enter the profession. Hammond (2010) asserted that in nearly all states, teachers have to pass at least three tests-generally multiple choice tests of basic skills, subject matter, and teaching knowledge in order to become licensed, even though these are not strongly related to their ultimate success in the classroom.

The Ministry of Education and Youth believes that every Belizean student deserves a caring, competent, and highly qualified teacher. In this regard it has tasked the Teacher Education and Development Services (TEDS) to work diligently to make a difference in the quality of teaching and teacher preparation today, tomorrow, and for the next century. Consequently, it has partnered with other agencies and non-governmental organizations to support teachers, students, and parents to accomplish this task. Qualified teachers play a pivotal role in this undertaking. In this regard, TEDS' primary responsibilities focus on program

standards and development and quality assurance as it relates to: teacher education programs (pre-primary, primary and secondary), pre-service teacher assessment; principal and manager education and teacher educator education (Ministry of Education & Youth, 2010).

The teacher certification process refers to the academic preparation and competency testing required of public school teachers (Sparks, 2004). In the past, teacher training was not deemed as important. The results of low standard of attainment and the absence of attractive classroom methods were a concerns attributed to the many untrained teachers in the education system at the time (Bennett, 2008). The educational proposals also called for the replacement of the pupil-teacher system by more systematic training of teachers (Bennett, 2008). In an effort to alleviate this problem, Bennett (2008) added that a West Indian Royal Commission visited Belize, then British Honduras, to examine the state of teacher training. There were four major recommendations in regards to policy that were made by the Commission. One very significant one according to Bennett (2008) was to provide opportunities for teachers to study abroad, therefore, 1941 that the first four student teachers left to take up scholarship training in a Jamaican training college. St. Johns College teacher training program was established to provide scholarship to young males pupil teachers (Bennett, 2008) of the Catholic Management. This training program marked the beginning of many primary schools becoming staffed with high school graduates with some teacher training. The effort to improve teacher qualification for improved academic performance of students coupled with a study that showed that the proportion of untrained teachers was too large and led to the setting of the 1980 goal to make a concerted effort to train primary school teachers.

The Primary Education Project (PEP) was a planned project for the period 1980 – 1984. Another project, The Belize Primary Education Development Project (BPEDP) focused on

increasing the percentage of fully trained teachers while the schools remained modestly staffed (Bennett, 2008). In 1981 the amalgamation of the Belize Teachers College occurred and BELCAST became the new institution responsible for the two-year intramural course followed by one year program of internship prior to graduation (Pastor, 1995 & Thompson, 2008). These include: First Teachers, Second Class, and the First Class Certificate Examination. By 1983 when a UNESCO mission visited Belize, there were 1,359 primary school teachers of whom 486 were fully trained, 401 partially trained and 472 untrained. In Belize; like the United States traditional, teacher preparation programs are the primary source of teacher supply in most states (Boyd et al., 2007). Most traditional teacher preparation programs devote significant resources to teaching pedagogy, the skills that enable teachers to structure and communicate material to students.

Belize still approaches teacher training from a national prospective. The teacher is considered truly qualified to teach if he or she possesses an associate degree in primary education earned through an accredited school. The University of Belize is one of those institutions which also offer a bachelor's degree in primary education. The possession of any of the two; an associate's or a bachelor's degree in primary education allows a teacher to receive a full license to teach in primary schools in Belize. This is unlike the United States where the would-be teachers who successfully complete approved programs need to pass any required certification exam to become licensed. The legislation considers new teachers highly qualified if they receive state certification and demonstrate content knowledge of the material they teacher, either by passing a subject area exam or by having an undergraduate major in that subject or both (Boyd et al., 2007).

The Joint Board of Teacher Education from Jamaica supervises and approved the certification of teachers in this region. The Belize Board of Teacher Education (BBTE) provides oversight regarding the management of the delivery of teacher education in Belize with respect to the policies, procedures, and regulations (Education and Training Act, 2010). The Belize Teachers' College offered a three-year training program known as the "2+1" program (Wright, 2006). During this training teachers were given one year of course work and they were to complete a one year internship at a selected primary school. In 1991, the Belize Teachers' College introduced two-tier Level 1and Level 2 programs (Wright, 2006). The level one program did not mean certification. Teachers had to complete both Level 1 and Level 2 to become certified.

In the early 1990's there was the development of a national university and the training college was amalgamated. The University College of Belize now known as the University of Belize is responsible to prepare teachers and prospective teachers in undergraduate education in primary, secondary and content specific areas.

While the debate on the international stage continues; Belize's Ministry of Education has deemed teacher certification as important. This premise is expressed in the implementation of Rule 56 (1) which states that "from the date on which these Rules come into force, every person employed on the teaching staff of a pre-school centre, primary school and secondary school shall be required to have a license to teach issued by the Chief Education Officer (Education Rules, 2000). Licenses are issued to individuals who have the necessary level of academic preparation in the subject area to ensure subject-matter competence for effective teaching at the specified level education rule # 57 (1) (a). Continuously providing students with effective teachers is one of the philosophies of Belize's current Minister of Education as reflected in his education week

address in which he spoke of the country's investment in teacher training. Belize's aim to provide a qualified teacher in every classroom is in sync with the No child left behind policy of the USA. Policies such as these are based on knowledge that the effectiveness of the teacher is the major determinant of student academic progress. Students of under-certified teachers make about 20% less academic growth per year than do students of teachers with regular certification.

Another construct examined in this study is teacher experience. The importance of teacher experience and student achievement is described below.

Teacher Experience and Student Achievement

The importance of experience teachers in schools has been argued as being necessary for school's effectiveness (Adeyemi, 2005). More experienced or better educated or more skilled teachers may inherently be better able to teach, but they may not persistently practice those abilities in the classroom (Buddin & Zamarro, 2009). The following are research cited by Klecker (2002) on teacher experience and student achievement:

- Stone (1997) found that teacher leadership was positively correlated with years-of-teaching-experience.
- Bodenhausen (1988) found that students with teachers with more than 10 years of teaching advance placement had higher scores on advance placement tests.
- Chidolue (1996) found significant positive relationships between teachers' teaching experience and student achievement in high school biology classes.

Research shows that inexperience teachers are typically less effective that more senior teachers; the benefits of experience, however, appear to level off after about five years (Thompson, 2008). Research conducted by Croninger et al. (2004) found that teachers who hold elementary education degrees and those who have more than two years of experience teaching

first grade are associated with higher student achievement in reading. Another study conducted by Adeyemi (2005) in secondary schools showed a significant relationship between teachers' teaching experience and students' academic achievement in the Senior Secondary Certificate (SSC) examination and a significant difference in all subjects. According to Buddin & Zamarro (2009) student achievement increases with teacher experience, but the linkage is weak and largely reflects poor outcomes for teachers during their first years or two in the classroom.

Student Achievement and Testing in Belizean Education

Student Achievement

A comparative assessment of inequality of opportunity in educational achievement in five Latin American countries done by World Bank on groups of children from more privileged family backgrounds have significantly higher densities at high achievements and students in larger cities have significantly higher densities at high achievements compared with students in rural areas and small towns.

Recent educational reform efforts seek to employ standardized test score gains as a key policy instrument for holding educators and school systems accountable (Kupermintz, 2003). To effect change in the way testing is done, Taylor (2000) recommends that emphasis be placed on all three kinds of abilities which include analytical, creative and practical components. In order to enhance the achievement gap of all youngsters and ethnic minority youngsters in particular, it is important to systematically evaluate the different skills children develop depending on the social ecology of family life (Taylor, 2000).

Classroom and school variables should reflect the range of social and cultural factors that may be argued to affect student learning and growth, independent of teacher quality

(Kupermintz, 2003). School culture and climate, teacher qualifications, curriculum frameworks and instructional approaches, and a myriad of other factors, interact synergistically to produce growth in student academic skills and knowledge (Kupermintz, 2003).

Finally, we turn our attention to the full range of potential influences on student learning: personal propensities and resources (both cognitive and non-cognitive), physical and mental maturation, home environment, cultural heritage, institutional and informal community resources (Kupermintz, 2003). A study conducted by Crooks (1997) revealed that school achievement for Mopan Maya children in San Antonio, Toledo, Belize is the result of social, cultural, and biological factors within a social , cultural, political, and economic environment.

The conclusion is based on the empirical finding that differential teacher effectiveness is a strong determinant of differences in student learning (Hammond, 2000). The Federal No Child Left Behind Act of 2001 (NCLB) calls for a highly qualified teacher in every classroom. According to NCLB, "highly qualified" as pointed out by Hammond (2000) is defined as full certification or licensure, a college degree, and demonstrated content knowledge in the subject being taught.

Transformative Pedagogical Content Knowledge and Belizean Education

Pedagogy

Effective teaching necessitates making difficult and principled choices, exercising careful judgment, and honoring the complex nature of the educational mission. Thus, teachers must master a repertoire of instructional methods and strategies, yet remain critical and reflective about their practice. Their professional responsibilities focus on educating students, in addition to participating in wider activities within the school and in partnership with parents and the community. Based on the latest developments in pedagogy, teaching has become more than an

activity that conserves valued knowledge and skills by transmitting them to succeeding generations.

The professional teaching standards represent the teaching profession's consensus on the critical aspects of the art and science of teaching (pedagogy) that characterizes accomplished teachers in various fields. Cast in terms of actions that teachers take to advance student outcomes, these standards also incorporate the essential pedagogical knowledge, skills, dispositions, and commitments that allow teachers to practice at a high level. These standards rest on a fundamental philosophical foundation comprised of five core propositions:

- Teachers are committed to students and their learning.
- Teachers know the subjects they teach and have the necessary pedagogical knowledge.
- Teachers are responsible for managing and monitoring student learning.
- Teachers think systematically about their practice and learn from experience.
- Teachers are members of learning communities.

Research outside foreign language education suggests that reflective practices help to sustain in-service pedagogical learning during the beginning years of teaching and serve to equip beginning teachers with tools to adapt and improve as teachers (Watzke, 2007).

Teachers' Content Knowledge and Student Achievement

Teaching necessarily begins with a teacher's understanding of what is to be learned and how it is to be taught. Shulman (1987) explained that the first source of knowledge base is content knowledge. This is the knowledge, understanding, skill and disposition that are to be learned by school children. Teachers' classroom practice and students' learning are highly affected by the knowledge which teachers possess (Rizvi & Lawson, 2007). According to

Darling-Hammond and Berry (2006) by requiring that teachers demonstrate subject-matter competence through the equivalent of a major or a test in each subject they teach, NCLB appropriately recognizes the importance of subject-matter knowledge.

A teacher according to Shulman (1987) has special responsibilities in relation to content knowledge, serving as the primary source of student understanding of subject matter. The view of the sources of content knowledge necessarily implies that the teacher must have not only depth of understanding with respect to the particular subjects taught, but also a broad liberal education that serves as a framework for old learning and a facilitator for new understanding. Many policy documents are based on the logical assumption that teachers' content knowledge has a significant influence on student learning (Mewborn, 2001). Several studies conducted reveals

- that pre-service teachers lack an understanding of quotitive (measurement) division and are prone to rely only on a partitive (sharing) interpretation of division
- many teachers are unable to generate a word problem for a whole number divided by a fraction, often providing a problem that represents a multiplication situation;
- teachers tend to rely on their knowledge of whole numbers when working in the domain of rational numbers
- many teachers do not know the difference between a ratio and a fraction, believing that because they can be represented with the same notation they behave in identical ways
- another common finding is that teachers confuse the concepts of area and perimeter.
- Many studies reveal that many elementary teachers do in fact lack a conceptual understanding of the mathematics they are expected to teach (Mewborn, 2001).

A study conducted by Kanter (2010) looked at the impact of project-base science (PBS) curriculum on minority student achievement. Nine, sixth through eighth-grade urban science teachers who used the middle school PBS curriculum with the students in their classroom participated. Student achievement was measured using a pre and post tests. The results of the study revealed that students' science achievement improved with the PBS curriculum, but their attitudes towards science and plans to pursue science did not. Increase in teachers' content knowledge and pedagogical knowledge with professional development correlated with the improvements in student science achievement but did not correlate with improvements in student science attitudes or plans.

Another study conducted by Tchoshanou (2010) examines the relationship between teachers' knowledge of concepts and connections, teaching practices, and student achievement in middle grades Mathematics. The study found out that teacher content knowledge of concepts and connections is significantly associated with student achievement and lesson quality in middle grades mathematics.

The amount of content knowledge a teacher might have Tchoshanou (2010) explain is not enough to influence student learning and achievement positively. Content knowledge and pedagogical knowledge are interconnected in the TPCK framework.

Teachers' Pedagogical Knowledge and Student Achievement

Jang (2010) have stated that many studies have shown that pedagogical knowledge is not the only reason to affect the successful teaching. It also includes teachers' understanding toward students' prior knowledge and learning difficulties, teaching methods and strategies, the goals of education, values and beliefs, etc.

Hill (2007) stated that funding issued from the Institute for Educational Sciences (IES) focuses on building broad understanding of effective teacher preparation and knowledge enhancement programs. Prior to their teaching experiences, prospective teachers' own experiences as learners together with their familiarity with relevant developmental and cognitive research could be used to enhance their knowledge of common ways of thinking among children (Tirosh, 2000). According to Hill (2007) teachers' mathematical knowledge has long been a topic of concern for United States teachers, educators and policy makers. There has been a lack of understanding of the implication due to lack of research being conducted in this area.

According to Hill (2007) federal education policy initially defined a highly qualified teacher as one with full certification, a bachelor's degree, and "demonstrated competence" in subject knowledge and teaching. "Demonstrated competence" might rest on a subject matter major, advanced degree or credential, or passing a state certification test in the subject taught. Although content knowledge is crucial, Canoy (2010) suggested that many research findings reveals that effective mathematics teaching depends mainly on the richness of the teachers' pedagogical content knowledge. The tremendous effort that was (and is) involved in upgrading teachers' knowledge and skills makes understanding the relationship between subject matter knowledge and academic credentials particularly pressing (Hill, 2007). According to Hill (2007) research has shown that there is a statistically significant correlation between teachers knowledge and students poverty status. The important task of enhancing teachers' understanding of children's knowledge should be addressed in both pre-service and in-service teacher education programs (Tirosh, 2000).

Watzke, (2007) identified prior knowledge as having a filtering effect; the prior knowledge of pre-service FL teachers is represented by learning experiences as a FL student and

by the modeling provided to them by past teachers. A study conducted by Watzke (2007) looked at studies of the professional development of beginning teachers have found that increased experience engaging with learners, building teacher-learner relationships, and reflecting on teaching helps new teachers sustain development of a pedagogical knowledge base. Knowledge breeds confidence, improves status, and enhances the capability of the teacher to take more control, over the teaching-learning process.

Watzke (2007) stated that for the purposes of investigating teacher development, this construct frames change in teachers' combined understanding of content knowledge and pedagogical practices for the organization, presentation, and adaptation of instruction to diverse learners. Shulman (1986) argued that if teachers are to be successful it is important to confront both content and knowledge simultaneously into teaching. Content knowledge, pedagogical knowledge intersects to give rise to pedagogical content knowledge.

Teachers' Pedagogical Content Knowledge and Student Achievement

Chong, Choy and Wong (2008) claimed that the emphases on teacher's subject knowledge and pedagogy were being treated as mutually exclusive domains in research. Shulman (1986) advanced thinking resulted in the inclusion of both concepts to bring about pedagogical content knowledge. Pedagogical Content Knowledge as explained is concerned with the representation and formulation of concepts, pedagogical techniques, knowledge of what makes concepts difficult or easy to learn, knowledge of students' prior knowledge and theories of epistemology (Shulman, 1986; Chong et al., 2008).

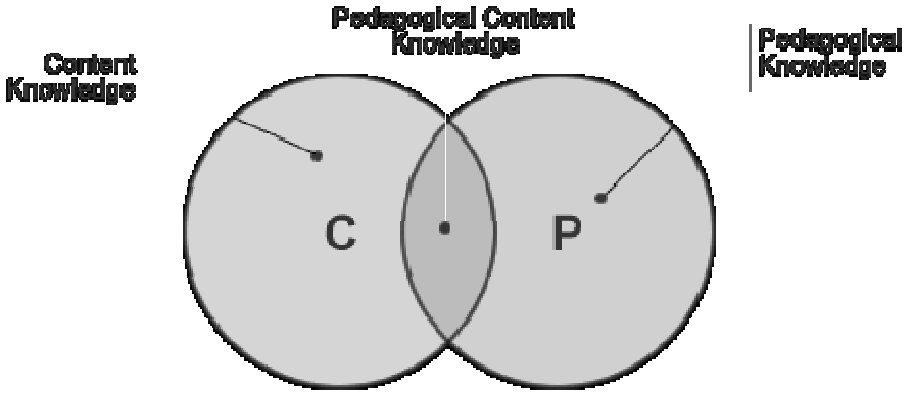
Pedagogical content knowledge also involves knowledge of teaching strategies that incorporate appropriate conceptual representations, to address learner difficulties and misconceptions and foster meaningful understanding. It also includes knowledge of what the

students bring to the learning situation, knowledge that might be either facilitative or dysfunctional for the particular learning task at hand (Chong et al., 2008). According to Adedoyin (2011) teachers are always expected to exhibit a basic set of pedagogical knowledge and skills in the classroom, which involves a good knowledge of their teaching subjects, teaching methods, skills and knowledge of child development. The continuing appeal of the notion of pedagogical content knowledge is that it bridges content knowledge and the practice of teaching, assuring that discussions of content are relevant to teaching and retain attention to content (Ball, Thames, & Phelps, 2005). PCK is concerned with how teachers relate their subject matter knowledge to their pedagogical knowledge and how subject matter knowledge is related to the process of pedagogical reasoning (Adedoyin, 2011).

Chong et al. (2008) state that Pedagogical Content Knowledge exist at the intersection between content and knowledge whereby both amalgamated give rise to transformation of content into pedagogical power forms. In the heart of pedagogical content knowledge is the blend between both content and knowledge. The introduction of pedagogical content knowledge in 1987 by Shulman has since been emphasized by the National Science Teachers Association (NSTA, 1996) and National Council for Accreditation of Teacher Education (NCATE, 1999) in teacher preparation and teacher professional development. Pedagogical Content knowledge is valued as an epistemological concept that usefully blends together the traditionally separated knowledge bases of content and pedagogy.

Figure 2.1

Intersection of Content and Pedagogy



The two circles represent an intersection of pedagogical content knowledge as an interplay between pedagogy and content (Koehler, 2011). Investigating teachers' PCK is challenging for many reasons. PCK deals with teachers' adequate planning for lessons to be taught, classroom interactions, how to explain mathematical concepts and mathematical competency in terms of the subject matter (Adedoyin, 2011). The literature on pedagogical content knowledge has identified three processes. The first process concerns with how teachers' prior beliefs and values are related to teaching and learning and how it affect the development of pedagogical content knowledge. In the second process, pedagogical knowledge developed during the pre-service years may wash out or quickly fall away in a teacher's thinking and practices depending on the nature of the teacher, the pre-service program, and the in-service teaching context. The third process involves change and development occurring simultaneously on inner and social levels (Watzke, 2007).

According to Hill (2007) common and specialized knowledge are different than PCK. A close examination of the PCK definitions offered by Shulman (1986) shows PCK is composed of knowledge of the typical errors students make and knowledge of the best methods for

representing particular subject matter. Subject matter knowledge, including specialized content knowledge, lies outside the realm of PCK. It is knowledge that allows teachers to engage in particular teaching tasks, but that is also solely mathematical. Tirosh (2000) cited that recent studies have, however, reported that prospective teachers' abilities to analyze the reasoning behind students' responses were poor. Thus a major goal in teacher education programs should be to promote development of prospective teachers' knowledge of common ways children think. Canoy (2010) in his research suggested that the linkages between content knowledge and pedagogical content knowledge should be considered and topic-specific pedagogical content knowledge should be emphasized more that general pedagogical content knowledge in all teacher training programs. According to Tirosh, (2000) researchers in mathematics education should, therefore, attempt to identify the components of PCK that could efficiently be addressed at various stages of prospective teachers' education programs and those that could be dealt with only after teachers have gained some teaching experience.

National Examination for Primary School Students in Belize

The Primary School Examination (PSE) was implemented in May 2000. The examination is designed to measure pupils' achievement in Mathematics, English, Science and Social Studies (Primary School Examination, 2004). The PSE, a criterion referenced examination, replaced the Belize National Selection Examination (BNSE), a norm referenced examination (Bennett, 2008). In norm reference scoring the student's performance on an assessment is compared to the performance of others (Gay et al., 2006). According to Bennett (2008) the BNSE was instituted in 1982 as a more precise instrument to measure academic achievement of primary school students.

Prior to the existence of the BNSE Bennett, explained that the Primary School Leaving Certificate (PSLC) was commonly referred to as the Primary exam. This examination was based on a pass/fail concept, but had no indication of what that standard meant. According to Therese Ariola, (personal communication, 2010) areas tested at the time were: Mathematics, English, Social Studies, Verbal Reasoning, General Knowledge, Science and Learning Potential. In addition, all examinations were taken on the same day. According to Bennett (2008), this examination was very valuable to Belizeans since it determined entry to secondary school and job eligibility (Bennett, 2008). The PSLC was later improved by a British consultant office in Barbados. This resulted in some changes such as: the name change to Primary Education Certificate Examination and the ranking of candidates by scores in the subjects and letter grade assignment on a five point scale. In addition, according to Bennett prior to 1981 students were completing the following examinations: the primary education certificate examination; the college entrance examination; and the entrance examination to junior secondary school. Educators and others regarded this as a duplication of efforts because in addition students also had to sit the Government Scholarship Examination which was to select students for scholarship to secondary school.

The BNSE was as a result of many educators' discontent. In 1981 the MOE developed a single examination with a threefold purpose: certification as a school leaving certificate; selection identification of students of secondary school potential; and scholarship selection of students for the award of government scholarships (Bennett, 2008). Based on the 1979 model and after due scrutiny, BNSE, the new exam, was introduced in 1983 which remained in effect until the introduction of PSE in May 2000.

The PSE tests the minimum skills level of each primary school leaving pupil (PSE, 2004). The scores reported in each subject area reflect the number of correct responses attained by each candidate and are not a comparative ranking of candidates who sat the test. Students and parents receive a student subtest and objective report indicating candidates' performance on each component tested on the PSE.

Summary

Providing quality education in primary education is of great importance for policy makers, stakeholders, school manager and ministry of education. The location of the schools in urban or rural areas is of interest in ensuring that quality education is provided to the children. The school environment needs to be conducive for students learning; the classrooms are to be adequately furnished with required space; teachers are to be highly qualified and given incentives especially in rural areas, teachers are monitored to ensure different teaching strategies are employed to ensure learning and principals, parents and other stakeholders assist collectively in providing and promoting that children receive a holistic education.

Teachers' knowledge as mentioned by Shulman (1987) is critical in student learning. Content knowledge, Pedagogical knowledge and pedagogical content knowledge infrastructure, teachers the foundation for a successful The Ministry of Education is charged with ensuring that every child receive quality primary education

Chapter III

METHODOLOGY

Introduction

The purpose of this study was to evaluate whether or not there was a significant difference in school location, school type, teacher certification, and teacher experience and student achievement on the PSE. In addition, this study examined if there exists a relationship among the following: teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge PSE scores.

The need for this study came about because of the continuous concern of parents, other stakeholders and the Ministry of Education (MOE) regarding the low performance of students on the PSE. This study addressed the concern of the low performance of standard six students in Mathematics, English, Science and Social Studies by examining the relationship among school location, school type, teacher certification, teacher experience, and teacher content knowledge, pedagogical knowledge, and pedagogical content knowledge on student achievement on PSE.

The researcher hoped to gather information to inform teachers, principals, local managers, general managers, teachers' training institutions, other stakeholders or partners in education, and the MOE by identifying potential predictors relating to student achievement on the PSE.

Research Questions and Hypotheses

The study investigated the following research questions and hypotheses:

1. Are there differences in students' PSE achievement scores between urban and rural Belizean primary schools?

2. Are there differences in students' PSE achievement scores between multi-grade and mono-grade Belizean primary schools?

3. Are there differences in students' PSE achievement scores among teachers' with various level of training in Belizean primary schools? Three levels were examined:

- Bachelor's Degree or Higher
- Associates Degree
- Others

4. Are there differences in students' PSE achievement scores among teachers' with various years of experience in Belizean primary schools?

5. Is there a relationship between students' PSE achievement scores among teacher's knowledge? Three areas were examined:

- content knowledge,
- pedagogical knowledge
- pedagogical content knowledge

Several hypotheses were developed based on these research questions. Each hypothesis was written as null. The following were the research questions followed by the null hypotheses.

Research Question 1

Are there differences in students' PSE achievement scores between urban and rural Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There were no mean differences in PSE scores between standard six students who attend urban or rural primary schools.

Research Question 2

Are there differences in students' PSE achievement scores between multi-grade and mono-grade Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There is no mean difference in PSE scores for standard six students in multi-grade or mono-grade schools.

Research Question 3

Are there differences among teachers with different levels of training in Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There are no mean differences in PSE scores between standard six students and teacher with different levels of training in Belizean primary schools.

Research Question 4

Are there differences in students' PSE achievement scores among teachers with various years of experience in Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There are no mean differences in PSE scores between standard six students and teacher experience in primary schools.

Research Question 5

Is there a relationship among teachers' knowledge and students PSE achievement score? Three areas were examined:

- Content Knowledge
- Pedagogical Knowledge
- Pedagogical Content Knowledge

This chapter presents a description of the participants, data collection, and protection of human participants, instrumentation, and data analysis of the research.

Participants

The participants of this study were 52 full time primary school teachers of standard six classes for the school years 2009-2010. The schools were selected from both rural and urban settings and mono-grade and multi-grade schools. The general managers for all government and grant aided schools were sent a letter describing the purpose of the study and requesting permission to conduct the study at their school/s.

Data Collection

Approval to conduct this study was granted by the Institutional Review Board (IRB) at Oklahoma State University on April 12th, 2011. Upon receiving approval from IRB, the researcher sent letters to the general managers of each denominational and government schools requesting approval to conduct the study in their respective school/s (Appendix C).

Upon receiving the signed consent forms from general managers to conduct the study in the respective schools; consent forms and surveys for principals and teachers were given to the education officers in the six districts to distribute to the respective participating schools. Teachers were asked to complete the survey and return it in a sealed envelope provided by the researcher to the District Education Center in their respective districts.

School reports of PSE results for 2009-2010 were obtained from the office of the Examination Unit of the Ministry of Education. The researcher analyzed the scores of the students in rural and urban schools, mono-grade and multi-grade schools, and students taught by teachers of various certification and experiences to determine if there were any significant differences. The researcher also analyzed the scores of the students on PSE and teachers'

content knowledge, pedagogical knowledge, and pedagogical content knowledge to determine if there exit a relationship.

Protection of Human Participants

The Institutional Review Board of Oklahoma State University gave approval to conduct this study on April 12th, 2011. The general managers of all the participating schools gave permission to conduct the study in their schools. In addition, participants were reminded that confidentiality was very important; the participants' anonymity was maintained because all surveys were coded. The letter clarified the purpose of the study.

Instrumentation

The Technology Pedagogy Content Knowledge was introduced to the educational research field as a theoretical framework for understanding teacher knowledge required for effective technology integration (Schmidt, et al., 2009). The Technology Pedagogy and Content Knowledge (TPACK), builds on Shulman's idea of PCK, and attempts to capture some of the essential qualities of knowledge required by teachers for technology integration in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge (Mishra & Koehler, 2006). The Technology Pedagogy and Content Knowledge (TPACK) is a survey adopted to collect data regarding teachers' content knowledge, pedagogical knowledge, and pedagogical content knowledge. Content knowledge was based on the four subject areas tested by the PSE which includes: Mathematics, Social Studies, English and Science. The TPACK survey instrument was used to collect data from the participants of the research. The survey was a forced response format made up of five options: Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree and Strongly Agree. Teachers were asked to select the response that best described how much they agreed or disagreed with each statement.

The first part of the survey collected information including gender, age, location of the school, type of school, qualification, if the teacher is presently enrolled in an institution, years teaching standard six and years of teaching. The second part of the survey consisted of a series of statements that collected information regarding teachers' Content Knowledge (CK), Pedagogical Knowledge and Pedagogical Content Knowledge. Item responses were scored with a value of 1 assigned to strongly disagree, increasing by one for each construct (Schmidt, et. al, 2009). For each construct the participant's responses were averaged.

Schmidt et al. reported on the reliability as follows:

Table 3.1

Reliability of Survey Instrument

TPACK Domain	Internal Consistency (alpha)
TK	.82
CK	
SS	.84
Math	.85
Science	.82
Literacy	.75
PK	.84
PCK	.85
TPK	.86
TCK	.80
TPCK	.92

The researcher made minor changes to the instrument to suit the Belizean context. The choices for teacher qualification were edited, literacy section heading was changed to Language Arts, and the technology section of the instrument was removed.

Data Analysis

The district education officers were given 10 surveys each and during visits to schools identified teachers who were teaching standard six for school year 2009-2010. District education officers used the convenient sampling method to distribute surveys to participants. Each survey was coded on delivery so as to identify the schools that returned the survey. After the surveys were distributed to the participants, they were allowed two weeks to return their completed survey. One week after the initial distribution of the surveys, the participants were sent a reminder through the district education officers in each district to submit the survey. An email was sent to the Education Officer to read out at a teachers' meeting expressing gratitude to participants for their cooperation. Similar correspondence was sent to the district center officers who assisted in the process.

The participants were classified based on the responses received about their qualification. There were three categories: category 1 included teachers who held an associate's degree and associate degree in primary education; category 2included teachers who held a: trained teachers, Level 1 and Level 2 teaching certificate; and category 3: teachers who held a Bachelors degree in Science/Administration, Bachelors degree in primary education and Masters in education.

Analysis of Variance (ANOVA), sometimes called the *F* test is used to test the difference(s) among two or more means (Gay et al., 2006; Shavelson, 1996; Pyrczak, 2001). The three assumptions are independence, normality, and homogeneity of Variances. Independence is the score for any particular subject is independent of the scores of all other subjects. Normality

is the scores within each treatment population are normally distributed. Homogeneity is that the variances of scores in each treatment population are equal (Shavelson, 1996)

The data were analyzed using ANOVA to determine the extent to which the PSE scores for students in 2009 - 2010 differed according to the independent variables, the school location, school type, teaching experience, and type of certification held by the teachers. Linear Regression was used to examine relationship of the variables of (teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge) and its effect on student achievement on the PSE. The SPSS 19.0 computer program was utilized to analyze the data.

Summary

The purpose of this study was to determine whether or not there was a statistically significant difference in school, location, type of school, teachers' experience and teacher certification on the performance of standard six students in Belize on the PSE. In addition, the research also examined if there was a relationship with student achievement and teachers' content knowledge, pedagogical knowledge, and pedagogical content knowledge. This chapter presented the participants, data collection, protection of human participants, instrumentation, and data analysis. Chapter IV presents the findings of the study.

Chapter IV
METHODOLOGY AND FINDINGS

The purpose of this study was to evaluate whether or not there was a significant difference in school location, school type, teacher certification, and teacher experience and student achievement on the PSE. In addition, this study seeks to examine if there exist a relationship among the following: teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge PSE scores.

The sample of the population is 60 of 294 primary schools in Belize. There are five research questions and hypotheses that guided this study. The following are the research questions and hypotheses: The study investigated the following research questions and hypotheses:

1. Are there differences in students' PSE achievement scores between urban and rural Belizean primary schools?

2. Are there differences in students' PSE achievement scores between multi-grade and mono-grade in Belizean primary schools?

3. Are there differences in students' PSE achievement scores among teachers' with various level of training in Belizean primary schools? Three levels were examined:

- Bachelor's Degree or Higher
- Associates Degree
- Others

4. Are there differences in students' PSE achievement scores among teachers' with various years of experience in Belizean primary schools?

5. Is there a relationship between students' PSE achievement scores among teacher's knowledge? Three areas were examined:

- content knowledge,
- pedagogical knowledge
- pedagogical content knowledge

Several hypotheses were developed based on these research questions. Each hypothesis was written as null. The following were the research questions followed by the null hypotheses.

Research Question 1

Are there differences in students' PSE achievement scores between urban and rural Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There were no mean differences in PSE scores between standard six students who attend urban or rural primary schools.

Research Question 2

Are there differences in students' PSE achievement scores between multi-grade and mono-grade Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There is no mean difference in PSE scores for standard six students in multi-grade or mono-grade schools.

Research Question 3

Are there differences among teachers with different levels of training in Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There are no mean differences in PSE scores between standard six students and teacher with different levels of training in Belizean primary schools.

Research Question 4

Are there differences in students' PSE achievement scores among teachers with various years of experience in Belizean primary schools? The following null hypothesis was developed based on this question:

H_{o1}: There are no mean differences in PSE scores between standard six students and teacher experience primary schools.

Research Question 5

Is there a relationship among teachers' knowledge and students PSE achievement score? Three areas were examined:

- Content Knowledge
- Pedagogical Knowledge
- Pedagogical Content Knowledge

Chapter three discussed the data collection and analysis of data in a quantitative approach. This chapter discussed the description and analysis of the demographic information in addition to the information collected from the section of the survey looking at content knowledge, pedagogical knowledge and pedagogical content knowledge collected from the survey completed by the respondents. The chapter begins with the demographic data of the participants. The second section provides the findings for the survey. The third section provides the statistical information of the five research questions and hypotheses. The fourth section provides the ANOVA, Pearson product model and multiple regression results. In addition, a summary of the results is also presented in this chapter.

Demographic Data

The sample for this research included 60 teachers who taught standard six for school year 2009 to 2010. The sample included 10 standard six teachers from each of the six districts in Belize. Table 4.2 displays the demographics of the teachers who participated by district.

Table 4.2

Distribution of Teachers by District

District	Frequency	Percent
Corozal	8	15.4
Orange Walk	10	19.2
Belize	9	17.2
Cayo	6	11.5
Stann Creek	9	17.3
Toledo	10	19.2
Total	52	100.0

Of the 60 teachers selected to participate in the study the survey, 52 provided usable data by responding to all the survey items. This resulted to 86.6% response rate. The highest response rate was 19.2% from Toledo and Orange Walk. The lowest response rate was 11.5% from the Cayo District. As shown in table 4.3, most of the respondents were females.

Table 4.3

Distribution of Teachers by Sex

Sex	Frequency	Percent
Male	23	44.2
Female	29	55.8
Total	52	100.0

Table 4.4 provides data on the age range of the participants of the survey. The majority of the teachers 78.8% were over 32 years of age while only 1.9% was between the age ranges of 18 – 22.

Table 4.4

Distribution of Teachers by Age Group

Age Group	Frequency	Percent
18 – 22	1	1.9
23 – 26	2	3.8
27 – 32	8	15.4
32+	41	78.8
Total	52	100.0

Table 4.5 indicates that most of the participants 55.8% were teaching in schools located in the rural areas.

Table 4.5

Distribution of Teachers by School Location

School Location	Frequency	Percent
Urban	23	44.2
Rural	29	55.8
Total	52	100.00

Table 4.6 illustrates data from the survey indicated that in 36 (69.2%) of the teachers were teaching in mono-grade schools.

Table 4.6

Distribution of Teachers by School Type

School Type	Frequency	Percent
Multi-grade	16	30.8
Mono-grade	36	69.2
Total	52	100.0

Table 4.7 provides the result of the teacher demographic information related to qualification. The highest qualifications were Bachelor's degree in primary education and Trained Teacher 12(23.1%) and 1 teacher had a First Class 1 participant (1.9%).

Table 4.7

Distribution of Teachers by Teaching Qualification

Teaching Qualification	Frequency	Percent
High School	2	3.8
First Class	1	1.9
Associate Degree	9	17.3
Associate Degree in Primary Education	7	13.5
Bachelor's Degree in Science/Administration	2	3.8
Bachelor's Degree in Primary Education	12	23.1
Master's Degree in Education	2	3.8
Trained Teacher	2	3.8
Level 1	12	23.1
Level 2	3	5.8
Total	52	

Table 4.8 shows that the majority of the teachers were not enrolled in an institution.

Table 4.8

Distribution of Teachers by School Enrollment

School Enrollment Status	Frequency	Percent
Enrolled	11	21.2
Not Enrolled	41	78.8
Total	52	100.0

The survey also collected data on teaching experience. As shown in table 4.9, this section included the participants' position during the school year 2009-2010, the number of years in the particular position and the total number of years teaching experience the participants.

Table 4.9

Distribution of Teachers by Teaching Post 2009-2010

Teaching Post Held in 2010	Frequency	Percent
*Teacher	34	65.4
**Teaching Principal	18	34.6
Total	52	100.

*Teacher only

** Teacher and administrator

Participants only teaching are 34(65.4%) and teaching principals are 18(34.6%). The teacher experience and time in position shows in general that the years of teacher experience for each teacher was greater (higher) than the time teaching in the position held in 2010. There were cases when the years of teacher experience for each teacher are equal to the time teaching in the position held in 2010. However, there were no cases where the years of teacher experience for

each teacher was less (lower) than the time teaching in the position held in 2010 which is also expected.

Inferential Statistics

The SPSS 19.0 was used to calculate the statistical results presented in this section of the chapter. A One- way Between Subjects ANOVA was used to test the differences among two or more means (Pyrcak, 2001, p.97). Research questions one through four utilized a One-way Between Subjects ANOVA to determine if there were statistical differences in PSE mean scores among the variables of school location, school type, teachers' certification, and teachers' experience and student achievement on PSE. In addition, research question five used Pearson product and multiple regressions to ascertain if a relationship existed between teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge and students' achievement on the PSE.

Results of Research Question 1

Research question 1 asked: Are there differences in students PSE achievement scores between urban and rural Belizean primary schools?" The One-Way ANOVA comparing the mean score between the two groups suggested no mean differences in PSE scores between standard six students in urban and rural primary schools (i.e. H_0: μ urban = μ rural).

Before conducting a One-way ANOVA test, the validity of the assumptions associated with this test were examined. The assumptions were: independent variable consists of two or more categorical independent groups, dependent variable is either interval or ratio (continuous), dependent variable is approximately normally distributed for each category of the independent variable, equality of variances between the independent groups (homogeneity of variances) and

independence of cases or independence within sample. The results indicated that the assumptions were all met since:

1. Independent variable (School Location) had 2 categorical groups namely Urban and Rural.
2. "PSE Achievement Scores" was the dependent variable and had a ratio or continuous variable.
3. Dependent variable (PSE Achievement Scores) was approximately normally distributed for each category of the independent variable (School Location) since the significant value of the Shapiro-Wilk Test was greater than 0.05 for each School Location group (see Table 4.10).

Table 4.10

Tests of Normality

	School Location	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Student PSE Scores	Rural	.125	29	.200	.960	29	.324
	Urban	.148	23	.200	.924	23	.083

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

4. Levene's Test was used to examine the equality of variances between the independent groups. This assumption was met since the Levene's Test of Homogeneity of Variance (Table 11) was not significant (significance value is greater than 0.05

indicating there is homogeneity of variances between the independent groups), $F(1, 50) = 0.269$, $p = 0.606$.

Table 4.11

Test of Homogeneity of Variances

Student PSE Scores			
Levene Statistic	df1	df2	Sig.
.269	1	50	.606

5. Independence of cases or independence within sample was met since data from different subjects are independent hence the behavior of one participant did not influence the behavior of another.

Table 4.12

ANOVA Calculations for School Location

Student PSE Scores					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	6132.335	1	6132.335	7.283	.009
Within Groups	42102.652	50	842.053		
Total	48234.987	51			

Results of the ANOVA revealed there was a significant difference in the students' PSE Achievement Scores between schools located in Urban (M = 255.3, SD = 30.56) and Rural (M = 233.4, SD = 27.72), areas; F (1, 50) = 7.283, p = 0.009, (Table 4.12). The study rejected the null hypothesis. These results suggested that students who attend urban school locations have statistically significantly higher PSE achievement scores than those who attend rural school locations.

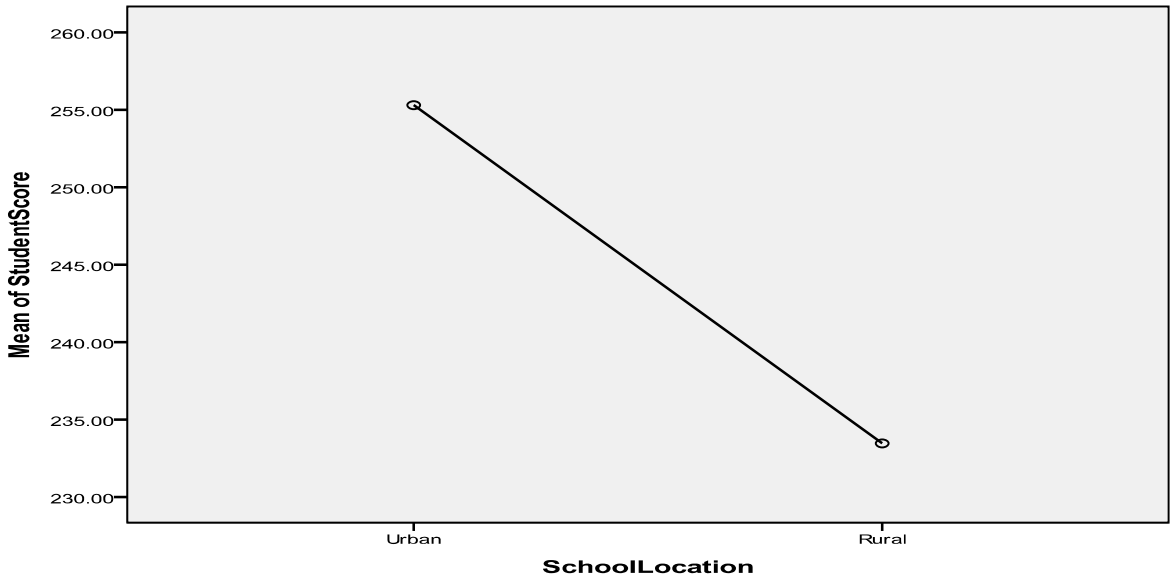
The descriptive statistics in Table 4.13 and the means plot in Figure 4.1 show that students from urban school locations had higher mean PSE scores than those from rural school locations.

Table 4.13

Descriptive Statistics for Student PSE Scores and School Location

Student PSE Scores								
School Location	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Rural	29	233.4	27.71715	5.14695	222.9	244.0	165.3	313.9
Urban	23	255.3	30.59406	6.37930	242.1	268.5	190.0	325.0
Total	52	243.1	30.75360	4.26476	234.6	251.7	165.3	325.0

Figure 4.1
Means Plot of PSE Scores and School Location



Result of Research Question 2

The second research question asked "Are there differences in students' PSE achievement scores between multi-grade and mono-grade Belizean primary schools?" One-Way ANOVA comparing the mean score between the two groups suggested no mean differences in PSE scores between standard six students in multi-grade and mono-grade primary schools (i.e. H_0: μ Multi-grade = μ Mono-grade).

One-way ANOVA was conducted to find out if mean PSE Scores from students who attend mono-grade schools were statistically and significantly higher than those in multi-grade schools. However, before conducting the One-way ANOVA, the validity of the assumptions associated with this test were examined. The results of testing the assumptions of the One-way ANOVA indicated that the assumptions were all met since:

1. The independent variable, type of school, had two groups namely mono-grade and multi-grade. Hence, the assumption of the independent variable consisting of two or more categorical independent groups was met.
2. Assumption of dependent variable was either interval or ratio (continuous) was met since the dependent variable, PSE Achievement Scores, was a ratio or continuous variable.
3. Dependent variable (PSE Achievement Scores) was approximately normally distributed for each category of the independent variable (Type of School) was met since the significant value of the Shapiro-Wilk Test was greater than 0.05 for each School Location group (Table 4.14).

Table 4.14

Tests of Normality

	Type of School	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Student PSE Scores	Multi-Grade	.142	16	.200	.953	16	.546
	Mono-Grade	.091	36	.200	.970	36	.430

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

4. Equality of variances between the independent groups (homogeneity of variances) was met since the Levene's Test of Homogeneity of Variance (see Table 4.15) was not significant (i.e. significance value is greater than 0.05 indicating there was homogeneity of variances between the independent groups); ($F(1, 50) = 0.269$, $p = 0.517$).

Table 4.15

Test of Homogeneity of Variances

Student PSE Scores			
Levene Statistic	df1	df2	Sig.
.269	1	50	.517

5. Independence of cases or independence within sample was met since data from different subjects were independent hence the behavior of one participant did not influence the behavior of another (see table 4.16).

Table 4.16

ANOVA Calculation for School Type

Student PSE Scores					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	5362.805	1	5362.805	6.254	.016
Within Groups	42872.182	50	857.444		
Total	48234.987	51			

One-Way between Subjects ANOVA test was conducted to examine whether there were significant differences in the students' mean PSE Achievement Scores between Types of School (mono-grade and multi-grade) groups. There was a significant difference in the PSE Achievement Scores between mono-grade (M = 249.9, SD = 27.15) and multi-grade (M = 227.9,

SD = 33.74) types of School (Table 18); F (1, 50) = 6.254, p = 0.016. Results rejected the null hypothesis and indicated that students who attend mono-grade schools have significantly higher PSE Achievement Scores than students who attend multi-grade schools.

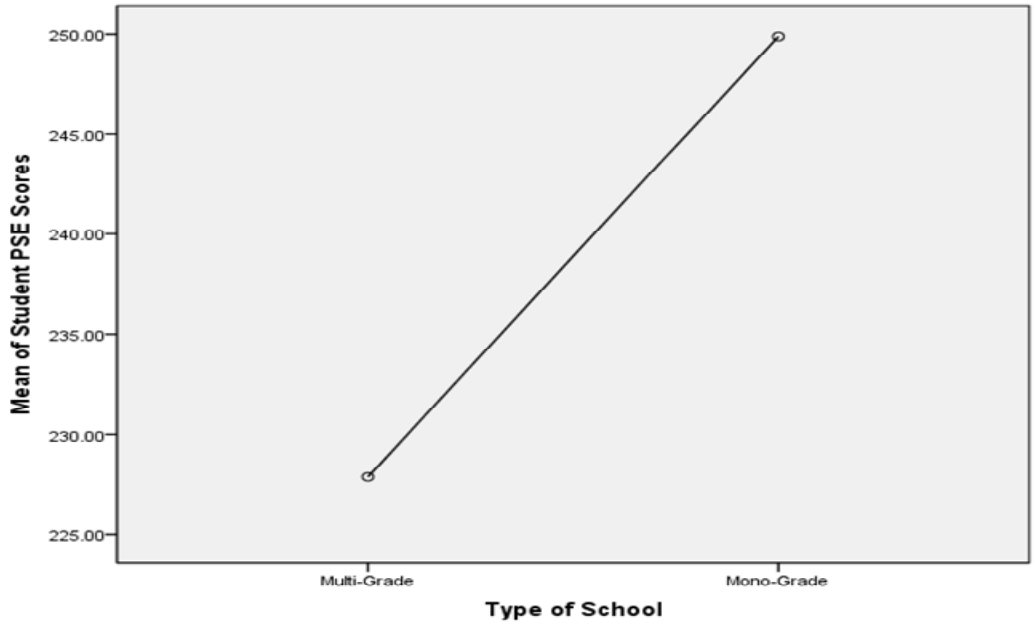
The descriptive statistics in Table 4.17 and the means plot in Figure 4.2 show that students from mono-grade primary schools had higher mean PSE scores than those from multi-grade primary schools.

Table 4.17

Descriptive Statistics for Student PSE Scores and Type of School

Student PSE Scores								
Type of School	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Multi-Grade	16	227.9	33.7390	8.4348	209.9	245.9	165.3	313.9
Mono-Grade	36	249.9	27.1490	4.5248	240.7	259.1	196.3	325.0
Total	52	243.1	30.7536	4.2648	234.6	251.7	165.3	325.0

Figure 4.2
Means Plot of PSE Scores and Type of School



Results of Research Question 3

The third research question asked: Are there differences in students PSE achievement scores among teachers' certification in Belizean primary schools? ANOVA results indicated that there were no mean differences in PSE scores among standard six students who were taught by teachers with Associates Degree, Bachelor's Degree & Higher and Other (which are comprised of High School, First Class, Trained Teacher, Level 1 and Level 2) as the Highest Education Level completed. That is, H_0: μ Associates Degree = μ Bachelor's Degree & Higher = μ Other.

One-way ANOVA conducted to find out if there were statistical significant difference in the mean PSE Scores among standard six students who were taught by teachers with Associates Degree, Bachelor's Degree & Higher and Other. Before conducting a One-way ANOVA, the

validity of the assumptions associated with this test was examined. The results of testing the assumptions of the One-way ANOVA indicated that the assumptions were all met since:

1. Independent variable consisted of two or more categorical independent groups. Independent variable was “Highest Education Level Completed” This variable had 3 groups namely Associates Degree, Bachelor’s Degree and Higher, and Other.
2. Dependent variable was either interval or ratio (continuous) since “PSE Achievement Scores” was the dependent variable and was a ratio or continuous variable.
3. "PSE Achievement Scores” was approximately normally distributed for each category of “Highest Education Level Completed” since the significant value of the Shapiro-Wilk Test was greater than 0.05 for each group (Table 4.18).

Table 4.18
Test of Normality

	Highest Education Level Completed	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Student PSE Scores	Associates Degree	.112	20	.200	.958	20	.513
	Bachelor's Degree or Higher	.136	16	.200	.953	16	.535
	Other	.164	16	.200	.938	16	.329

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

4. Equality of variances between the independent groups (homogeneity of variances) was met since the Levene's Test of Homogeneity of Variance (see Table 4.19) was not significant (i.e. significance value is greater than 0.05 indicating there was homogeneity of variances between the independent groups); ($F(2, 49) = 0.117$, $p = 0.889$).

Table 4.19

Test of Homogeneity of Variances

Student PSE Scores			
Levene Statistic	df1	df2	Sig.
.117	2	49	.889

5. Independence of cases or independence within sample was met since data from different subjects were independent hence the behavior of one participant did not influence the behavior of another.

Table 4.20

ANOVA Calculations for Teacher Certification

Student PSE Scores					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2947.230	2	1473.615	1.594	.213
Within Groups	45287.757	49	924.240		
Total	48234.987	51			

One-way between Subjects ANOVA was conducted to examine whether there were statistically significant differences in the students' PSE Achievement Scores among teachers with different levels of qualification. The results revealed there was not a significant difference in mean PSE Achievement Scores among teachers with Associates Degree (M = 235.9, SD = 30.29), Bachelor's Degree & Higher (M = 253.9, SD = 33.12) and other (M = 241.4, SD = 27.57) Highest Education Level completed (see Table 21); F (2, 49) = 1.549, p = 0.213. Hence, the study failed to reject the null hypothesis. It was therefore concluded that students who were taught by teachers with different levels of qualification had the same PSE Achievement Scores. Apparently, the differences we saw in this sample were simply due to sampling error.

The descriptive statistics in Table 4.21 and the means plot in Figure 4.3 indicate that students taught by teachers who held a Bachelor's Degree & Higher had the highest mean PSE score, followed by Other and then teachers possessing an Associates Degree.

Table 4.21

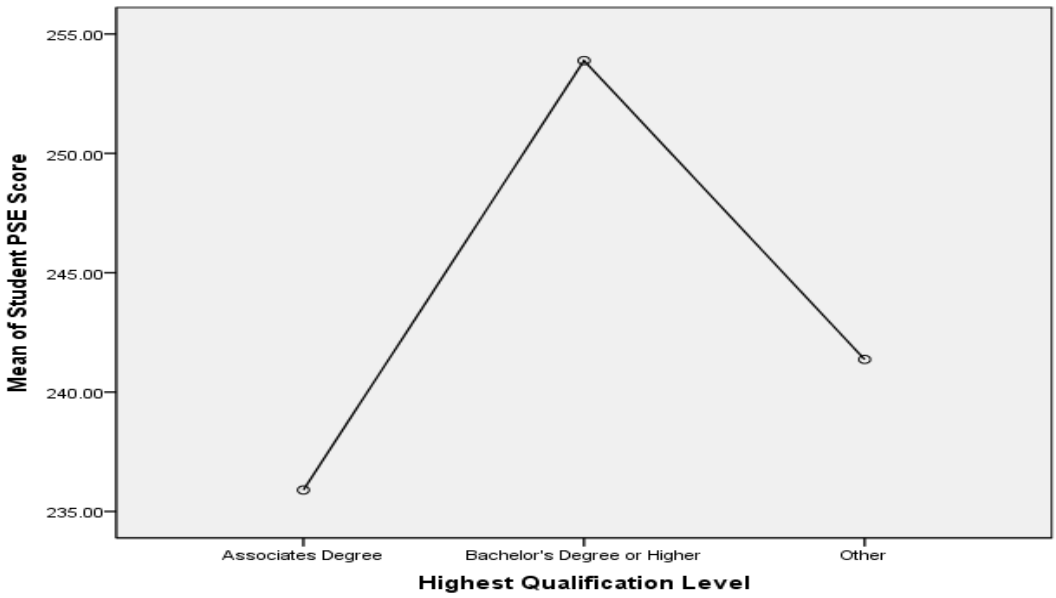
Descriptive Statistics on Student PSE Scores and Highest Education Level Completed

Highest Education Level Completed	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Associates	20	235.9	30.28582	6.77212	221.7	250.1	165.3	280.5

Degree								
Bachelor's Degree or Higher	16	253.9	33.11534	8.27883	236.2	271.5	196.3	325.0
Other	16	241.4	27.58137	6.89534	226.7	256.1	190.0	282.0
Total	52	243.1	30.75360	4.26476	234.6	251.7	165.3	325.0

Means Plot of PSE Scores and Highest Qualification Level

Figure 4.3



Results of Research Question 4

The fourth research question asked "Are there differences in students' PSE achievement scores between teachers' with different years of experience in Belizean primary schools?" ANOVA results indicated no mean difference in PSE scores among Standard six students who were taught by teachers with teaching experience of at least 5 years experience and more that 5 years experience. That is, H_0: μ at least 5 years experience = μ more than 5 years experience.

A One-way ANOVA was conducted to find out if mean PSE Scores from students who had teachers with at least 5 years of teaching experience are statistically and significantly higher than those with more than 5 years of teaching experience. However, before conducting a One-way ANOVA test, the validity of the assumptions associated with this test was being examined. The results of testing the assumptions of the One-way ANOVA indicated that the assumptions were all met since:

1. Independent variable, teaching experience, consisted of two or more categorical independent groups namely at least 5 years experience and more than 5 years experience.
2. The dependent variable, PSE achievement scores, was a ratio or continuous variable.
3. Dependent variable PSE achievement scores was approximately normally distributed for each category of the independent variable (Teaching Experience) was met since the significant value of the Shapiro-Wilk Test was greater than 0.05 for each Teacher Experience group (Table 4.22).

Table 4.22

Tests of Normality

	Teaching Experience	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Student PSE Scores	At Least 5 Years Experience	.181	5	.200	.956	5	.782
	More Than 5 Years Experience	.081	47	.200	.987	47	.876

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

4. Equality of variances between the independent groups (homogeneity of variances) was met since the Levene's Test of Homogeneity of Variance (see Table 4.23) was not significant (i.e. significance value is greater than 0.05 indicating there is homogeneity of variances between the independent groups); ($F(1, 50) = 0.117$, $p = .093$).

Table 4.23

Test of Homogeneity of Variances

Student PSE Scores			
Levene Statistic	df1	df2	Sig.
2.941	1	50	.093

5. Independence of cases – This assumption was that data from different subjects were independent, which means that the behavior of one participant did not influence the behavior of another.

Table 4.24

ANOVA Calculations for Teacher Experience

Student PSE Scores					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	118.426	1	118.426	.123	.727
Within Groups	48116.561	50	962.331		
Total	48234.987	51			

A One-way between Subjects ANOVA was conducted to examine whether there were statistically significant differences in the PSE Achievement Scores among students who are taught by teachers with different years of teaching experience. The results revealed there were no significant difference in mean PSE achievement scores between students who were taught by teachers with at least 5 years experience (M = 247.7, SD = 11.88) and more than 5 years experience (M = 242.6, SD = 32.15) (Table 26); F (2, 49) = 0.123, p = 0.727. The study failed to reject the null hypothesis. Students who are taught by teachers with different years of Teaching

Experience had the same PSE achievement scores. Apparently, the differences we saw in this sample were simply due to sampling error.

The descriptive statistics in Table 4.25 and the means plot in Figure 4.4 indicated that students with teachers with at least 5 years experience had higher mean PSE score than those with more than 5 years experience.

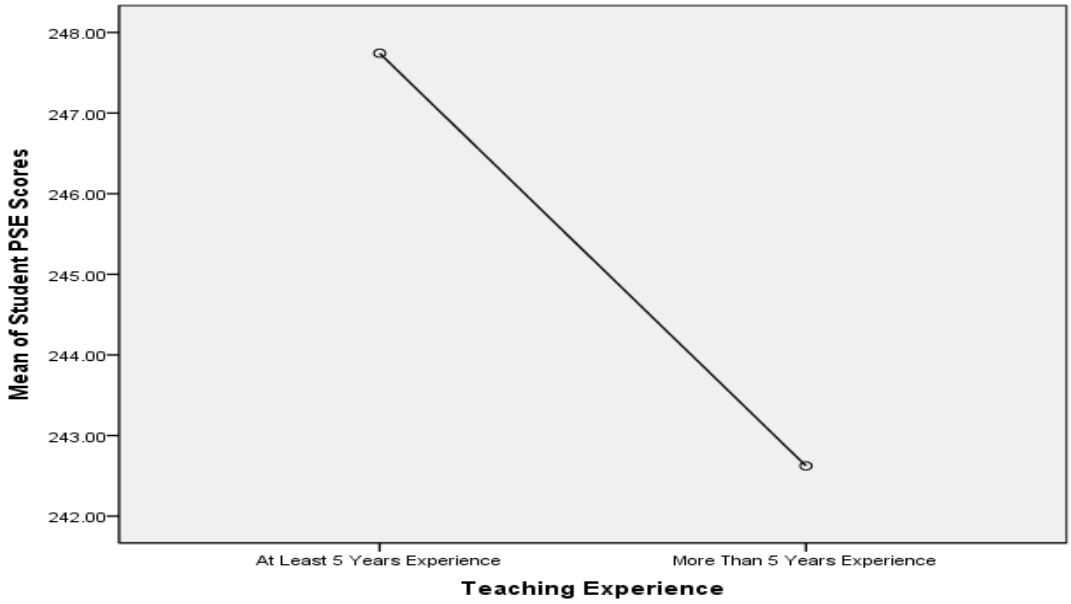
Table 4.25

Descriptive Statistics for Student PSE Scores and Teacher Experience

Student PSE Scores								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
Teacher Experience					Lower Bound	Upper Bound		
At Least 5 Years Experience	5	247.7	11.8790	5.3124	233.0	262.5	233.6	262.2
More Than 5 Years Experience	47	242.6	32.1519	4.6898	233.2	252.1	165.3	325.0
Total	52	243.1	30.7536	4.2648	234.6	251.7	165.3	325.0

Figure 4.4

Means Plot of PSE Scores and Teacher Experience



Results of Research Question 5

The fifth research question asked "Is there a relationship between PSE achievement scores and teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge?" In order to investigate the relationship between PSE achievement scores and teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge a Pearson product-moment correlation coefficient analysis and a Multiple Regression analysis were used.

A Pearson product-moment correlation coefficient was computed using a Covariance matrix to assess the relationship between PSE achievement scores and content knowledge, pedagogical knowledge and pedagogical content knowledge as well as the relationship between PSE achievement scores and other variables in this study (i.e. Gender, School Location, Type of School, Enrollment Status, and Teaching Experience). The results (see Table 4.26 & Figure 4.5)

indicated that there were weak negative correlations between the PSE achievement scores and content knowledge (r = -0.120, n = 52, p = 0.397), pedagogical knowledge (r = -0.158, n = 52, p = 0.264) and pedagogical content knowledge (r = -0.01, n = 52, p = 0.997). However, there were strong negative correlations between the PSE achievement scores and School Location (r = -0.356, n = 52, p = 0.010) and Type of School (r = -0.333, n = 52, p = 0.016). Results also indicated that the strong negative correlations between the PSE achievement scores and School Location and Type of School were in line with the ANOVA results for research questions one and two. The weak negative correlations between the PSE achievement scores and content knowledge, pedagogical knowledge, pedagogical content knowledge suggested that content knowledge, pedagogical knowledge, and pedagogical content knowledge are poor predictors of PSE achievement scores.

Table 4.26

Pearson Product-Moment Correlations Between Gender, School Location, Type of School, Enrollment Status, Teaching Experience, Student Score, Content Knowledge, Pedagogical Knowledge, and Pedagogical Content Knowledge

		Student PSE Score	School Location	School Type	Teaching Qualifications	Teaching Experience (Years)	Content Knowledge	Pedagogical Knowledge	Pedagogical Content Knowledge
Student PSE Score	Pearson Correlation	1	-0.356**	-0.333*	-.058	.020	-.120	-.158	-.001
	Sig. (2-tailed)		.010	.016	.684	.886	.397	.264	.997
	N	52	52	52	52	52	52	52	52
School Location	Pearson Correlation	-0.356**	1	0.342*	.023	-.090	-0.106	.012	-.074
	Sig. (2-	.010		.013	.871	.524	.454	.931	.600

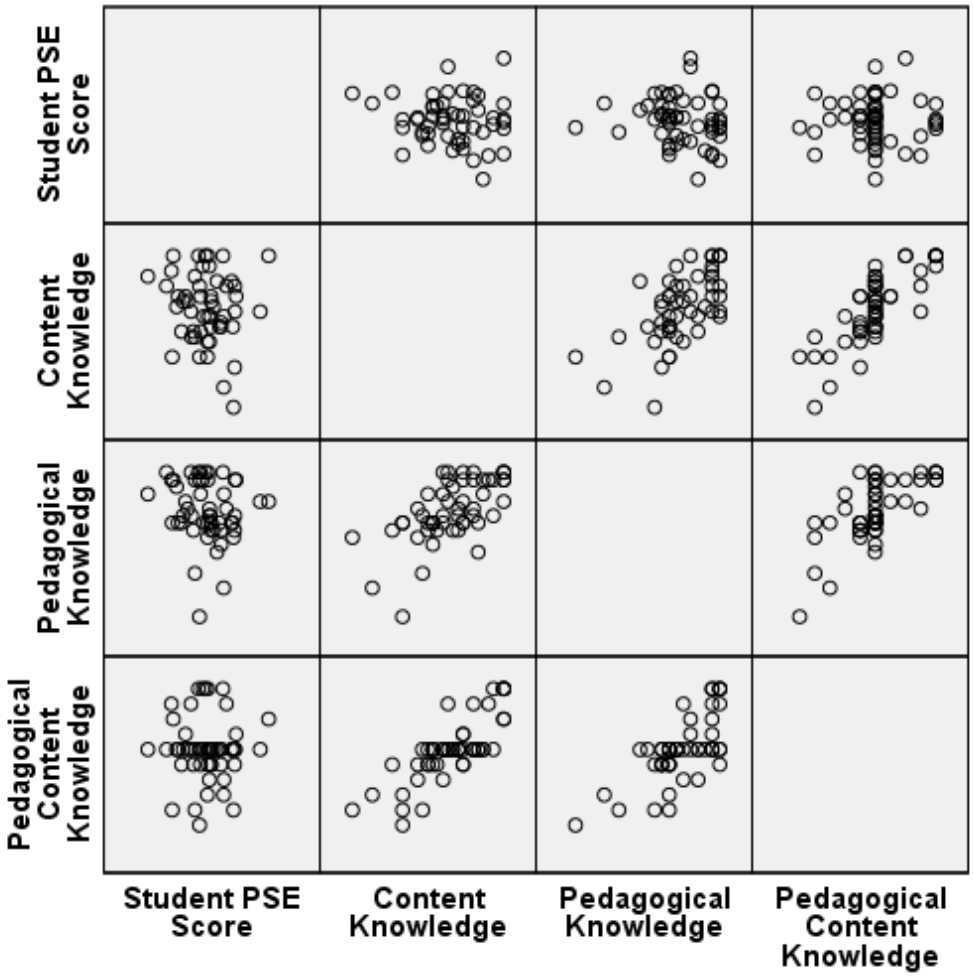
	tailed)								
	N	52	52	52	52	52	52	52	52
School Type	Pearson Correlation	-0.333*	0.342*	1	.047	.199	0.010	.184	-.040
	Sig. (2-tailed)	.016	.013		.739	.156	.942	.193	.778
	N	52	52	52	52	52	52	52	52
Teaching Qualifications	Pearson Correlation	-.058	.023	.047	1	0.410**	-.190	.100	-.187
	Sig. (2-tailed)	.684	.871	.739		.003	.178	.482	.184
	N	52	52	52	52	52	52	52	52
Teaching Experience (Years)	Pearson Correlation	.020	-.090	.199	0.410**	1	.000	0.376**	.101
	Sig. (2-tailed)	.886	.524	.156	.003		.998	.006	.477
	N	52	52	52	52	52	52	52	52
Content Knowledge	Pearson Correlation	-.120	-0.106	0.010	-.190	.000	1	0.628**	0.799**
	Sig. (2-tailed)	.397	.454	.942	.178	.998		.000	.000
	N	52	52	52	52	52	52	52	52
Pedagogical Knowledge	Pearson Correlation	-.158	.012	.184	.100	0.376**	0.628**	1	0.695**
	Sig. (2-tailed)	.264	.931	.193	.482	.006	.000		.000
	N	52	52	52	52	52	52	52	52
Pedagogical Content Knowledge	Pearson Correlation	-.001	-.074	-.040	-.187	.101	0.799**	0.695**	1
	Sig. (2-tailed)	.997	.600	.778	.184	.477	.000	.000	
	N	52	52	52	52	52	52	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.5

Scatter Plot of PSE Scores, Content Knowledge, Pedagogical Knowledge, and Pedagogical Content Knowledge



A Standard Multiple Regression was conducted to examine the relationship between PSE achievement scores and subset of independent variables (content knowledge, pedagogical knowledge and pedagogical content knowledge). Similar to the results of the null hypothesis tested by Multiple Regression, there was no relationship between PSE achievement scores and content knowledge, pedagogical knowledge and pedagogical content knowledge. Before conducting the Multiple Regression, the validity of the assumptions associated with this test was

examined. These Multiple Regression assumptions were: (i) linearity of the relationship between dependent and independent variables, (ii) independence of the errors (no serial correlation), (iii) homoscedasticity (constant variance) of the errors, and (iv) normality of the error distribution. It was found that the homoscedasticity (constant variance) of the errors assumption was violated since there were non-random patterns of data points seen in the plots that resembled a funnel shape (i.e. points got wider towards the right end of the plots); indicating non-constant variance of the errors for content knowledge and pedagogical knowledge variables (Graphs 4.6 & 4.7).

Figure 4.6

Partial Regression Plot, Content Knowledge and Student PSE Scores

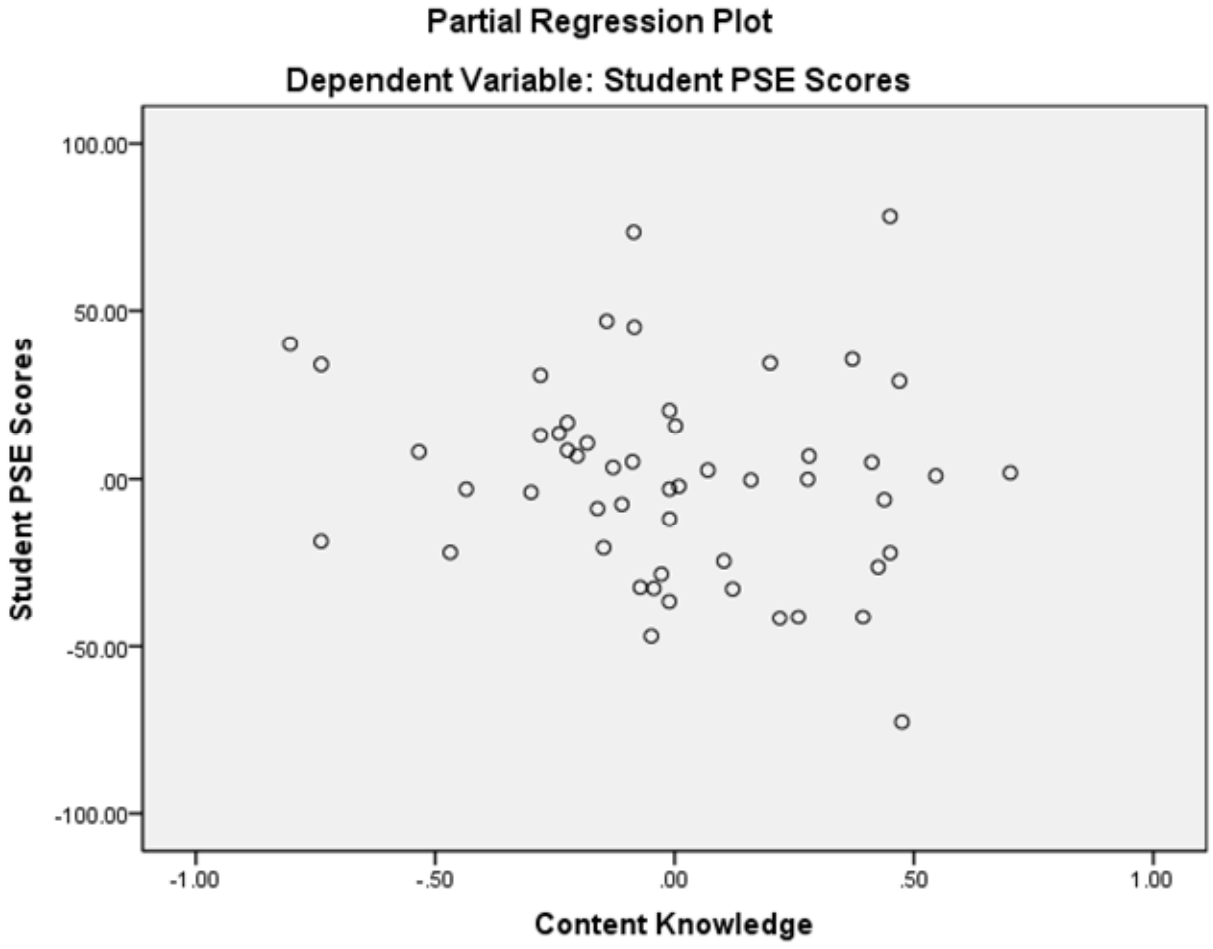
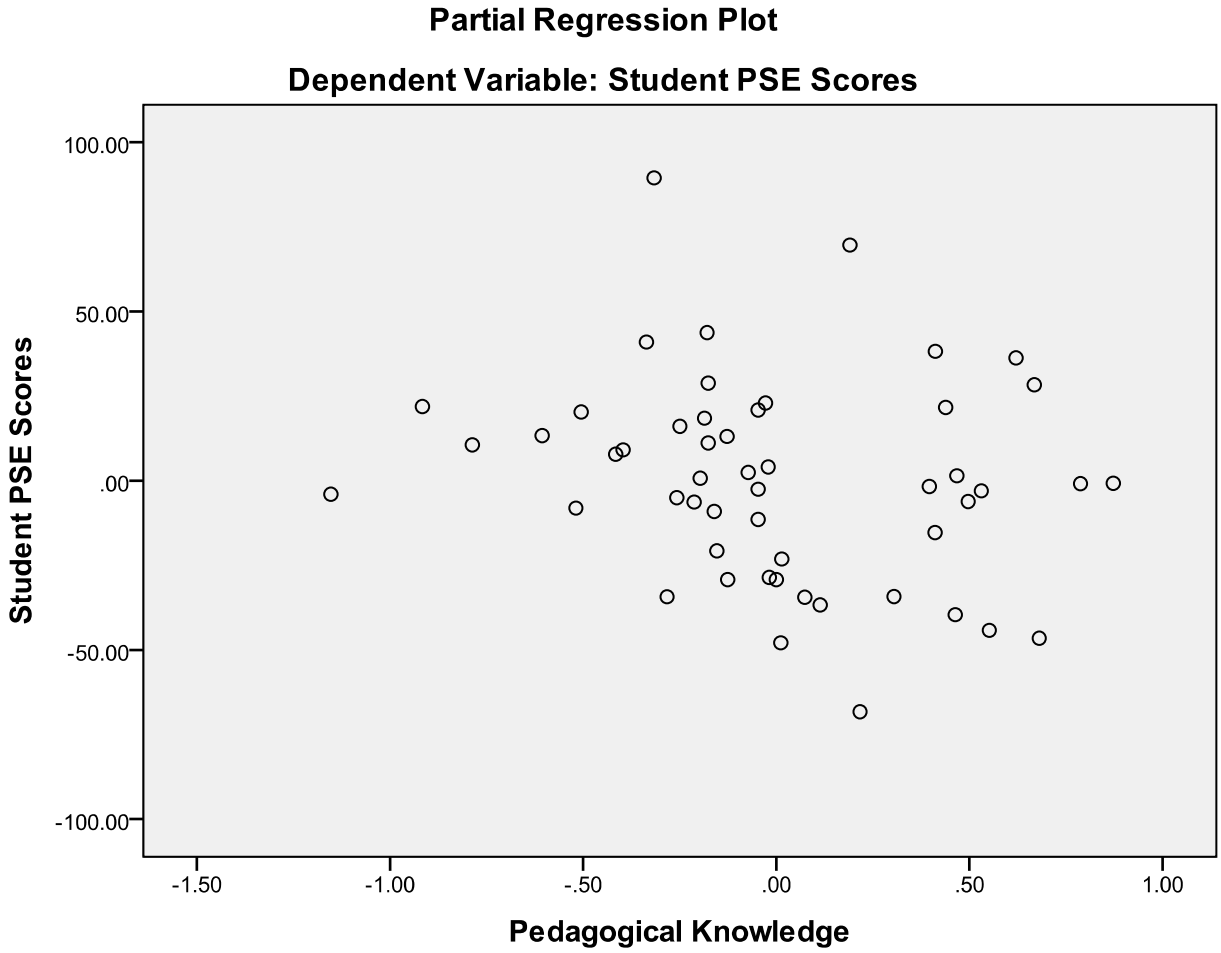


Figure 4.7

Partial Regression Plot, Pedagogical Knowledge and Student PSE Scores



The transformation used to correct this violation of the assumption of homoscedasticity was carried out by taking one over the square root of each data observation for the content knowledge and pedagogical knowledge independent variables. The predictor variables that were used in the Regression model are 1/Square Root (Content Knowledge), 1/Square Root (Pedagogical Knowledge), Pedagogical Content Knowledge. The Simultaneous Method, where all predictor variables aforementioned are entered at once in the model, was used for selecting the model since the researcher specified the set of predictor variables that make up the model.

Using the Simultaneous Method, a non-significant model emerged, F (3, 48) = 1.219, p = 0.313, (Table 4.27).

Table 4.27

ANOVA Calculations for Content Knowledge, Pedagogical Knowledge and Pedagogical Knowledge

ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3413.637	3	1137.879	1.219	.313
	Residual	44821.350	48	933.778		
	Total	48234.987	51			

a. Predictors: (Constant), 1/Square Root (Content Knowledge), 1/Square Root (Pedagogical Knowledge), Pedagogical Content Knowledge

b. Dependent Variable: Student PSE Scores

The study failed to reject the null hypothesis. This model also accounted for 7.1% of the variance in PSE achievement (Table 4.28). These results suggested that there was no relationship between the dependent variable, PSE achievement scores and the subset of independent variable (teachers 'content knowledge, pedagogical knowledge and pedagogical content knowledge).

Table 4.28

Model Summary for Content Knowledge, Pedagogical Knowledge, and Pedagogical Content Knowledge

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.266	.071	.013	30.55778	1.810

a. Predictors: (Constant), 1/Square Root (Content Knowledge), 1/Square Root (Pedagogical Knowledge), Pedagogical Content Knowledge

b. Dependent Variable: Student PSE Scores

Summary

The findings for the five research questions that guided this study were presented in chapter IV along with related tables and graphs. For research question one there was a significance difference in the students' PSE achievement scores between urban and rural school location. This study rejected the null hypothesis. Research question two revealed that there was a significance difference in the PSE achievement scores between mono-grade and multi-grade school types. This study results rejected the null hypothesis. Results for research question three revealed that there were no significance differences in mean PSE achievement scores and students taught by teachers with associate's degree, bachelors degree, higher and other. The study fails to reject the null hypothesis. The results of the study for research question four revealed that there is no significant differences in PSE achievement scores and students taught by teachers with at least 5 years experience and more than 5 years. The study failed to reject the null hypothesis. The result of the study for question five revealed that there is no relationship

between PSE achievement scores and content knowledge, pedagogical knowledge, and pedagogical content knowledge. The study failed to reject the null hypotheses. Chapter V looks at discussions, conclusions, significance of the study and recommendations for further research

Chapter V

CONCLUSION, DISCUSSIONS, AND RECOMMENDATIONS

This chapter discusses the findings and conclusions base of the analysis of the data collected in relation to the theoretical framework used to test the hypotheses and research questions for the study. The theoretical framework of TPCK was introduced to the educational research field as a theoretical framework for understanding teacher knowledge required for effective technology integration (Schmidt, et al., 2009). In explaining the TPCK framework, Schmidt, et al., explains that technological knowledge is situated within content and pedagogical knowledge. TPCK introduces the relationship and the complexities between all three basic components of knowledge. The framework focuses on designing and evaluating teacher knowledge that is concentrated on effective student learning in various content areas. TPCK as a framework for measuring teaching knowledge could potentially have an impact on the type of training and professional development experiences that are designed for both pre-service and in-service teachers. The restatement of the purpose of the research of examining if there was a difference among school location, school type, teacher certification, teacher experience and teachers' content knowledge, pedagogical knowledge, and pedagogical content knowledge on student achievement.

Summary of Findings and Theoretical Perspective

This research used two data sources which included the students' PSE scores and the teachers' responses on the survey instrument. Sixty survey instruments were distributed and 52 were returned for a response rate of 86.6%. All of the participants of the study had taught standard six for the school year 2009-2010. A convenience sample of 10 teachers from each district in Belize consented to participate in the study.

The survey instruments were distributed to 10 teachers in every district across Belize. Toledo and Orange Walk Districts demonstrated 19.2% responses, the highest of all six districts while, Cayo respondent rate was the smallest 11.5%. Of the gender there were 29 (55%) females and 23(44.2%) males' respondents. The respondents age range demonstrated that 41 (78%) of the 52 respondents were 32+ while 1 (1.9%) the smallest age group was between age range 18-22. School location was divided into rural and urban of which 29 (55.8%) of the respondents were from rural schools and 23 (44.2%) were from urban schools. School types was divided into mono-grade and multi-grade of which 36 (69.2%) of the respondents came from mono-grade school and 16 (30.8%) of the 52 respondents were from multi-grade schools.

Each participant completed the Teacher Survey which is comprised of four sections namely; demographic information, educational background, teacher experience, and teacher knowledge (content knowledge, pedagogical knowledge, and pedagogical content knowledge). Section one of the survey consisted of the Demographic information consisted of gender, age range, location of school and type of school. Section two of the survey consisted of educational background which allowed participants to respond to their level of qualification, if they are currently enrolled in an institution and to indicate in which course of study they are enrolled. Section three of the survey consisted of teaching experience which allowed participants' to respond their position in school year 2009-2010, number of years in the position and the total number of years teaching experience. Section four of the survey explored participants' content knowledge of Mathematics, Social Studies, Science and English, teacher pedagogical knowledge and pedagogical content knowledge.

The survey results were matched with the students' scores of the PSE. There are also five research questions that were addressed in this study and the findings were presented in

chapter IV. The inferential statistics section of chapter IV of the study analyzed the first four questions by using ANOVA and the fifth research question was analyzed using multiple regression. Below are the findings for each research question.

Research Question One

One-way ANOVA test revealed there was a significant difference in the PSE scores between urban (M = 255.3, SD = 30.56) and rural (M = 233.4, SD = 27.72). The *F* test (1, 50) = 7.283 and p = 0.009. This does not support the null hypothesis so it was rejected.

Research Question Two

One-way ANOVA test revealed that there was a significant difference in the PSE scores between mono-grade (M = 249.9, SD = 27.15) and multi-grade (M = 227.9, SD = 33.74). The *F* test (1, 50) = 6.254, p = 0.016. This does not support the null hypothesis so it was rejected.

Research Question Three

One-way ANOVA results revealed there was not a significant difference in the mean PSE scores among teachers with Associate Degree (M = 235.9, SD = 30.29) Bachelor's Degree and Higher (M = 253.9, SD = 33.12) and other (M = 241.4, SD = 27.57). The *F* test for highest education level completed F test (2, 49) = 1.549, p = 0.213. This supported the null hypothesis so it was failed to be rejected.

Research Question Four

One-way ANOVA results revealed that there was not a significant different in mean PSE scores between students who were taught by teachers with at least 5 years experience (M = 247.7, SD = 11.88) and more than 5 years experience (M = 242. 6, SD = 32.15). The *F* test (2, 49) = 0.123, p = 0.727. This supported the null hypotheses, so it was failed to be rejected.

Research Question Five

Pearson product moment correlation coefficient was computed using a covariance matrix and the results revealed that there is a weak negative correlations between the PSE scores and content knowledge ($r = -0.120$, $n = 52$, $p = 0.397$) pedagogical knowledge ($r = -0.158$, $n = 52$, $p = 0.264$) and pedagogical content knowledge ($r = -0.01$, $n = 52$, $p = 0.997$). The multiple regression was computed using the simultaneous method, a non- significant model emerged, $F(3, 48) = 1.219$, $p = 0.313$. These results suggest that there is no relationship between the dependent variable PSE scores and the subset of independent variable (content knowledge, pedagogical knowledge, and pedagogical content knowledge). This supported the null hypotheses so it was failed to rejected.

Conclusions

This study looked at five research questions and many similar studies have been found either addressing an individual research question and in some cases two or three research questions. Research question one was tested using One-way ANOVA which revealed there was a significant difference in the PSE scores between urban and rural. A study conducted in Latin America and the Caribbean led by Second Regional Comparative and Explanatory Study (SERCE) whose objective is to give insight into the learning acquired by Latin America and Caribbean third and sixth grade primary students in the areas of mathematics, Language (Reading and Writing) and Natural Science during their school trajectory. According to the results school location is also responsible for the differences in student performance levels observed in the region. Latin American and Caribbean girls and boys attending rural schools perform at lower levels when compared to their counter parts attending urban schools.

One-way ANOVA test revealed that there was a significant difference in the PSE scores between mono-grade and multi-grade schools. The results could be attributed to the fact that teachers deployed to these schools are not trained especially in the most remote schools. The trained teachers that are presently teaching take only one course that has to do with multi-grade teaching during their educational programs. In addition, teachers take part in multi-grade in-service training that is not continuous to effect changes. There is also the challenge of transferability, whereby teachers do not always carry into the classroom knowledge and skills acquired both in formal and informal trainings. The curriculum unit through the Quality Assurance Development Services of the Ministry of Education in conjunction with Commonwealth Secretariat provided each teacher with a document "Resource Materials for Multi-grade Teaching" to help improve multi-grade teaching. The availability and accessibility of resources is minimal compared to mono-grade schools. The national curriculum is structured for mono-grade classroom and teachers are expected to tailor it to their specific needs. Principals in multi-grade schools spend most of their time teaching their classes, school management and less time used for supervising and supporting teachers.

One-way ANOVA results revealed there was no significant difference in the mean PSE scores among teachers with different level of training. A causal-comparative study was conducted by Richardson (2008) with twenty full time mathematics teachers from seven of the eight traditional middle junior high schools located in the Montgomery Public School (MPS) District. The study found that if the teachers had a traditional secondary mathematics certification then his or her students tended to score higher on the mathematics portion of the Alabama Reading and Math Test (ARMT) compared to teachers with alternative certification. The results of this study could be attributed to the types of programs offered in Belize. There is

no training program that offers teachers the opportunity to specialize in content area of the four major subjects tested on the PSE. If the study was to look at the individual student scores on the subject areas measured on the PSE it might have revealed different results.

One-way ANOVA results revealed that there was not a significant different in mean PSE scores between students who were taught by teachers with at least five years experience and student who were taught by teachers with more than five years experience. One research question in Richardson (2008) study examined the extent to which student scores on the mathematics section of the Alabama Reading and Mathematics Test (ARMT) differ according to a teacher's total number of years teaching mathematics. The results revealed a near perfect correlation. The results of this study could have been because the researcher observed that most schools assign the most experienced teachers to teach the upper division students especially in standard six. In addition, the sample size of this study was not large enough to inform the researcher on the significance of the construct.

Pearson product moment correlation coefficient was computed using a covariance matrix and the results revealed that there was a weak negative correlation between the PSE scores and content knowledge, pedagogical knowledge and pedagogical content knowledge. Results of a study conducted by Becker and Aloe (2008) revealed that the amount of evidence on the relationship of science teacher knowledge to student outcomes in science was not extensive nor of very high quality. Another study conducted by Lenhart (2010) of nine middle school math teachers at two rural schools were assessed for their PCK in Geometry and measurement in the specific area of decomposing and recomposing one-dimension and two-dimensional figures. A Pearson's Product Moment Coefficient statistical test was used to compare teacher assessment scores of each PCK level with student standard of learning math scores. The results showed that

there was a relationship between teacher PCK and student standard of learning scores in Geometry and measurement. In addition, results suggest that there was no relationship between the dependent variable PSE scores and content knowledge, pedagogical knowledge, and pedagogical content knowledge. Content knowledge and pedagogical knowledge are vital for mathematics teachers. Pedagogical content knowledge is something that can broaden teachers' perspectives on mathematics and help them to be better teachers (Lenhart, 2010). The results in this study demonstrated no relationship which could be attributed to the researcher not looking at specific subject areas and specific components of the subject tested on the PSE.

Discussion

The result of this study was in line with many studies that have been conducted. Some studies point to teachers' certification type or educational attainment level as the greatest predictors of students' academic success. Conversely, some studies conclude that teacher certification has a weak effect on student achievement, while teachers' education level has no effect or sometimes a negative effect on student achievement (O'Donnell, 2010). This study finding revealed that there was no significant difference in PSE scores of students being taught by teachers having an associate's degree, bachelor's degree and higher and others.

The study revealed that students who were taught by teachers having teaching experience of five years or more have no significant difference in PSE scores that students taught by teachers with more years of experience. Hammond (2000) stated that other studies of the effects of teacher experience on student learning have found a relationship between teachers' effectiveness and their years of experience, but not always a significant one or an entirely linear one. While many studies have established that inexperienced teachers (those with less than three years of experience) are typically less effective than more senior teachers.

According to Hammond (2000) studies in different subject matter fields that compare teachers with and without preparation have typically found higher ratings and greater student learning gains for teachers who have more formal preparation for teaching. Many research conducted in secondary schools show a significant difference in content knowledge and students' achievement. Results of research conducted by Richardson (2008) indicated that a significant relationship exist between teacher qualifications and student achievement. Specifically, the findings revealed that students taught by mathematics teachers who had 5 or more years experience performed better on the math portion of the Alabama Reading and Math Test (ARMT).

Implications

Results of this study have implications for research, theory and practice. The Ministry of Education should empower and provide much needed resources to monitor and support school managements, school boards, principals, and teachers to ensure that quality education is delivered to the children of Belize.

Implications for Research

This study adds to the body of literature by substantiating that student achievement is affected by many factors such as school location and school type. The evidence reveals that students attending mono-grade schools are at an advantage in comparison to their counterparts in multi-grade schools. Mono-grade schools are generally located in urban setting where there are highly qualified teachers, and access to resources and better infrastructure. In a research, Effectiveness of Multi-grade Classes: Cooperative Learning as a key element of success reveals that the social skills level of multi-grade student was higher than mono-grade students. The

levels of multi-grade and mono-grade are almost the same and grade students were higher than mono-grade students (Kadivar, Nejad, & Emamzade, 2005).

The recruitment of highly qualified and the equitable distribution of teachers in both rural and urban, mono-grade and multi-grade schools are necessary to improve student achievement. Toledo District has the most multi-grade schools and the overall performance of the district is consistently the lowest on the PSE. Research particularly in this area of the country can provide additional information to assist general managers, local managers, principals, and teachers to implement new and improve practices at the schools. All the schools in rural areas are provided with at least one experience and certified teacher to assist other teachers to improve learning and by extension improve student achievement on PSE.

Implications for Theory

Individual contributing knowledge bases interacts with the unique body of knowledge that brings about the TPCK. According to Eggen and Kauchak (2001) educational psychology views learning as internal, mental process instead of acquiring specific, observable behaviors.

The concept of TPCK is fairly new in Belize. There was an effort by the previous government (2004-2008) to provide each child at the primary level with a laptop. This initiative was to integrate technology as a tool for teaching and learning in the classroom. This concept did not materialize. Other joint efforts have been initiated by INTELCO and the Ministry of Education to equip all primary schools with computer laboratory. Again some schools were provided with internet access and computer laboratory across Belize.

The use of this theory as a base for this research is important because many studies revealed the positive correlation with student achievement. The TPCK is a distinct body of knowledge that can be developed and assessed (Angeli &Valanides, 2009). Teachers who

possess pedagogical content knowledge according to Eggen and Kauchak (2001) recognize topics that are hard to understand. The integrated approach of technology and PCK does find its place in the primary schools.

Implications for Practice

These findings suggest several courses of action for practice. According to Wright the need for training in multi-grade is essential for effective teaming in both multi-grade and mono-grade classrooms in Belize. The Ministry of Education and Youth need to increase the number of trained teachers hired to teach in rural primary schools and that each school has the basic resources to function effectively. Crooks (1997) explained that inequitable distribution of resources may lead to inferior infrastructure, reduced operating expenses, and lack of quality teachers in schools situated among predominantly poor population. There is also a need to increase the monitoring of teaching learning practices in the rural primary schools by school managements especially the denomination managements and to establish a mechanism for monitoring and supporting schools and establishing a reporting system across school management.

There is also a definite need to monitor and evaluate the system of deployment utilized by the local managers in their particular districts. MOE and school managements need to work collaboratively to produce a plan for deployment of principals and teachers. Each multi-grade school needs a trained teacher to act as a support in their school. Consideration for additional incentives to trained teachers in rural and remote schools could be a form of motivation. The prevalence of multi-grade primary schools in rural communities does have great impact on the overall performance of the schools by district of the PSE. There is the need to increase the number of continuous professional development in multi-grade teaching for all teachers in multi-

grade schools. In addition, it is essentials for principals to also be empowered to teach and manage multi-grade schools. There are some critical areas that need to be focused on in other to build successful multi-grade schools. Joubert (2009) emphasized that teachers need to develop a wide repertoire of teaching techniques and classroom management practices; programme learning materials and textbooks; local and regional professional support networks; and national policies with regards to teacher and administrators training, teacher recruitment and support, development of materials sensitive to multi-grade environment.

There was no relationship between student achievement on the PSE and teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge. Results from other research revealed that specialist in content area at the primary school level can assist to improve teacher's PCK. Teacher knowledge should be emphasized in training institutions across Belize.

Recommendations for Further Research

Results from this study suggested the need for additional research on school location, school type, teacher certification, teacher experience and teacher content knowledge, pedagogical knowledge and pedagogical content knowledge and how these variables affect student achievement on the PSE. Base on the findings and conclusions of this study, additional research on teacher certification and teacher experience and student achievement; teacher content knowledge, pedagogical knowledge, and pedagogical content knowledge and student achievement.

Additional research can be conducted on teacher certification and experience and student achievement in specific core subjects such as mathematic and/or English on the PSE. A study of

this nature could provide training institutions with valuable information to address specific content area training in mathematics, science, English, and social studies. This study involved small amount of data and a research of this nature can utilize a bigger sample size.

A longitudinal study of students from standard three through to standard six could add substantially to literature in the Belizean context. This four years study can examine the same factors with teachers and principals who are not transferred for a period of four years. Such a study can also contribute to the limited research in the field of education in Belize. There are many other researches that can evolve from this study that will help to provide more specific information that will be beneficial to policy makers, managers, principals and Ministry of Education. There is the need to examine teaching strategies or the quality of teaching in both multi-grade and mono-grade and in rural and urban schools. A replication of this study can be done in specific district/s in Belize or by regions in the country to determine whether specific factors have effects on student achievement. The no significance difference in PSE score for students taught by teacher with different levels of certification indicated that there might be other factors that are playing an important role in student achievement. In addition, other studies that can follow this study is to investigate the financial aspects between mono-grade and multi-grade schools and the different motivational levels of the teachers and students in both mono-grade and multi-grade schools. Joubert (2009) added that the most difficulty faced by teachers is that teaching is more demanding in multi-grade schools; in addition teachers are generally unmotivated.

Qualitative studies are an important component of the future of this research. A qualitative component is recommended to be added for the teacher's knowledge section of the survey that looked at content knowledge, pedagogical knowledge and pedagogical content

knowledge. This could include interviews with teachers and principals and observation of the teaching of mathematics, social studies, English and science. In addition, interviews can be done with local and assistant local managers on strategies used to deploy principals and teachers.

Concluding Remarks

For schools to improve their student achievement scores on the PSE there must be a collaborate effort between the general managers, local managers, principals and teachers to ensure that the schools have certified teachers who can effectively deliver quality education to the children of Belize. The time has come for mechanism to be in place to minimize the deployment of unqualified teachers to the rural schools and begin ensuring that qualified teachers are in both rural and urban schools. In addition, there must be constant monitoring of the delivery of lessons by both qualified and unqualified teachers. There is a need to improve school monitoring by local managers who are directly responsible for primary schools in their district.

The stronger teachers seem to be placed in standard six so they can work tirelessly to bring the students to a level to pass the PSE. The school leaders' duty is to ensure that each child in every school has a qualified teacher especially in the early years of primary school. A good foundation is necessary so that concepts are learned from one standard to the other so when the students reach standard six it is only to review what was taught.

Teachers have direct contact with our students, and therefore need to be knowledgeable and willing to go the extra mile to provide quality education regardless of the diversities children bring to the classrooms. Principals are the gatekeepers and should ensure that wherever students are they are receiving quality education in a conducive environment. Training institutions need to revisit course offered and sequencing so that trained teachers are effective in schools.

Primary school teachers should have the opportunity to be trained in specific content areas especially mathematics, English, social studies and science. Content knowledge, pedagogical knowledge and pedagogical content knowledge will better equip teachers to teach students in our Belizean primary schools. Policy makers, training institutions, general managers, and local managers should join forces to ensure the education system is getting value for the money invested. Every primary school should be a quality child friendly school so that every aspect of a child's life at school is being addressed and there is involvement of all stakeholders to participate in the decision making process to improve education at the primary level in Belize.

Summary

The purpose of this study was to evaluate whether or not there was a significant difference in school location, school type, teacher certification, and teacher experience and student achievement on PSE scores. In addition, the study examined if a relationship existed among content knowledge, pedagogical knowledge and pedagogical content knowledge) and student achievement on PSE scores.

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APPENDICES

Appendix A

MAP OF BELIZE

Appendix B

TEACHER SURVEY

Thank you for taking the time to complete this questionnaire. Please answer each question to the best of your knowledge. Your thoughtfulness and candid response will be greatly appreciated. Your individual name or identification will not at any time be associated with your responses and will be kept completely confidential.

Demographic Information

1. Gender

a. Male b. Female

2. Age range

a. 18 – 22 b. 23- 26

c. 27-32 d. 32 +

3. Location of school

a. urban b. rural

4. Type of school

a. mono-grade b. multi-grade

Educational Background

5. Please place a check mark on the highest level of qualification you currently have.

____ High School	____ 1st Class	____ Assoc. Degree
____ Assoc. Pri. Ed.	____ B.S./B.A.	____ B. Pri. Ed.
____ B. Sec. Ed	____ M. Ed	____ Trained Teacher
____ Level 1	____ Level 2	____ Others

6. Are you currently enrolled at an institution?

a. Yes b. No

7. Please indicate below the course of study you enrolled in.

Teaching Experience

8. Your position in 2010

_____

9. Number of years in the position

_____

10. The total number of years teaching experience

_____

Please complete each of the following items below to the best of your ability. Please answer all of the items and if you are uncertain or neutral you may select Neither Agree or Disagree.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
CK (Content Knowledge)					
Mathematics					
11. I have sufficient knowledge about mathematics					
12. I can use a mathematical way of thinking					
13. I have various ways and strategies of developing my understanding of mathematics.					
Social Studies					
14. I have sufficient knowledge about social studies.					
15. I can use a historical way of thinking					
16. I have various ways and strategies of developing my understanding of social studies.					
Science					
17. I have sufficient knowledge about science.					
18. I can use a scientific way of thinking					
19. I have various ways and strategies of developing my understanding of science.					
Language Arts					

20. I have sufficient knowledge about Language Arts.					
21. I can use a literacy way of thinking					
22. I have various ways and strategies of developing my understanding of language Arts.					
PK (Pedagogical Knowledge)					
23. I know how to assess student performance in a class					
24. I can adapt my teaching base-upon what students currently understand or do not understand					
25. I can adapt my teaching style to different learners					
26. I can access student learning in multiple ways					
27. I can use a wide range of teaching approaches in a classroom setting (collaborative learning, direct instruction, inquiry learning, problem/project base learning etc.).					
28. I am familiar with common student understandings and misconceptions.					
29. I know how to organized and maintain classroom management.					
PCK (Pedagogical Content Knowledge)					
30. I know how to select effective teaching approaches to guide student thinking and learning in mathematics.					
31. I know how to select effective teaching approaches to guide student thinking and learning in social studies.					
32. I know how to select effective teaching approaches to guide student thinking and learning in science.					
33. I know how to select effective teaching approaches to guide student thinking and learning in language arts.					

Appendix C
INSTITUTIONALREVIEW BOARD APPROVAL LETTER

Status Recommended by Reviewer(s): Approved **Protocol Expires: 4/11/2012**

Principal Investigator(s):

Carmen Lopez
Belize
Stillwater, OK 74078

Edward Harris
308 Willard
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:
Please send remaining approval letters from managers/principals as they are received.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North(phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Shelia H. Kennison

Shelia Kennison, Chair
Institutional Review Board

Appendix D
LETTER OF PERMISSION

Letter of Permission

Dear Manager/Principal:

As part of my requirement for my doctoral degree at Oklahoma State University, I am conducting a research title: The Effects of Teacher Certification and Experience on student achievement on Primary School Examination in Belizean Primary Schools. Through this study I will try to derive on factors that could have influence on the performance of students on the standardized national examination known as the Primary School Examination (PSE) taken by all standard six students across the country of Belize.

This study will be conducted through Oklahoma State University, United States of America. The results of the study may help you to better understand factors that influence the performance of standard six students on the Primary School Examination. There will be 60 standard six teachers selected across the country to participate. We would really appreciate your help with this initiative.

If you choose to participate, the standard six teachers from selected primary schools will be asked to complete a short survey regarding their background, experience, and pedagogical experience. The achievement of the students will be measured using student's Primary School Examination scores on Mathematics, Social Studies and Science. The participation of your school is voluntary and your refusal will not affect any relationship that already exists with the school or the teacher.

The records of this study will be kept highly confidential. The identity of the participants in this study will not be revealed in any manner. Research records will be stored securely and locked away at the Toledo District Education Center and only my advisor Dr. Ed Harris and I will be able to access the information. The teachers and schools will be coded to eliminate chances of identification.

I can be contacted at telephone number 501-702-2406 after work hours, 501-722-2002 during normal working hours and at cell number 501-607-3213 at your convenience. My email address is cjanelopez@yahoo.com. My chair/advisor Dr. Ed. Harris can be contacted at email address edharris@okstate.edu or at telephone number 405-744-7932.
If you have questions about your rights as a research volunteer, you may contact the Oklahoma State University Institutional Review Board (IRB) Chair, Dr. Shelia Kennison, 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu.

Respectfully yours;

Carmen Jane Lopez

Doctoral Candidate
Oklahoma State University

Updated: November, 2010

Letter of Permission

Dear Manager/Principal:

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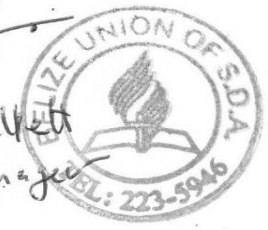
Respectfully yours;

Carmen Jane Lopez

Doctoral Candidate
Oklahoma State University

Permission is granted

Pr. Leslie Gillett
General Manager



Updated: November, 2010

Letter of Permission

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Respectfully yours;

Carmen Jane Lopez

Doctoral Candidate
Oklahoma State University

Approved - Permission given.

General Manager
Catholic Public School
P.O. Box 220
Belize City, Belize, C.A.

Updated: November, 2010

Letter of Permission

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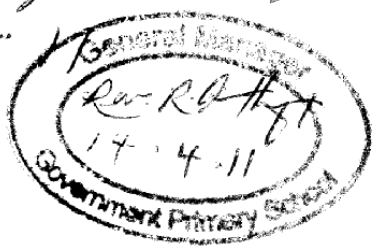
Respectfully yours;

Carmen Jane Lopez

Doctoral Candidate
Oklahoma State University

Rev. Rudolph Griffith
General Mgr. Govt. Schools
14-4-11



pdated: November, 2010

Appendix E

VITA

Carmen Jane Lopez

Candidate for the Degree of Doctor of Education

Thesis: THE EFFECTS OF TEACHER CERTIFIFICATION AND EXPERIENCE OF STUDENT ACHIEVEMENT ON PRIMARY SCHOOL EXAMINATION IN BELIZEAN PRIMARY SCHOOLS

Major Field: Higher Education

Biographical:

Education:

Completed the requirement for Doctor of Education in Higher Education at Oklahoma State University, Stillwater, Oklahoma May 2012

Completed the requirement for a Master of Education in Education at University of North Florida, Jacksonville, 2002

Completed the requirement for Bachelor of Education in Secondary Education, Biology at University College of Belize, Belize City, 1997

Experience:

Education Officer, Toledo District Education Center, Ministry of Education, 2008 to present

Vice Principal, Julian Cho Technical High School, Toledo, 2006 – 2008

Head of Department and Teacher at Julian Cho Technical High School, 2003 – 2006

Teacher at Julian Cho Technical High School, 2000 – 2003

Vice Principal and Teacher at San Pedro Columbia Roman Catholic School, 1999 – 2000

Teacher at Claver College Adult and Continuing Education Program, 1998 to present
Teacher at San Pedro Columbia roman Catholic School, 1997 – 2000

Awards and Honors:

Research Skills:

Name: Carmen Jane Lopez Date of Degree: July, 2012:

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: THE EFFECTS OF TEACHER CERTIFIFICATION AND EXPERIENCE OF STUDENT ACHIEVEMENT ON PRIMARY SCHOOL EXAMINATION IN BELIZEAN PRIMARY SCHOOLS

Page in Study: 120 Candidate for degree of Doctor in Education

Major Field: Higher Education

Scope and Method of the Study:

The research questions and hypotheses were tested using a quantitative, non-experimental methodology. This research utilized a causal comparative approach. The purpose of this study is to determine if there exists a difference among independent variables such as school type, school location, teacher certification, teachers' experience and student achievement. In addition, the research seeks to find out if there is a relationship between teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge and student achievement. Analysis of Variance (ANOVA) is used to compute the first four research questions of the study. Differences of the students score measured by Primary School Examination and multiple regression to seek if a relationship exist. The IBM, SPSS 19.0 is used for the statistical analyses of data.

Findings and Conclusions:

Results indicate that there are differences between students' achievement attending mono-grade school and multi-grade school. Differences also exist between students' achievement of student attending urban and rural schools. There are no statistical differences in students' achievement attending schools taught by teachers with 0-5 years or 5 or more years of experience. There is no statistical difference between types of certification and student achievement. The results also indicate that there is no relationship between student achievement and teachers' content knowledge, pedagogical knowledge, and pedagogical content knowledge.

ADVISER'S APPROVAL: Dr. Ed Harris