AN INVESTIGATION INTO TEACHERS' VIEWS OF ANY BARRIERS TO THE IMPLEMENTATION OF THE PRIMARY SCHOOL STANDARD TWO SCIENCE CURRICULUM AND STRATEGIES FOR ENHANCEMENT

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ABSTRACT

An Investigation into Teachers' Views of Any Barriers to The Implementation of The Science Curriculum in Standard Two, at A Primary School in The Victoria Education District and Strategies for Enhancing The Implementation Process

Carlene Hayes

Science explores the natural world in which humans live and communicate with one another to ensure their survival. Science education allows students to become problem solvers, creative and critical thinkers in the classroom. Teachers play a vital role in the implementation of the Science curriculum in the primary school.

The purpose of this case study is to examine three teachers' views of any barriers that may exist in the implementation of the Standard Two Science curriculum at Paradise Place Boys' School. This qualitative research provides an analysis of these teachers' views about any barriers and some initiatives that can be used to counteract them.

The main source of information was interviews done with these three teachers. The findings of this study revealed that teachers needed to build their professional knowledge, adequacy, attitude and interest to enhance the implementation of the Science curriculum at the Standard Two level.

Keywords: curriculum implementation, barriers, professional development

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To the participants of my study, I say thank you for going the extra effort to ensure this study was completed.

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INTRODUCTION TO THE STUDY

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AN INVESTIGATION INTO TEACHERS' VIEWS OF ANY BARRIERS TO THE IMPLEMENTATION OF THE SCIENCE CURRICULUM IN STANDARD TWO, AT A PRIMARY SCHOOL IN THE VICTORIA EDUCATION DISTRICT AND STRATEGIES FOR ENHANCING THE IMPLEMENTATION PROCESS

Background to the Study

According to Ornstein and Hunkins (2004) the curriculum is a plan for action with strategies for achieving its goals. The desired goals of the Science Curriculum are for students to develop proficiency in the use of the scientific method and knowledge, to become aware of the role that science plays in our lives and to stimulate students' curiosity and creativity. (Summary of Primary School Curriculum, 2001). Curriculum implementation involves the daily classroom activities that teachers engage in, that monitor student progress and evaluate student performance. Teachers are responsible for implementing the science curriculum and determining if it is having the desired effect on student learning. Teachers rely upon the curriculum materials such as textbooks, worksheets and lesson plans to structure planned and enacted instruction (Forbes & Davis, 2010).

Osborne & Dillon (2010) state that "the teaching of science requires the teacher to engage with sets of ideas and values about the curriculum, pedagogy and assessment" (p. 13). Therefore, it is important for teachers to understand the content

included in the curriculum and what are some of the best practices in its delivery to the students. Assessment is also vital, to determine whether students have gained knowledge of the concepts taught in Science. This shows how integral teachers are to the process of curriculum implementation, since students' learning is influenced by the teacher (Ornstein & Hunkins, 2004). There are many factors that influence curriculum implementation, some of them being the school ethos; the teacher – his/ her professional adequacy, knowledge, support and attitude; the adequacy of resources; the teaching and learning environment; and the learner. The teacher is a pertinent factor and will even mitigate against the other factors by his/ her approach to curriculum implementation.

School Context

Paradise Place Boys' School is an all-male primary school located on the outskirts of San Fernando, in the Victoria Education District. A large percentage of the students of this school live in a small, squatting community near to the school called Jacksonville. It is one of the districts in the town of Chaos, that is commonly called 'The Town That Never Sleeps'. In the past, Chaos was a separate town, but in the 1990's it became one of the district of the city of San Fernando. Chaos is bordered by a river to the south; the oil refinery to the north; the Sir Solomon Hochoy highway to the east; and the Gulf of Paria to the west.

The residents of Jacksonville are of low socio-economic status and families are mainly of the single-parent type. Most of these families are headed by young mothers, who have little education beyond lower secondary school. These families are either recipients of social welfare or workers with the Community Environmental

Protection and Enhancement Programme (CEPEP). CEPEP is a local, government-run company that cleans and maintains the communities in Trinidad and Tobago, with its workers being paid minimum wages forth-nightly. Despite the impoverished conditions under which the residents live, the community has an ideal mixture of both East Indian and African cultures, since the descendants of both races can be found living Jacksonville.

School Organizational Structure

Paradise Place Boys' School has twelve staff members and one hundred and fifty students on roll. Figure 1.1 shows the hierarchal structure of the school, showing the administration and distribution of staff members into the seven departments.

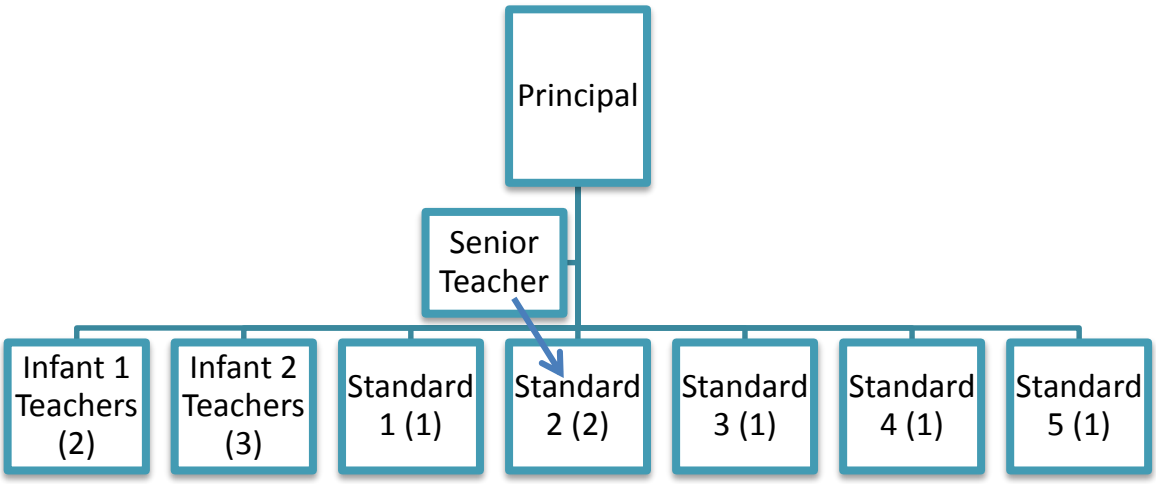

Figure 1.1 The Organisational Structure of Paradise Place Boys' School

The organizational structure of this school show that the administration of the school comprises of the principal and senior teacher. The other members of staff are

distributed into the seven departmental levels. There are two classes in each Infant level and in the Standard Two level, while the all other classes of Standard 1, 3, 4 and 5 have only one class per level. The senior teacher teaches one of the Standard Two classes; however this class also has students performing at the Standard One level. The school's main building is an old, two storey structure, with its top floor having wooden flooring. However, there is another small building called "the annex" that is used to house two classes and is located out of the school's gate. There is an all-female primary school located next door to Paradise Place Boys' School with a gate linking the two schools.

Mission Statement

The mission of Paradise Place Boys' School is to ensure that our students self-actualize in a health promoting environment that is supported by all stakeholders in education.

Vision Statement

The vision of Paradise Place Boys' School is to produce functionally literate, well rounded individuals, who are able to contribute positively to society.

School's Motto

In Thy Light we shall see Light

Goals of the School

The goals of Paradise Place Boys' School are:

- provide opportunities for continuous training for the Human Resource Personnel in the school.

- formulate curricular and co-curricular programs that will meet the needs of each student.
- produce one hundred percent of students who are functionally literate and who possess numeric skills to function adequately at secondary level.
- identify and utilize the individual talents skills and competencies available in the community for the benefit of the students.
- promote and engender a basic understanding of democracy and the constitution of Trinidad and Tobago.
- produce discipline, tolerant and productive members of the community.
- challenge and encourage every student to strive for excellence and to perform at the highest level of which he is capable.
- facilitate personal and spiritual growth of all members of the school community.

Global context

A world-wide phenomenon has been increased attention to sustained professional development for teachers due to changes in curriculum content and associated pedagogy (Osborne & Dillon, 2010). This suggests that the professional development of teachers plays a crucial role in equipping them for curriculum implementation. Evidence from recent meta-analyses of research conducted in the United States shows that teacher professional development focused on science content, has a positive effect on student achievement (Blank & de las Alas, 2009). In the United States, the introduction of new science curricula is done systematically, utilising student -centred teaching strategies along with high quality training for pre-service and

in-service science teachers. (Darling-Hammond, 1997). This pertains as well in the education system in the United Kingdom. Trends in twenty six countries worldwide, including most Asian countries, show that professional development of science teachers to deal with the rapid pace of

Curriculum change was inadequate in both quality and quantity (Coll & Taylor, 2008).This is likely to have a significant impact on the implementation of the science curriculum by teachers.

In the United States, the National Research Council began the development of national science standards in 1992. Then the National Research Council (NRC) published the *National Science Education Standards* in 1996. These standards detail what all students should know and be able to do in science at Grades K–4, 5–8, and 9–12. There became an emphasis on content standards in 2001, with the No Child Left Behind (NCLB) Act, which made students' progress in science a required part of federal and state accountability systems and which required schools to administer annual tests in science achievement. Standards are guidelines that give clear parameters for what students should know and be able to do in Grades K–12. They also give the criteria to evaluate the quality of academic programs and instruction used in curriculum implementation.

In 2010, the National Governors Association Center for Best Practices in the United States of America developed the Common Core State Standards (CCSS) that clearly state what level of student expectation should be observed in the specific grade level. The CCSS has its main objective as focusing on core conceptual understandings and procedures at an early age. This allows teachers to emphasize in

their lessons the core concepts and procedures so that students can master them. Therefore, if there are barriers that exist in the implementation of the curriculum these core conceptual understandings cannot be achieved and will have a significant impact in the teaching/ learning environment.

Local Context

In Trinidad and Tobago, the existing science curriculum was written in 2001 by both local and international consultants, specialists in the field of Science and science educators. Then, it was implemented on a phase basis in the primary schools. The Standard Two and Three Science syllabus was piloted in September 2002. It was designed to focus on content as well as the processes of science and encourage students to use technology, problem solving skills, critical thinking skills and foster their ability to be a team player. Science teaching was viewed as exploring the operation of the natural world and how this knowledge can benefit our society. (Primary School Science Syllabus, 2004)

Initially, performance standards based on three levels were included in the draft Science syllabus, however it was removed from the final version used for implementation. Standards offer a coherent vision of what it means to be scientifically literate, describing what all students should understand and be able to do in science (National Science Education Standards, 1996). The standards included in the draft Science syllabus of Trinidad and Tobago, took into consideration the international science standards defined by the National Science Education Standards.

They clearly define the outcomes, or the expectations, of what the students need to know and be able to do in Science at the Standard Two level.

In Trinidad and Tobago there is a national summative assessment called the National Test, which is designed to assess the achievement of students in specific subject areas in primary schools. These tests are compiled, scored and analyzed by the Division of Educational Research and Evaluation (DERE) of the Ministry of Education. The subjects of Science and Social Studies are assessed in these tests at Standard Two and Four. All primary school students in these class levels are given these tests at the end of the academic year. The Standard Two National Test in Science utilizes the performance standards included in the Standard Two Primary Science Curriculum. This test id divided into three sections and comprises of questions based on all the concepts and objectives in the six strands across the existing Science curriculum.

This national assessment allows for benchmarking of student performance against the developed set standards. The DERE engages in standard setting workshops to determine the cut score for these tests, using the Angoff procedure to determine the set standards. During the DERE's standard setting exercise, all the test items are assigned a numerical value - dichotomous (score of 1) and polytomous (score of 2 or more) in three rotations, then the average value is found and used as the set standard or benchmark. Students of Standard Two will be placed in four levels based on their performance in this Science National Test as seen in Table 1.1.

Table 1.1

National Test Performance Levels

Level	**Indictors**
4 - Exceed Standard	The student exceeds the overall standard of work required at this level. This is superior academic performance. The student consistently displays an in-depth understanding of the work with an exemplary display of the skills required in all areas.
3 - Meet Standard	The student meets the overall standard of work required at this level. This is satisfactory academic performance with a solid understanding and adequate display of the skills required.
2 - Nearly Meet Standard	The student nearly meets the overall standard of work required at this level. This is marginal academic performance and includes work that approaches, but falls short of meeting satisfactory performance. The performance indicates a partial understanding and a limited display of the skills required.
1 - Below Standard	The student performs well below the standard of work required at this level. This is inadequate academic performance indicating little understanding and minimal display of skills required. This is major need for additional instructional opportunities, remedial assistance and/or increased student commitment to academics in order o achieve at Level 3.

Table 1

The Standard Two level will be used for this study because it is the initial level of this national assessment in science. This researcher has observed that the major percentage of the Standard Two students at the Paradise Place Boys' School

generally perform at Levels 1 and 2 in Science National Test. These findings emerged after the perusal of the school's results for these tests from 2008 – 2012 as seen in Table 1.2.

Table 1.2

Standard Two Science National Test

Paradise Place Boys' School

Year	Level 1	Level 2	Level 3	Level 4
2008	56%	40%	4%	0%
2009	53%	29%	18%	0%
2010	52%	34%	14%	0%
2011	28%	50%	17%	5%
2012	42%	33%	15%	10%

Table 1.2

Further examination of the school's National Test results reveals that in the 2011 and 2012 Science National Test, 17% and 15% of the students meet standard level (Level 3) and 5% and 10% of students exceed standard (Level 4) respectively . This showed a slight improvement in student performance for these years. However, the majority of students still continued to perform in the lower levels of achievement at the Science National Test.

The Academic Performance Index (API) is a determinant of scholastic performance in relation to a preset standard or benchmark. The API gives the progress of students based on a national assessment. In Trinidad and Tobago, the API of a school is calculated annually based on students' performance in the National Tests for Standard One and Three. Based on a school's API, it is placed into one of four categories; they are Academic Emergency (0-80), Academic Watch (81-240),

Mostly Effective (241-400) and Excelling (401-560). Based on the information seen in Table 1.3, Paradise Place Boys' School has an API of below 240 for all the years that it was measured. This resulted in the school's average API of 195 and therefore the school has been placed in the Academic Watch category.

Table 1.3

School's Academic Performance Index

School	**2005**	**2006**	**2007**	**2009**	**2011**	**2012**
Paradise Place Boys' School	161	248	194	191	191	182

Table 1.3

Therefore, based on the results aforementioned Paradise Place Boys' School has the majority of its students performing below the set standards in this national assessment. This researcher has observed this underperformance and wanted to find out more about student performance in the Science National Test in relation to the implementation of the Standard Two Science curriculum.

Delimitations of the study

The study is restricted to three teachers in one specific all male primary school in the Victoria Education District.

Statement of Problem

The ability of the teacher to implement the Standard Two Science curriculum in appropriate and meaningful ways often bears a relationship to the achievement levels of students. At Paradise Place Boys' School, students have not performed well at the National Test in Science over the past five years. Teachers' views of any barriers that existed in the science teaching/ learning environment needed to be explored, as a first step towards planning for the enhancement of the science curriculum implementation process.

Purpose of the Study

Science teaching plays an important part in nation building and therefore, must be done by teachers who have gained mastery of subject content and appropriate pedagogy to meet the needs of all learners. (Primary School Science Syllabus, 2004). The purpose of this case study was to examine the views of teachers in relation to any barriers to the implementation of the Standard Two Science curriculum at Paradise Place Boys' School. This was a first step to understanding the teaching/learning milieu of Science at the school, since this may have impacted on students' performance in the Science national assessment. Then, with the collaboration of the teachers, a plan will be devised to enhance the implementation of the science curriculum.

Significance of Study

This research will add to the literature based on curriculum implementation and the teaching of Science in the elementary or primary level in the education system. The researcher used the qualitative research design to investigate any barriers that exist in the Science curriculum implementation. It also developed the researcher in conducting a focus group discussion, and gave support to teachers in enhancing the teaching/ learning environment in the science classroom. The recommendations included in the plan generated from this research can be used to assist other schools that experience similar circumstances.

Research Questions

Overarching Question :

How can the implementation of the science curriculum at Paradise Place Boys' School be enhanced?

Sub Questions:

1) What factors (if any) do teachers view as barriers to the implementation of the science curriculum in the classroom?

2) What initiatives do these teachers feel are needed to enhance the implementation of the science curriculum?

3) How might teachers' perceptions of barriers to implementation and suggestions for enhancing the process be used to prepare teachers to present the science curriculum more effectively?

Definition of Terms

Curriculum is a plan for action with strategies for achieving its goals.

Curriculum implementation takes place as the learner acquires the planned or intended experiences, knowledge, skills, ideas and attitudes that are aimed.

Standards are guidelines that give clear parameters for what students should know and be able to do at specific levels.

Barriers are obstacles which prevent a given policy instrument from being implemented, or limits the way in which it can be implemented.

Professional development refers to planned, collaborative, educational process of continual improvement for teachers that helps them to deepen their knowledge in subject content and enhance their teaching skills.

Time Line

Table 1.4 showed the duration of the different phases, the researcher engaged in, during this research study that investigated the perceived barriers to the Standard Two Science curriculum implementation at Paradise Place Boys' School.

Table 1.4
Table showing different phases

PHASE	CONTENT	DURATION
Preparatory	❖ Conceptualization of the Study	**November 2012 – January 2013**
	❖ Data collection for initial survey	**January – February 2013**
	❖ Literature Review	**December 2012 – May 2013**
Introductory	❖ School visits ❖ Interviews ❖ Document collection ❖ Data analysis ❖ Interpretation and Evaluation of findings	**March – May 2013**
Intervention	❖ Focus Group Meeting ❖ Data analysis	**May – June 2013**
Evaluation	❖ Plan development	**June 2013**
Completion	❖ Final Write Up ❖ Submission	**June 2013**

Table 1.4

CHAPTER TWO

LITERATURE REVIEW

Rationale

It is pertinent that teachers view themselves as one of the key stakeholders in curriculum implementation in the primary school. They must recognise that implementation is a crucial stage in the curriculum development process. This case study seeked to investigate if there were any barriers to implementation of the Standard Two Science curriculum by the teachers at Paradise Place Boys' School. Since, this can significantly impact on their students' academic performance in Science.

This literature reviewed aims to inform the case study on existing research in the field of curriculum, emphasizing precisely how the Science curriculum implementation influences students' learning experiences in the science classroom. The review done of the existing literature establishes a theoretical framework for conducting this case study. The information derived for this literature review was sourced from books, education journals, online reports sanctioned by international government bodies, science journals, curriculum documents and reports published by the Ministry of Education.

Introduction

Ayers, Quinn and Stovall (2008) identify that :

> Curriculum is everything experienced and learned inside and outside school. Curriculum describes the complex intersections of the common places of teacher and learner experiences (p. 309)

Hollins (1996) also shares this view about the curriculum as being:

> All of the learning, routines, and interactions that occur among all participants as a function of schooling, whether planned or not, which inform and shape response to the environment within and outside of school.

The curriculum therefore encompasses all of the teaching and learning activities both internally and externally of the school system, that can be deliberate and/or incidental. Accordingly, the curriculum can be seen as all of the experiences undergone by students based on teachers' guidance. (Dewey, 1938)

But Zais (1976) asserts that the term 'curriculum' can be viewed in two ways:

> Curriculum as a plan for the education of learners is part of the subject matter of the curriculum field. Curriculum as a field of study is defined by the range of subject matter with which it is concerned and the procedures of inquiry and practice that it follows.
>
> (p. 3-4)

These two aspects of curriculum show the importance of its existence in the education system and its significant impacts in terms of knowledge and delivery.

Ornstein and Hunkins (2004) further explain that:

> The planned, formal curriculum focuses on goals, objectives, subject matter, and organization of instruction; the unplanned, informal curriculum deals with social-psychological interaction among students and teachers, especially their feelings, attitudes, and behaviours. (p. 12)
>
> Philosophy is central to curriculum because the philosophy advocated or reflected by a particular school and its officials influences the goals, aims and content, as well as the organization, of its curriculum. (p. 30)

Psychology also contributes to the design and delivery of the curriculum. It provides a foundation to understand the milieu of the teaching and learning process. Ornstein & Hunkins (2004) cite the work of Taba who incorporates the work of Piaget in her psychological perspective of curriculum when she says:

> Organizing curricula and teaching new experiences so that they are compatible with existing experiences (assimilation), moving from concrete experiences to concepts and principles (accommodation), and classifying and understanding new relationships (equilibration). (p. 110)

Barnes (1977) affirms that:

> A ‘psychological’ model of learning is not enough: for curriculum theory a social model is needed, for it must acknowledge both learner and social milieu, and include communication from pupil to teacher as well as vice versa. (p. 188)

What is curriculum implementation?

Tamir (2004) theorizes that:

> Curriculum implementation is the process of putting ideas and materials into practice. This term is used to describe the entire process, beginning with dissemination and ending with utilization and evaluation. Implementation in its general sense involves two additional processes, namely adoption and adaptation.
>
> Adoption refers to the decision to use a particular innovation. This decision is followed by actual utilization of the materials in the classroom.
>
> Adaptation is the process of modifying and further developing a programme by those adopting it. (p. 283)

It can be viewed as a process of individuals' growth and professional development involving interactions between the key players as well as gaining crucial feedback. Curriculum implementation involves changes in individuals' views, attitudes, actions and content knowledge.

Curriculum implementation is one of the six phases involved in the curriculum development process as seen in Figure 2.1. Implementation is an interaction process between those who have created the program and those who are charged with delivering it (Ornstein & Hunkins, 2004). Figure 2.1 shows the curriculum development process used by the Ministry of Education of Trinidad and Tobago.

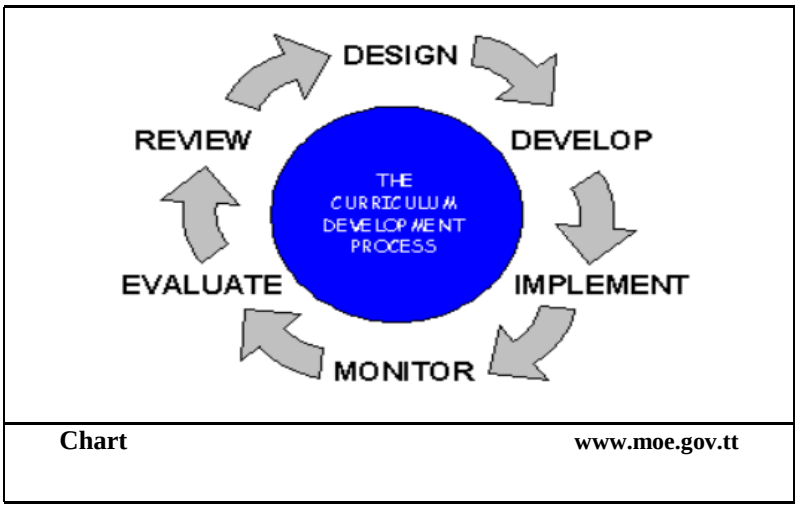

Figure 2.1 The Curriculum Development Process

Zais (1976) comments further that:

> The curriculum provides direction for classroom instruction, but does not consist of a series of lesson plans. It is the teacher's prerogative and responsibility to interpret and translate the curriculum document in terms of her own and her students' experience. (p. 13)

This shows that the teacher, being an important stake holder in the implementation phase of the curriculum development process, can adapt their instruction to suit the needs of their students. Implementation can be seen as a fluid, dynamic process that involves individuals to engage in restructuring and replacing knowledge.

Fullan (2001) states:

> Implementation consists of the process of putting into practice an idea, program, or set of activities and structures new to people attempting or expected to change. (p. 69)

Curriculum implementation as a change process

Pratt (1994) notes that:

> Implementing a curriculum conveys change which implies social action that builds a climate of acceptance for the change (p. 34)

Change occurs when something is done differently. In terms of curriculum implementation, change results in new knowledge happening and this can cause significant impacts. Human beings generally like to operate in their comfort zone, and show reluctance to change. The only way for change to happen successfully, is to ensure that they understand the need for change and how it will happen.

Ornstein & Hunkins (2004) cite the work of Lewin's Force Field Model that states:

> All persons find themselves in environments comprised of competing forces: driving and restraining forces. When these two groups of forces were equal, a balance or equilibrium existed in a steady state or status quo. However, at times the driving forces begin to overpower the restraining forces, initiating change action. When the restraining forces regain momentum, change will slow down (p. 305) (See Figure 2.2)

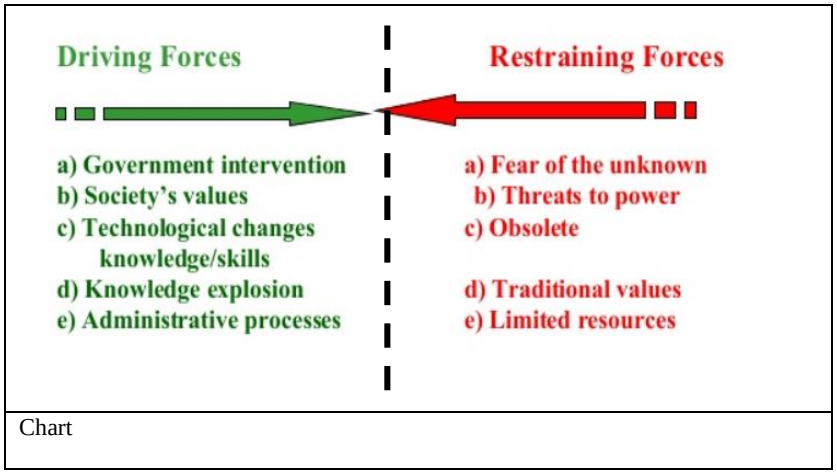

Figure 2.2 Force Field Model (Lewin, 1951)

In viewing the change process involved in curriculum implementation, there are nine key factors that can work either positively or negatively (Fullan, 2001). Figure 2.3 summarized the views of these factors based on recent studies of implementation.

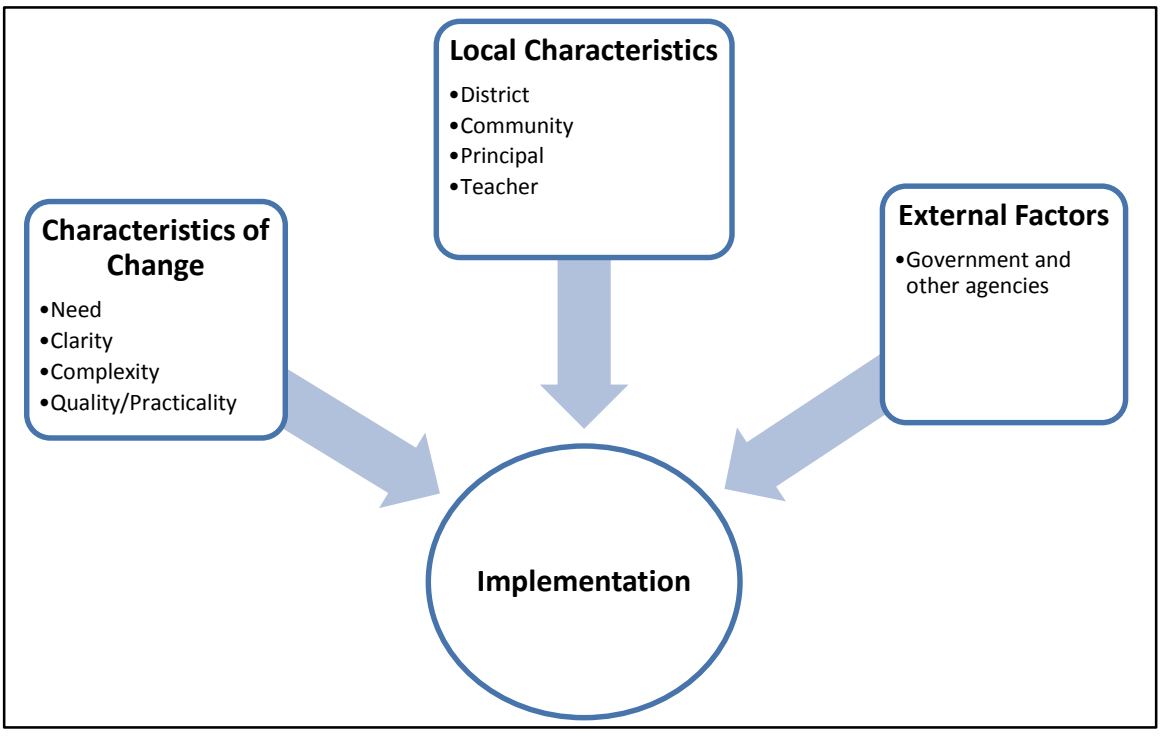

Figure 2.3 Interactive factors affecting implementation. (From Fullan , 2001).

Teachers may tend to resist the change that is associated with curriculum implementation because of many reasons. Some of them are not understanding what is required of them; doing more work in an overloaded curriculum with no extra financial reward; learning new teaching methods or pedagogical strategies (*since it may be different from what they are currently using)*; modifying their current instructional strategies and understandings of classroom practice.

Teachers' influence on curriculum implementation

Chikumbu and Makamure (2000) contend that:

> Since implementation takes place through the interaction of the learner and the planned learning opportunities, the role and influence of the teacher in the process is indisputable (University of Zimbabwe, 1995: 28). (p. 51)

The teacher is the most crucial factor in the curriculum implementation process, bringing their expertise, knowledge and experience to the implementation process. They have the most knowledge about the practice of classroom teaching and are responsible for introducing the curriculum into the classroom. There is also the existence of both extrinsic and intrinsic factors that can impede curriculum change by teachers. These extrinsic factors identified are adequacy of resources, time, school ethos and professional support. The intrinsic factors are professional knowledge, professional adequacy and professional interest and motivation. These both types of factors are summarized in Table 2.1

Table 2.1

Factors influencing the implementation of the curriculum in schools

Factors	Description
Adequacy of resources	Adequacy of equipment, facilities and general resources required for implementing a new curriculum
Time	Time available for preparing and delivering the requirements of the new curriculum. e.g. teachers need enough time to develop their own understanding of the subject they are required to teach.
School ethos	Overall school beliefs towards the new curriculum. Status of the curriculum as viewed by staff, administrators and community. e.g. school administration recognises the importance of the subject in the overall school curriculum.
Professional support	Support for teachers from both within the school and outside. e.g. opportunities to receive ongoing curriculum professional support
Professional adequacy	Teachers' own ability and competence to teach the curriculum. i.e. confidence in teaching
Professional knowledge	Knowledge and understandings teachers possess regarding the new curriculum. e.g. different ways of teaching to foster student learning.
Professional attitude and interest	Attitudes and interest of teachers toward the new curriculum e.g. keen to teach the subject

Table 2.1

Table 2.1. [S*ource:* adapted from the *Science Curriculum Implementation Questionnaire (SCIQ).* http://home.cc.umanitoba.ca/~lewthwai/introSCIQ.html]

For the successful implementation of the curriculum, teachers' knowledge must be enhanced through training via professional development workshops. But this is in theory, since in reality when curriculum implementation takes place, sometimes not all the teachers are exposed to these workshops.

What is Science ?

Science is designed to discover information about the natural world in which humans live and to ascertain the ways in which this information can be structured into significant patterns.

Brandwein, Passow and Fort (1989) cite Seaborg who defines science as:

> an organized body of knowledge and a method of proceeding to an extension of this knowledge by hypothesis and experiment. (p. 420)

Science education allows students to develop creativity both individually and collaboratively. It enables students to explore and understand the environment as well as participate in discussions concerning the environment.

The National Science Teachers' Association (2000) posits that:

> Science is characterized by the systematic gathering of information through various forms of direct and indirect observations and the testing of this information by methods including, but not limited to, experimentation. The principal product of science is knowledge in the form of naturalistic concepts and the laws and theories related to those concepts.

Irez, S. (2008) believes that:

> Science has become a fundamental aspect of our culture and social life in the past century. (p. 422)

This statement gives the idea that science is present in our environment and its affects our everyday lives.

Content Standards define what concepts and processes students need to know and be able to do. Science Content Standards encompass the history and nature of science, life science, science as inquiry, science as a social perspective, physical science, science and technology.

There is a relationship between the curriculum to be implemented, the teacher instruction, the assessment strategies used and the students. The content standards can be seen as the overarching body of knowledge that influences all of these aforementioned components.(See Figure 2.4)

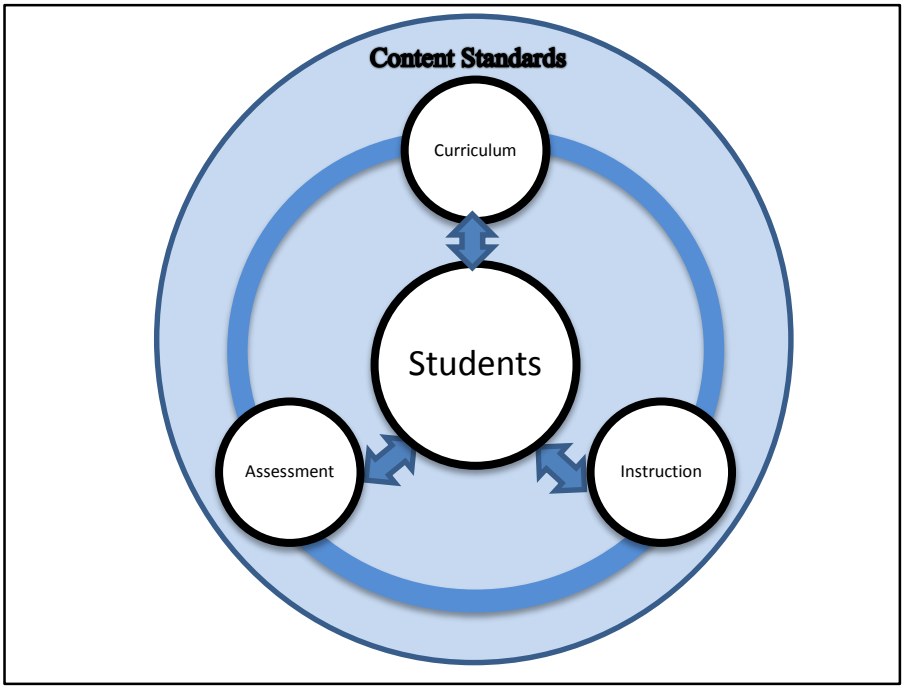

Figure 2.4 The relationship between the components that exist in the school system

Teachers' Role in Science Curriculum Implementation

Forbes and Davis (2010) explain that:

> Curriculum materials, which include instructional resources such as textbooks, lesson plans, and student artifact templates (i.e. worksheets), are important resources upon which teachers rely to structure both their planned and enacted instruction. However, to engage students in science as inquiry, teachers must learn to use curriculum materials effectively. (p. 820)

Teachers' theoretical knowledge, content knowledge, attitude and teaching strategies will affect how they implement the science curriculum.

Gabel (1994) discusses that:

> As a mediator, the teacher must ensure that students are given opportunities for quality learning experiences to provide a solid base for learning with understanding. This requires that teachers constantly learn about which learning experiences would be appropriate for their students. (p. 49)

Donnelly & Jenkins (2001) question:

> What is the nature of science teachers' professional expertise? …professional knowledge which science teachers bring is derived from that body of knowledge which they gained as students of science. (p. 18)

Cronin-Jones (1991) believes that:

> The quality of pupils' science education is conditioned above all by the quality of the teaching which they experience and that the single most important influence on this is the teacher. (p. 235).

In the existing Trinidad and Tobago primary school science syllabus (2004), it reiterates the importance of the role of teachers:

> If a child is to learn to be creative and inventive, he/she must be taught by a teacher who is creative and inventive and allowed to practice being creative and inventive. If a child is to learn to solve problems, he/she must be taught by a problem solver and allowed to solve meaningful problems regularly (p. i)

Millar, Leach, and Osborne (2000) cite Asoko's view that:

> Primary school teachers are generalists, teaching all subjects, and many find their understanding of science challenged by the demands of the curriculum which they are expected to teach. Teachers' lack of subject knowledge in science has been documented and frequently identified as a barrier to implementation of curriculum reform and to pupil progress. (p. 79).

Curriculum reform is illustrated when students work in small groups and participate in hands-on activities with others in the science classroom. This is in comparison to the traditional instruction that involves teachers delivering science lessons through lectures, using the textbooks and then allowing students to work individually on worksheets.

Gabel (1994) points out that:

> Textbooks have long been considered a major factor in shaping science-education instructional programs; students have difficulty in learning from science textbooks. (p.69)

Teachers with stronger content knowledge are more likely to teach in ways that help students construct knowledge, posing appropriate questions, suggest alternative explanations, and propose additional inquiries (Alonzo, 2002;Brickhouse, 1990; Cunningham, 1998; Gess-Newsome & Lederman, 1995; Lederman, 1999; Roehrig & Luft, 2004; Sanders, Borko, & Lockard, 1993).

Sampson and Blanchard (2012) conclude that:

> Student engagement in scientific argumentation can foster a better understanding of concepts and the processes of science. Most teachers lack the pedagogical knowledge necessary to design lessons that foster student engagement in scientific argumentation and have limited resources to assist them. (p. 1122)

Banilower, Cohen, Pasley, and Weiss (2010):

> Effective instruction requires skilled and knowledgeable teachers and research supports the idea that teacher understanding of content is important. Science teachers need on-going professional development to deepen their content/pedagogical content knowledge and assist them in applying what they are learning to their classroom instruction. (p. 33)

Ornstein & Hunkins (2004) propose that:

> For curriculum implementation to occur many teachers will need to experience skill-training workshops. (p. 322)

There is definitely a need for teachers to partake of professional development workshops to enhance their implementation of the science curriculum.

De Boer (2011) affirms that:

> Many countries are making either new or renewed efforts to set higher standards for student learning outcomes so they will not be left behind in that global competition. In part, this trend is motivated by international comparisons of students' performance on science assessments… (p. 567)

These science education standards propose a comprehensive view of science education. Science teachers must develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning. Professional development standards require

integrating knowledge of science, learning, and pedagogy and applying that understanding to science teaching.

Based on the literature reviewed, there are many reasons why teachers may not be able to implement the science curriculum. This may result from interacting with an overloaded curriculum, causing teachers to perform more work with no financial benefits, learning new Science pedagogy and changing their instructional strategies. The research also has shown that science teachers are affected by extrinsic factors such as lack of resources, time issues, school ethos and professional support. They are also affected by intrinsic factors such as professional knowledge, teacher competence and professional interest and motivation. Therefore, this researcher used the literature reviewed as a foundation for this case study, that investigated the teachers' views of any barriers to curriculum implementation at paradise Place Boys' School.

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CHAPTER THREE

METHODOLOGY

Nature of Qualitative Research

Qualitative research involves inquiry that is systematic, to gain meaning of contexts in the social world (Shank, 2002). It makes use of a naturalistic approach that addresses the particular phenomena in context-specific settings. Qualitative research is multifaceted and dynamic. Merriam (1998) affirms that "the essential characteristics of qualitative research are the goal of eliciting understanding and meaning, the researcher as primary instrument of data collection and analysis, the use of fieldwork, an inductive orientation to analysis and findings that are richly descriptive" (p. 11). According to Denzin & Lincoln (2000) "qualitative researchers study things in their natural setting, attempting to make sense of, or to interpret phenomena in terms of the meanings people bring to them" (p. 3)

This researcher used the qualitative approach to conduct this study, since it was appropriately matched with the research issue. According to Creswell (2007), "case study research is a qualitative approach in which the investigator explores a bounded system (a case) over time, through detailed, in-depth data collection involving multiple sources of information … and reports a case description and case-based themes" (p. 73). The intrinsic case study was undertaken for this research project, to gain a better understanding of the case itself and all its particulars; its purpose was not to build any theories. It involved gaining an understanding of whether any barriers existed to the implementation of the Standard Two science

curriculum. The researcher gained this information based on the views of teachers at Paradise Place Boys' School.

Theoretical Foundation of the Research

The researcher engaged in action research for this study, based on the quest for understanding if any barriers may exist in the implementation of the science curriculum in Standard Two. Mills (2007) states that:

> action research is any systemic inquiry conducted by teacher researchers, principals, school counsellors, or other stakeholders in the teaching/ learning environment to gather information about how their particular schools operate, how they teach, and how well their students learn (p. 5).

In conducting this case study using qualitative research, the researcher considered the philosophical assumptions of ontology and epistemology. Ontology refers to the study of' the nature of reality and truth. It is about clarification of the qualitative researcher's position about the implicit and/or explicit presuppositions from which the research was undertaken. In this case study, the researcher examined the teachers' views of any barriers that may exist in science curriculum implementation in Standard Two at Paradise Place Boys' School. It will seek to discover the reality of three teachers at this school, in terms of their views about any barriers to science curriculum implementation.

Epistemology is concerned with ways of knowing and learning about the social world (Ritchie and Lewis, 2003). It involves clarification of the qualitative researcher's approach about knowledge creation, for example in this case study there was knowledge derived from the face to face, in-depth interviews with the teachers of Paradise Place Boys' School. This will give an insight into what are their views of any barriers to the science curriculum implementation at Standard Two. This case study addressed the teachers' views of any barriers that exist in science curriculum implementation and then used these identified barriers expressed to create a plan to enhance science curriculum implementation through collaboration.

Osterman and Kottkamp (1993) advocate reasons for action research as a professional growth opportunity:

- Everyone needs professional growth opportunities
- All professionals want to improve.
- All professionals can learn.
- All professionals are capable of assuming responsibility for their own professional growth and development.
- People need and want information about their own performance.
- Collaboration enriches professional development. (p. 46)

Sampling

In making qualitative sampling decisions, there must be a careful selection of persons in applicable settings that can provide the research study with pertinent information that you need to answer your research questions (Maxwell, 1996). According to Merriam (1998), "in qualitative research, the most appropriate sampling strategy is nonprobability sampling such as purposeful sampling" (p. 67). In this case study, the sample of teachers was selected using this aforementioned strategy. The decision of the number of teachers to include in this sample was based on the number of teachers, who had valuable information about the Standard Two Science curriculum implementation.

The researcher selected initially six teachers for the study, based on their teaching experience, class level presently teaching and their willingness to participate in this research study. But eventually, the researcher decided to use only three of the selected teachers because of the size of the staff, since six participants meant 50% of the staff involved. The researcher wanted to avoid any major disturbance in the daily routine of the school. Also, the three teachers chosen were viewed by the researcher as the key informants for this study based on the Standard Two science curriculum implementation.

The sample comprised of two teachers presently teaching the Standard Two classes and one teacher who taught the Standard Two level previously for four years during the period 2008 – 2012. Table 3.2 gives a short profile on each teacher participant in the sample selected for this case study.

Table 3.2

Profiles of Teachers in Case Study

Participant Code	Profile
Teacher 1	Senior Teacher of the school, in charge in the absence of the principal, 18 years teaching experience, in age range of 36-45 years, strong science background – teacher secured passes in two science subjects at the CXC Ordinary level examination and two science subjects at the GCE Advanced level examination, presently teaches Standard Two, present class has students performing at Standard One level
Teacher 2	23 years teaching experience, in age range of 36-45 years, teacher secured passes in one science subject at the GCE Ordinary level examination , presently teaches Standard Four, taught Standard Two previously for four years
Teacher 3	14 years teaching experience, in age range of 26-35 years, moderate science background – teacher secured passes in one science subject at the CXC Ordinary level examination and one science subject at the GCE Advanced level examination, presently teaches Standard Two

Table 3.2

Design and Procedure

A modification of the dialectic action research spiral was used for this case study and is illustrated in Figure 3.1. It is a dynamic and responsive model for research done by teachers and for teachers and students (Mills, 2007). This action research process involves the four elements of identifying an area of focus, collecting the data, analysing and interpreting the data, and developing an action plan. In this case study, the teachers themselves were not involved in the collection and analysis of the data, but they were involved in the collaboration step to devise an action plan. Therefore, this resulted in a modification of the dialectic action research spiral.

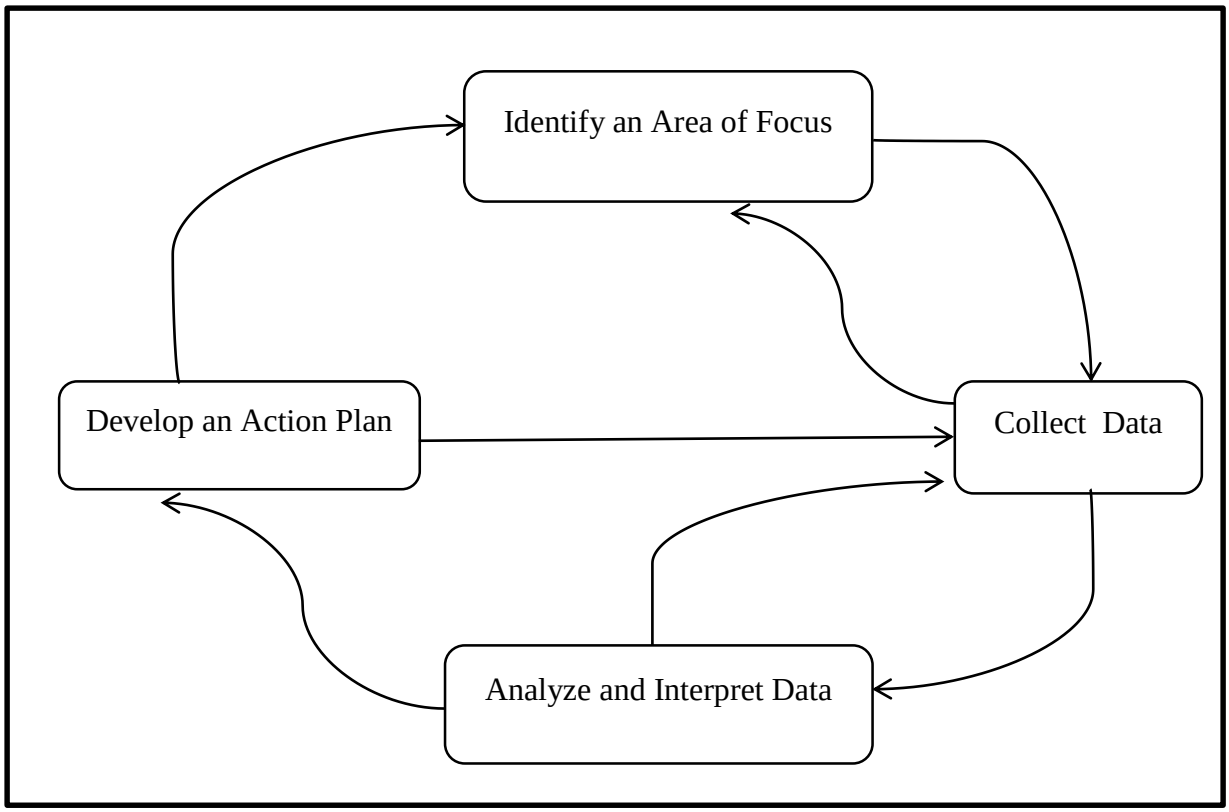


Figure 3.1. The Dialectic Action Research Spiral from Mills, 2000, p. 20

The researcher used the modification of this model, since it was appropriately suited for the research conducted in this case study. The area of focus was the teachers' views of any barriers to implementation of the science curriculum by the teachers at the Standard Two level at Paradise Place Boys' School. These views of the teachers were explored through data collection techniques. Then the data was analyzed and interpreted by the researcher who used the coding technique of data analysis. The researcher then used the interpretations from the collected data of this case study and conducted a focus group meeting with the teachers. This resulted in a devised plan of action to enhance the implementation of the science curriculum at Paradise Place Boys' School.

Instrumentation

Initially, the three teachers of the sample were given a survey form to gain their views about Science. (See Appendix A) Then the researcher developed an interview protocol for participants. It was focussed on gaining information based on the research sub questions of this study. It allowed the selected teachers to give their views about the barriers that existed at Paradise Place Boys' School, in the implementation of the science curriculum at Standard Two. (See Appendix B)

Data Collection Strategies

In qualitative research, data collection methods allow the researcher to play a crucial role, since he or she will be the key element in gaining the information from the persons chosen in the sample. Merriam (1998) explains that "in qualitative case

studies, however, all three means of data collection (conducting interviews, observing, and analyzing documents) are frequently used" (p. 134). Mills (2007) concludes that "the literature on action research supports the assertion that qualitative methods are more appropriately applied to action research" (p. 55). For this research study, three data collection techniques were used to collect data; they were: analyzing documents, making observations, and conducting interviews.

In this case study, the data collection techniques of making observation and analyzing documents were used to gain knowledge about the research site's background and culture. This was necessary since the researcher entered the site as a passive observer and therefore understanding the school's background was the first step in gaining knowledge in this study. Then, the researcher used face to face interviews to gain the primary school teachers' views on barriers to the implementation of the science curriculum at Standard Two. Additionally, the researcher used a simple top floor map of the school to show the location of the Standard Two classes in the school. (See Appendix C).

This researcher analyzed documents pertaining to this study such as Science National Test results, teacher made Science tests and its results, lesson plans, students' science books and worksheets. Samples of the Standard Two Science Tests made by the teachers together with samples of students' work from both classes were taken. Observations were made and recorded using field notes and interviews were conducted with the three teachers selected for this study and transcribed. (see Appendix D) Figure 3.3 shows the data collection strategies used for this research study done at Paradise Place Boys' School.

Overarching Research Question : How can the implementation of the science curriculum at Paradise Place Boys' School be enhanced?	
Research Sub Questions	***Data Source / Data Collection Instrument***
1) What factors (if any) do teachers view as barriers to the implementation of the science curriculum in the classroom?	➢ Teachers' Views about Science Survey ➢ Teachers' Interviews
2) What initiatives do these teachers feel are needed to enhance the implementation of the science curriculum?	➢ Teachers' Interviews
3) How might teachers' perceptions of barriers to implementation and suggestions for enhancing the process be used to prepare teachers to present the science curriculum more effectively?	➢ Focus Group Meeting

Figure 3.3 Data Collection Strategies used

Observation

Kumar (2011) explains that "observation is a purposeful, systematic and selective way of watching and listening to an interaction or phenomenon as it takes place (p. 140). This method is done on the field with notes being taken that are descriptive. The passive observer researcher no longer takes on the role of the teacher

in the classroom setting, he or she sits and observes and focusses on only data collection (Mills, 2007). In this research, the researcher was a passive observer and took field notes- written records of observers. This technique of direct observation was used to gain information on the background of Paradise Place Boys' School.

Analysing Documents

Green & Thorogood (2004) state that "there are a number of ways in which public records can be used as the primary data for qualitative research" (p. 48). For this study, the researcher analyzed the results of the Science National Tests 2008 – 2012 , the school's API results published by the Ministry of Education to gain important background information about the school and the students' academic performance. These documents were not used to answer any of the research questions but it provided information about how teachers may possibly view their competence to teacher Science based on the results. Accordingly, Maharaj-Sharma (2007) explains the great significance of examinations in Trinidad and Tobago in relation to teachers :

> Teachers are hard-pressed by public opinion and school administrators to produce good examination results, as they are made to feel that their competence is reflected in these results" (p. 31).

Interviewing

Merriam (1998) states that "interviewing is necessary when we cannot observe behaviours, feelings or how people interpret the world around them" (p. 72). Kumar (2000) comments that "interviewing is a commonly used method of collecting information from people" (p. 144). The interview method was used in this case study, since it enabled the researcher to establish rapport with the participants. The interview took the form of a set of predetermined, guiding questions, but some questions allowed the teacher to respond freely. The researcher requested the interviewee's permission to use a voice recorder during the interview, since this ensured that all the data was captured. The researcher presented individually the transcripts of the teachers' responses in the interviews. Participants were asked to check and ensure all the information was correctly represented.

Focus Group Meeting

The focus group meeting is another technique in interviewing, and involves a limited number of participants who can contribute to the area of focus of the study (Mills, 2007). It is important that all participants are allowed time to share their views and all involved understand that it is a group-sharing activity. For this case study, the researcher had presented the data collected from interviews to teachers before and now the collated data was used from interviews in this focus-group meeting. The findings from the data answered the first and second research sub questions and the teachers discussed and shared their views on how the implementation of the science curriculum in Standard Two can be enhanced at Paradise Place Boys School.

Classroom Maps

Class maps are useful, non-written sources of data since it "provides contextual insights for people who have not visited the school as well as it provides the researcher with a reflective tool"(Mills, 2007, p. 70). A map of one of the Standard Two classes was drawn to show the close proximity of surrounding classes and absence of enclosed rooms. This contributes to the high noise levels experienced by the teachers in the school setting. This data is also related to background information of this study.

Photographs

Photographs are another type of non-written sources of data in research. The camera is able to capture images to assist the researcher in making observations. The researcher took a limited number of photographers to assist in noting details in the school environment of Paradise Place Boys' School.

Validity

Validity determines whether the findings from the data collected are accurate from the standpoint of the researcher or the participant (Creswell, 2007). It questions how we know that the data collected accurately gauge what we are trying to measure. In process validity, the study is conducted in a dependable and competent manner (Mills, 2007). For this research, the researcher ensured that all the data collected represented the views of the teachers pertaining to any barriers that may exist in the implementation of the science curriculum at Standard Two.

Reliability

Reliability in qualitative action research refers to whether your data would be consistently collected if the same techniques were utilized over time (Mills, 2007). Reliability can also be referred to as dependability. Research done by teacher researchers generates knowledge that is vital to other teachers beyond the study. (Elliott, 1991). This showed that the knowledge generated can be applicable by other teacher researchers to new contexts, once they are similar to the context that was investigated. This brought in the idea that research-generated knowledge from research can have some level of generalizability since it "was grounded in the daily practices of teaching" (Cain, 2011, p. 9)

Ethical Considerations and Trustworthiness

Permission was sought from the principal of Paradise Place Boys' School and the teachers in the sample to conduct this case study. All participants were guaranteed of their anonymity, and that there was confidentiality of all the information gathered for this research. The participants were told about the purpose of the case study, to investigate their views of barriers that exist in the implementation of the science curriculum at Standard Two. The teachers were informed of their right to withdraw from this case study at any time and their participation was voluntary.

The researcher maintained a high level of professionalism when visiting the research site and conducting data collection at Paradise Place Boys' School. The researcher maintained a level of trust with the participants, and established an

excellent researcher/ participant relationship. The researcher established a level of trustworthiness by ensuring credibility was one of the keys present in the study (Lincoln and Guba, 1985).

Conducting the Study

Conceptualization of the study began in November 2012 after conducting an analysis of the Paradise Place Boys' School's performance in the Science National Tests for the period 2008 to 2012. This analysis showed that in 2008, 96% of the students who wrote the national assessment in Science failed to meet the required standard performance level. However, there was a slight, steady improvement in student performance through the years. In 2012, there were 75% of the students who failed to meet the required standard, and10% of the students exceeded the standard.

Then the researcher examined the students' performance on the teacher made Science tests in the Standard Two classes of Paradise Place Boys' School. This analysis revealed that 16 out of the 22 students failed to achieve a score of more than 60% in these Science tests. It was discovered through observation that both tests' structure varied between the two classes in the Standard Two level (See Appendix E). Samples of students' work was also observed in the two classes and collected (See Appendix F).The researcher observed this situation and wanted to gain further knowledge about the science curriculum implementation and whether this contributed to the students' underperformance in science.

The researcher made ten visits to Paradise Place Boys' School over the six month period of January – June 2013, spending appropriately twenty hours in the

field. Initially, a survey of teachers' views about science was conducted in February 2013, since the literature reviewed showed that their views can significantly impact on the implementation of the science curriculum (See Appendix G). A descriptive narrative of each teacher was done from this survey to understand initially the teachers' views about Science. This survey revealed that some of the teachers at Paradise Place Boys' School are not comfortable in teaching science, because of their lack of scientific knowledge. Teachers stated that they do not make connections with science taught in the classroom to students' everyday life. The survey was given to five teachers, but eventually the researcher decided only to use three teachers who were key players for this research.

The observations made during the school visits were used to gain vital background information of the school and the researcher recorded them using field notes. It also assisted this researcher in understanding the school context and teachers working conditions and relationships among themselves. The interviews were conducted on an individual basis and took four weeks (April, 22 – May, 22 2013) to be completed due to school activities, absence of participants and/or the researcher's schedule. The interview done with the teachers was the data collection technique used to gain information about the first two research sub questions of this study. These interviews were transcribed and participants were given to ensure the correct information was represented. Then these transcripts were coded and then codes were analysed for emergent themes and the researcher consulted the literature for factors

that impede curriculum implementation. The compiled data was then used to conduct a focus group meeting in June 2013 to devise a plan on how to enhance the implementation of the science curriculum at Standard Two. This meeting was recorded using a voice recorder and transcribed (See Appendix H). This plan was based on the collaborative efforts of the selected three teachers of Paradise Place Boys' School. This focus group meeting was done to gain information pertaining to the third research sub question of this study.

Data Analysis Procedure

Qualitative data analysis involves the process of making meaning and interpreting what has been said by participants and what has been observed and read by the researcher. In this case study, the researcher used the five step approach to data analysis that is proposed by Powell-Taylor & Renner (2003) as follows:

Step 1: Getting to know your data

Transcribe interviews, sort and arrange the data. Good analysis of the data collected can only be achieved by understanding the data concisely.

Step 2: Focus on the analysis

Review the purpose of the case study and what you want to find out. Gain a general sense of information and its overall meaning. Then identify the research questions that you want the analysis to answer.

Step 3: Coding the data

Use the raw data to bring meaning to the words, by developing codes through the identification of themes and patterns. Coding is the process of organizing the material into "chunks" before bringing meaning to those "chunks" (Rossman & Rallis, 1998, p.171). Then, organize them into coherent categories that summarize and bring meaning to the text. This step requires the researcher reading and reading the data.

Step 4: Identify patterns and connections within and between categories

When the data is organized into categories, you can see patterns and connections both between and within the categories.

Step 5: Interpretation

Then use the connections to explain your findings. This step involves interpreting the data – attaching meaning and significance to the findings of each research question in the study. It could be a meaning derived from a comparison of the finding with information gleaned from the literature or the researcher's personal interpretation that he/ she brings to the study from personal experiences, culture or history.

The researcher used the initial survey of teachers' attitude to make a descriptive narrative on each of the participants in this study. This created the foundation to understanding the views of the teachers at Paradise Place Boys' School about the implementation of the science curriculum. The transcripts of the interviews with the teachers' were coded and then these codes were placed into five categories based on the literature reviewed about factors that influenced the implementation of the curriculum (adapted from the *Science Curriculum Implementation Questionnaire).*

These factors are: resources, professional attitude and interest, professional support, professional adequacy and professional knowledge. The responses were also colour coded to identify which research sub question it pertained to in this study. These findings were used to devise a plan to enhance the Science curriculum implementation at Paradise Place Boys' School.

CHAPTER FOUR

DATA ANALYSIS

Descriptive Narrative on Teachers' Survey

The three teachers of Paradise Place Boys' School were given an initial survey to investigate their attitudes towards Science. The data gathered was used to provide a foundation for this case study that investigated the teachers' views about any barriers that exist in the implementation of the Science curriculum at Standard Two. This survey used a Likert Scale format with fifteen statements, and the teachers selected one response from the following criteria : Strongly Disagree (SD); Disagree (D), Undecided (U), Agree (A), Strongly Agree (SA) . The survey responses of each teacher can be viewed in Appendix A. The table below shows the percentage of participants who chose the different responses in this survey.

No.	Descriptors/Attitude	SD	D	U	A	SA
1	The science I am teaching at school can be linked to solving the problems of everyday life		33.3%		33.3%	33.3%
2	I enjoy teaching science lessons to my students				66.7%	33.3%
3	I am confident in my knowledge of the science content in the curriculum		33.3%		33.3%	33.3%
4	I have problems in understanding some of the science concepts	33.3%			66.7%	
5	My students enjoy my science lessons and view science as fun		33.3%		33.3%	33.3%
6	I use hands-on activities to teach science in my classroom		33.3%		33.3%	33.3%
7	The science I am teaching in school is helpful in understanding today's world		33.3%		66.7%	

No.	Descriptors/Attitude	SD	D	U	A	SA
8	I rely heavily on the textbook to gain information for my science lessons	33.3%			66.7%	
9	I do additional research on science concepts to assist me in my teaching		33.3%		33.3%	33.3%
10	I have adequate resources to teach my science lessons	66.7%	33.3%			
11	I give my students science notes to learn after my lessons		33.3%		66.7%	
12	The science I am teaching in school is of great importance to my country's development				66.7%	33.3%
13	I have some barriers to implementing my science lessons in the classroom				33.3%	66.7%
14	I use traditional methods (paper and pencil test) to assess my science lessons				33.3%	66.7%
15	I have attended science workshops that have been helpful to me	33.3%	33.3%			33.3%

Table 4.1 Percentage of teachers' who chose different responses

A descriptive narrative was written based on this survey done with the teachers, to give an individual description of each teacher's views towards Science.

Teacher 1:

This teacher links Science with solving everyday problems and understanding today's world, and enjoys teaching Science to her students. She is confident and competent about her Science teaching, makes Science fun for her students through hands-on activities, does not give notes and sees Science as important in the development of our country. This teacher does not heavily rely on the textbook, conducts additional research on Science concepts for her lessons and attended workshops to assist in her Science teaching. She sees some barriers to implementing

her science lessons such as inadequate resources and she uses traditional assessment methods in her classroom.

Teacher 2:

This teacher enjoys teaching Science to her students, but is not confident and competent about her Science teaching, she gives students notes and she believes her student do not see Science as being fun. This teacher relies heavily on the textbook and does not conduct additional research on Science concepts. She attended Science workshops, but they did not assist her in teaching Science. She does not use hands-on activities, neither links Science with solving everyday problems and understanding today's world. She has some barriers to implementing her science lessons such as inadequate resources and she uses traditional assessment methods in her classroom.

Teacher 3:

This teacher enjoys teaching and making Science fun for her students through hands-on activities and links Science with solving everyday problems and understanding today's world. She possesses Science competence and confidence in her classroom and understands that Science is important to develop our country. This teacher relies heavily on the textbook and gives notes, but she conducts additional research on Science concepts. She has attended workshops but they did not assist her in teaching Science. She sees some barriers to implementing her science lessons such as inadequate resources and uses traditional assessment methods.

Based on these descriptions, the researcher concluded that all teachers stated they loved to teach Science, but two heavily relied on the textbook, they also felt that the workshops they attended in Science never assisted them positively. Two of the teachers conducted additional research to assist them with teaching the Science concepts and were able to make linkages between Science and the real world. All teachers still used traditional assessment methods to assess their students in the classroom. They all agreed that they do not have adequate resources to teach Science at Paradise Place Boys' School. These initial views of the teachers explored in this survey about Science teaching will be further investigated as the researcher conducted this case study. The next phase of data collection was face to face interviews with these three teachers to gain their views about any barriers that may exist in the implementation of the science curriculum in Standard Two.

Analysis of Interviews

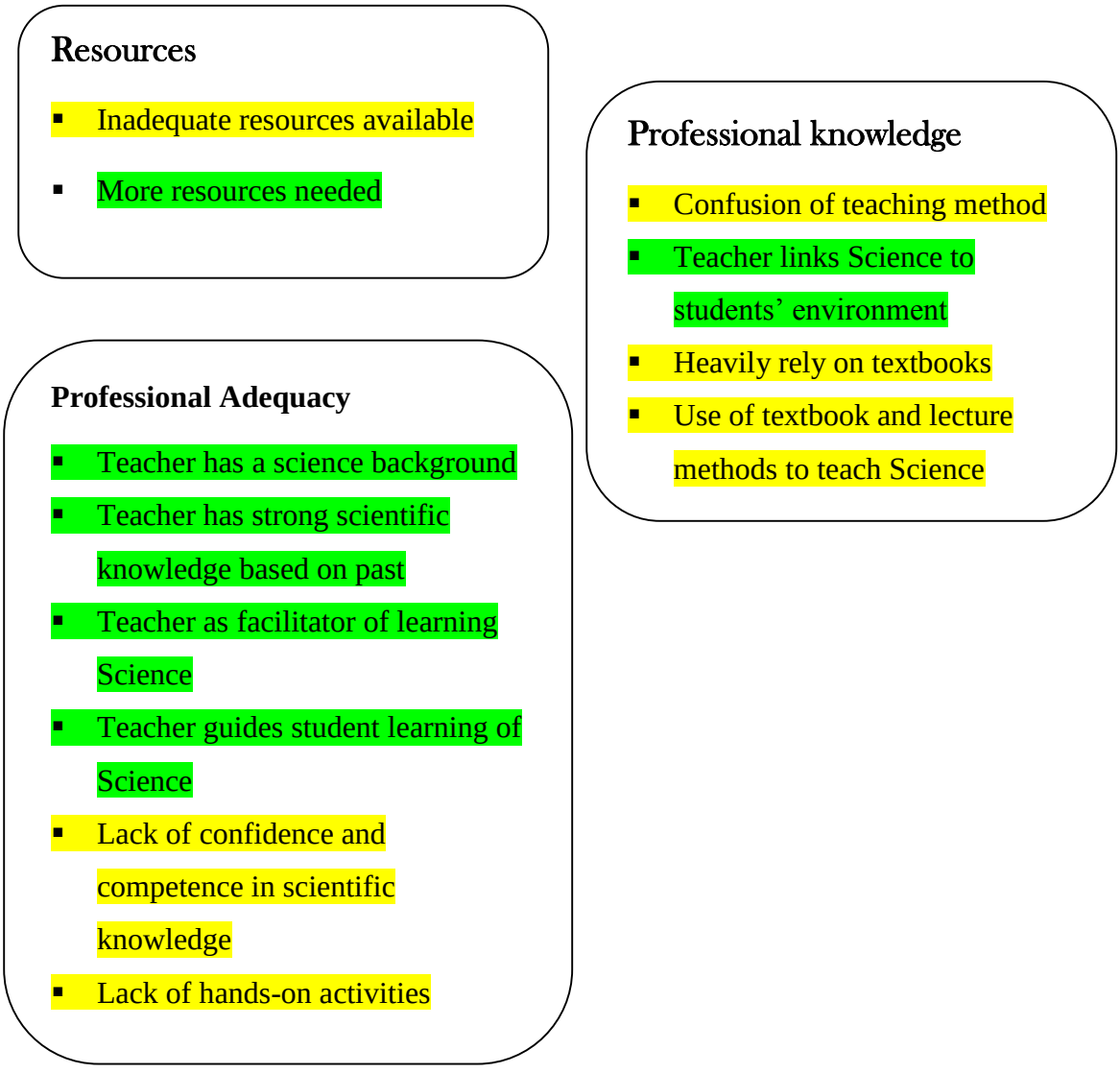
This research study examined the teachers' views of any barriers that existed in the implementation of the Standard Two Science curriculum at Paradise Place Boys' School. Interviews were conducted on an individual basis with the three selected teachers of this school. All interviews were transcribed and analyzed using the five step approach to data analysis recommended by Powell-Taylor & Renner (2003). The raw data was coded and then placed in five themes. Then it was categorized based on the research question it dealt with for the study. The following shows this analysis of data.

Key for categorizing themes:

Research Sub question 1 - What factors (if any) do teachers view as barriers to the implementation of the science curriculum in the classroom?

Research Sub question 2 - What initiatives do these teachers feel are needed to enhance the implementation of the science curriculum?

Teacher 1 Interview Responses in Themes



Teacher 1 Interview Responses in Themes (cont'd)

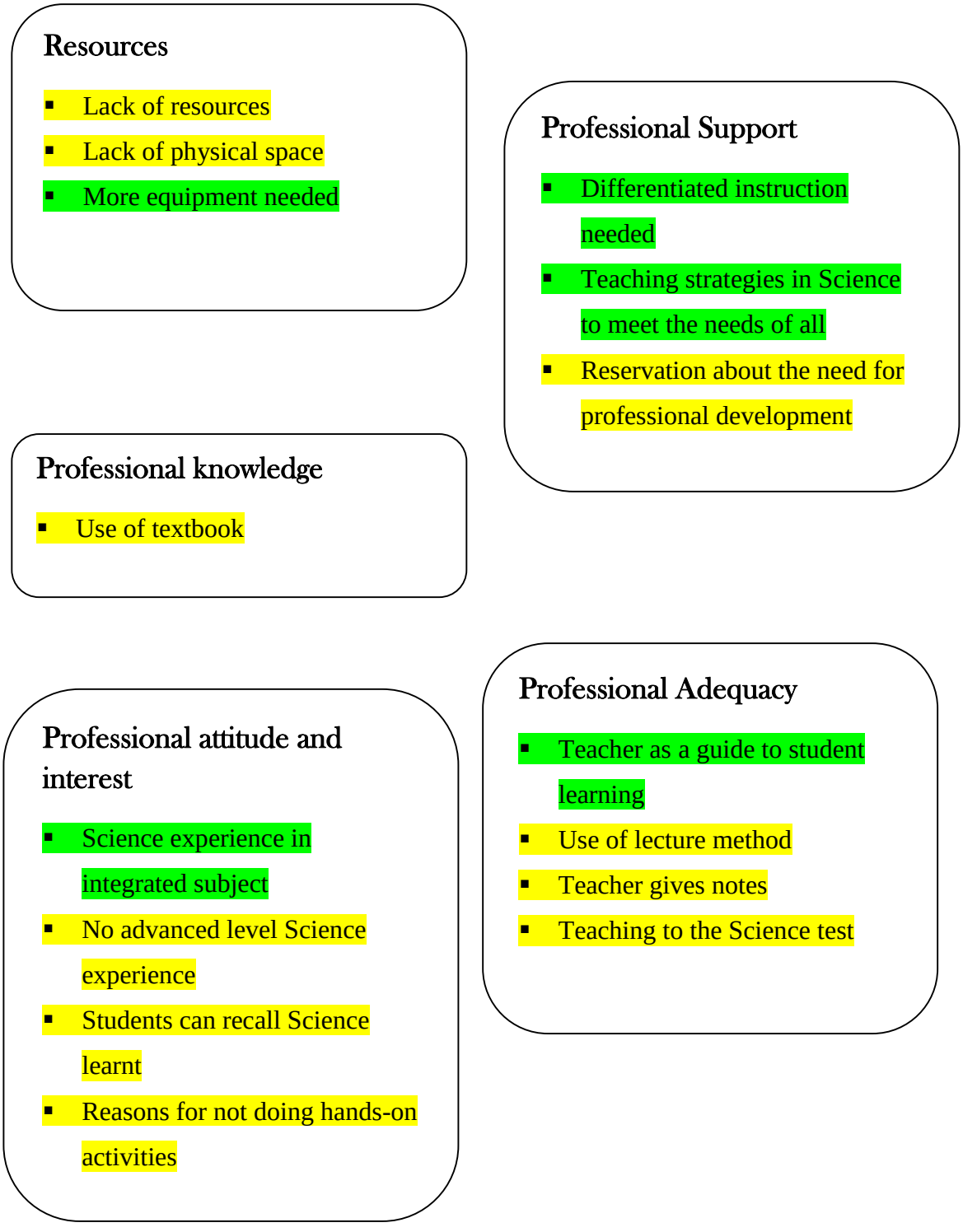
Professional attitude and interest

- Teacher guides student learning of Science
- Passionate about teaching Science
- Students with reading problems have other skills/ talents
- Teacher links Science to their culture
- Negative views of Science by students
- Students recognise relevance of learning Science in the classroom
- Making linkages between their experiences and Science

Professional Support

- Remedial work to help students
- Need for professional development of teachers
- Build scientific knowledge of teachers
- Need for teacher competence in unfamiliar science concepts
- Peer coaching available but used by limited teachers
- Avoid asking for assistance

Teacher 2 Interview Responses in Themes



Teacher 3 Interview Responses in Themes

Resources

- Students' low socio-economic
- Lack of resources
- Students lack the experience in using scientific resources
- Inequity of distribution of resources
- No internet available to use ICT in teaching Science to schools
- Need for resources to assist in National Test preparation
- Teacher wants more textbooks and workbook

Professional Support

- Lack of teacher competence in Science

Professional attitude and interest

- One science subject experience
- Biology based experience
- Student behaviour dictates choice of teaching method
- Overloaded curriculum to blame

Professional knowledge

- Use of textbook and workbook to teach Science
- Changing assessment for students

Professional Adequacy

- Teacher as facilitator
- Teacher as imparter of knowledge
- Gives students notes to learn
- Teaching to the test

In this case study, the researcher examined the teachers' views of any barriers to the Science curriculum implementation at the Standard Two level. The responses of the three teachers were gained from the interviews conducted by the researcher. This interview sought to address the research sub questions 1 and 2 :

1. What factors (if any) do teachers view as barriers to the implementation of the science curriculum in the classroom?
2. What initiatives do these teachers feel are needed to enhance the implementation of the science curriculum?

The draw data collected from these interviews with the teachers were coded and then placed into themes. The emerging themes collected from the interviews were resources, professional support, professional adequacy, professional knowledge, professional attitude and interest. The following are direct responses from the teachers showing their point of view based on these five themes.

Resources

All participants identified resources as a barrier to curriculum implementation.

Teacher 1 : "…the unavailability of resources, we do have some science equipment but those that we have are minimal"

Teacher 2: "our school has a lack of equipment to teach Science"

Teacher 3: "this school doesn't have the proper resources to teach Science"

Professional Support

The views expressed also identified the need for teachers to have professional support in their Science teaching.

Teacher 1: “Therefore their (the teachers) experience with Science is limited to what they teach in their class.”

Teacher 3: “I think some of the Science concepts in the syllabus are too difficult to teach my students. I cannot understand them fully, therefore it will be also difficult for boys to understand”

Professional knowledge

All participants agreed that textbooks are used in Science teaching at this school.

Teacher 1: “They (the teachers) use the textbook as the guide and Bible”

Teacher 2: “Then I give them a note for them to understand it better and we use the textbook to see the pictures”

Teacher 3: “Then I let them use the textbook to see the pictures of the activities”

Professional adequacy

One participant expressed the view that the teachers of this school need to build their confidence in Science teaching. While another participants expressed the view that they need to prepare students for the National Test.

Teacher 1: ‘We have a lot of teachers who have done no science, since they left secondary school. Therefore their experience with Science is limited to what they teach in their class.”

Teacher 2: “When I taught Standard Two, I had to ensure that we complete the entire Science syllabus by June, since the students had to write the National Test.”

Professional Attitude and Interest

One teacher expressed the view that students make too much noise in hands-on activities so she uses lecture method, this showed that she did not understand that student learning is promoted using hands-on activities in Science.

Teacher 2: "My students make too much noise and disturb the other classes, so I prefer to use the lecture method to teach the Science instead."

Based on the above analysis of teachers' responses, the researcher made the following summary findings in terms of the research questions in this study.

Research Sub question 1:

What factors (if any) do teachers view as barriers to the implementation of the science curriculum in the classroom?

Summary of teachers' views

Teacher 1	Teacher 2	Teacher 3
• inadequate resources available • use of the textbook by teachers • understand clearly about teaching methods	• lack of resources and space • use of the textbook • sceptical about need for support in their practice	• lack of resources • use of textbook and workbook • students low socio economic background • lack of experience with scientific resources

Teacher 1	Teacher 2	Teacher 3
• build scientific knowledge of teachers • peer coaching not adequately utilized • negative student views of Science • lack of teacher confidence and competence • lack of hands-on activities	• teaching to the test • no hands-on activities done • science learnt by rote • use of lecture method	• inequity of resources between schools • no internet service • lack of teacher competence • give science notes • student behaviour dictates teaching method • teaching to the test overloaded curriculum • teacher as imparter of knowledge

The teachers have expressed the views that there are barriers to the science curriculum implementation at Paradise Place Boys' School. Some of them being inadequate resources, overloaded curriculum, teacher confidence and competence in teaching Science, appropriate Science teaching strategies, students' low socio-economic background and negative views towards Science.

Research Sub question 2:

What initiatives do these teachers feel are needed to enhance the implementation of the science curriculum?

Teacher 1	Teacher 2	Teacher 3
• more resources needed • link Science to the environment • need for professional development • remedial work for weaker students • students recognise the relevance of Science • teacher as guide/facilitator	• more equipment • differentiated instruction • teacher as a guide • appropriate teaching strategies in Science	• need for resources • more textbooks and workbooks for students • change assessment strategies to suit learners • teacher as facilitator

The participants of this case study have also expressed their views that there can be some initiatives to alleviate these identified barriers. They have suggested that professional development workshops be done to build the teachers' scientific knowledge thereby modifying teacher pedagogy, promoting teacher confidence and competence in Science. Also making linkages between Science and everyday life, teaching to the differentiated learners in their classrooms and conducting alternative assessment were other initiates identified as well.

Summary of Findings

The researcher summarized from the findings of this study that the teachers have expressed their views that there are some barriers to the implementation of the Science curriculum at Paradise Place Boys' School.

1) **What factors (if any) do teachers view as barriers to the implementation of the science curriculum in the classroom?**

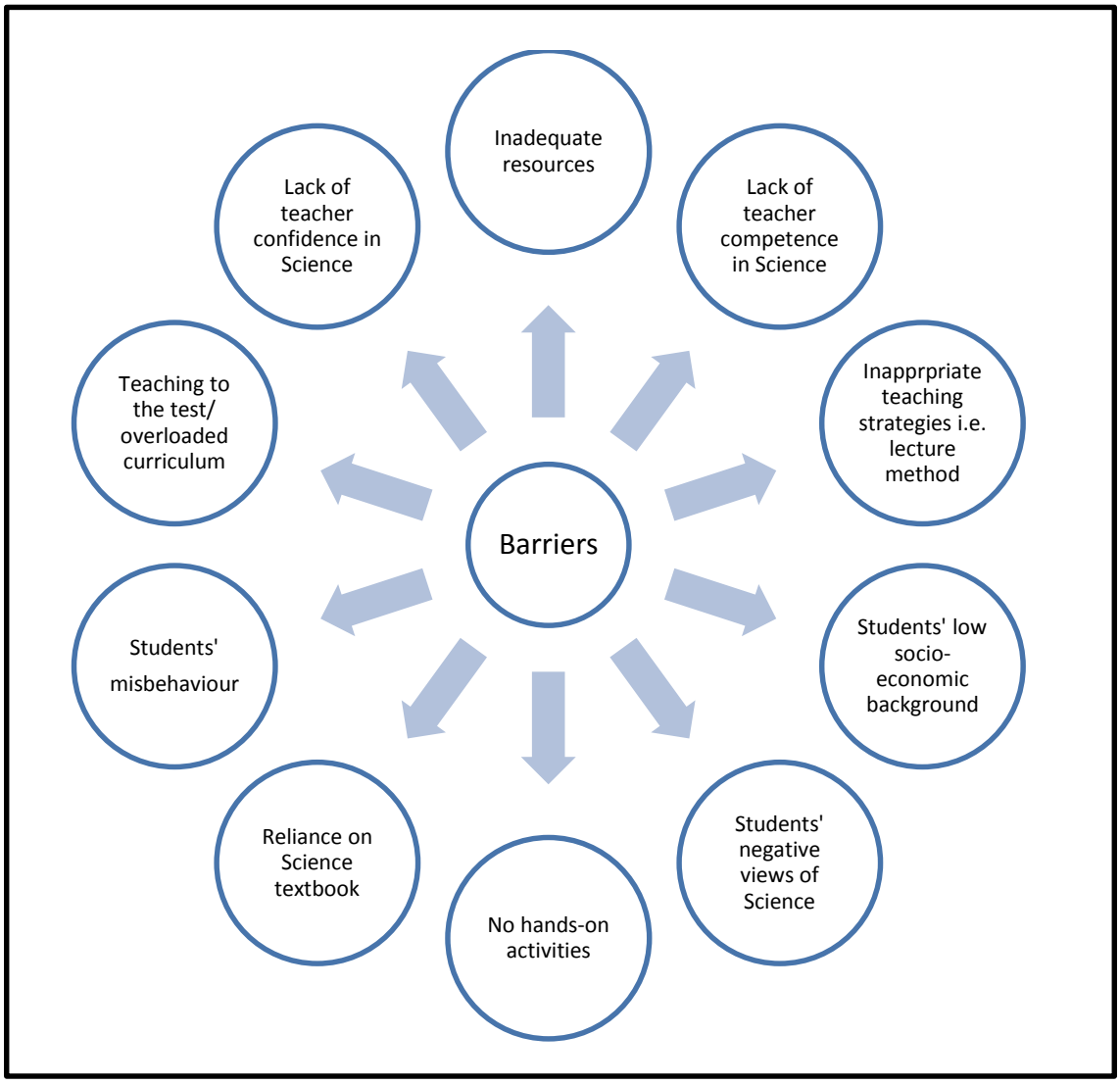


Figure 4.1 Teachers' views of barriers to science curriculum implementation

But this study's findings have shown that the teachers have also articulated some initiatives that can be done to enhance the implementation of the Science curriculum at Paradise Place Boys' School.

2) **What initiatives do these teachers feel are needed to enhance the implementation of the science curriculum?**

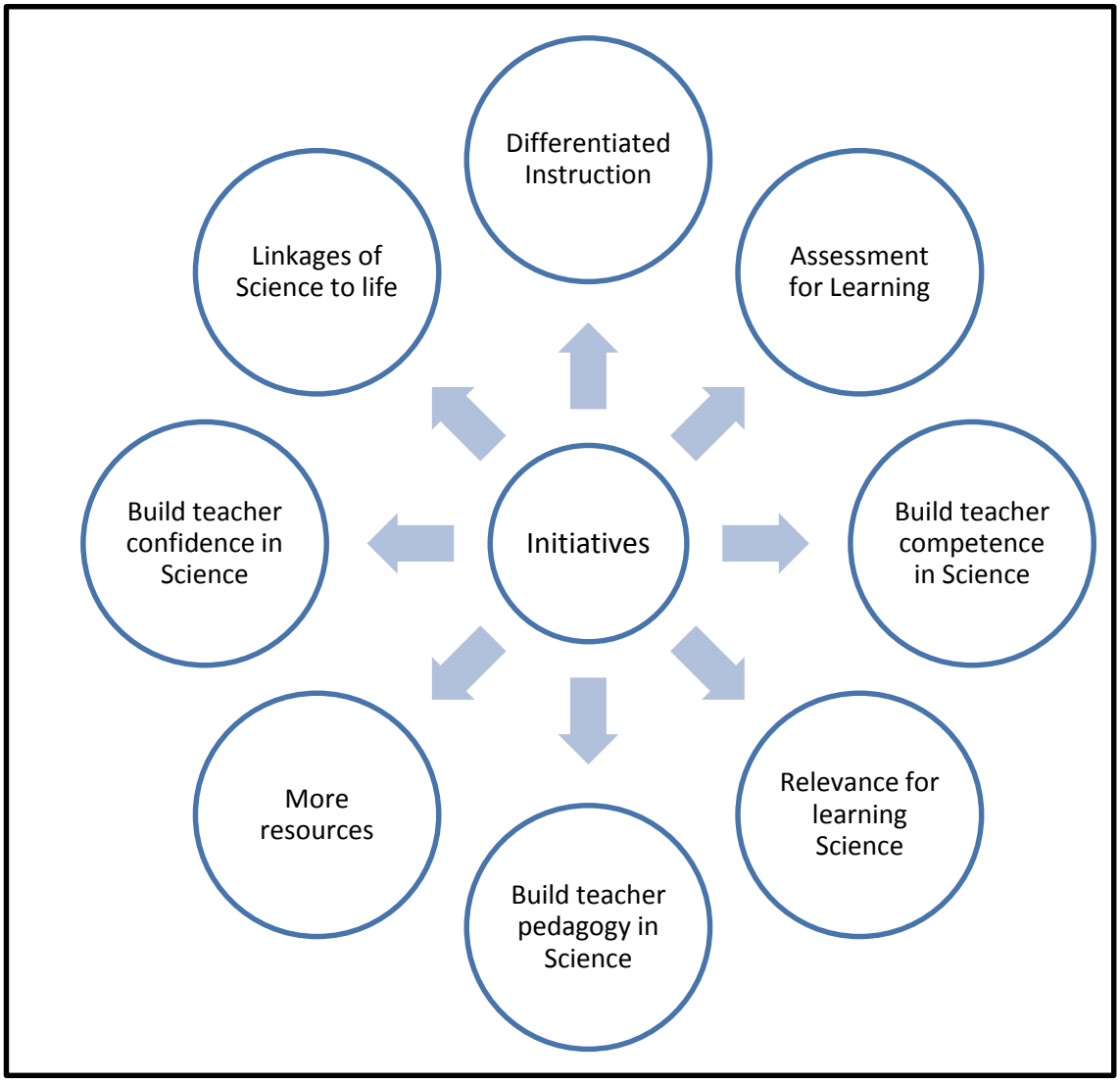


Figure 4.2 Teachers' views of initiatives to enhance science curriculum implementation

Based on the research reviewed these barriers identified can be placed into two broad categories: extrinsic factors and intrinsic factors. In this study, the teachers identified some extrinsic factors such as resources and professional support and intrinsic factors such as professional knowledge, professional adequacy and professional interest/ motivation. Also, the teachers stated some initiatives that can help alleviate these barriers identified and enhance the implementation of the science curriculum.

THE PLAN OF ACTION

The researcher used the findings of the first two research sub questions, in a focus group setting with the teachers, to discuss, collaborate and create a plan for the enhancement of the implementation process at this school. This plan addressed the research sub question 3 of this study:

How might teachers' perceptions of barriers to implementation and suggestions for enhancing the process be used to prepare teachers to present the science curriculum more effectively?

The details of the set up for this meeting are given in a sample of the field notes (see Appendix I). Also at the end of the meeting, an evaluation form was given to each teacher for their feedback. A sample of this is included in Appendix J.

The researcher planned an agenda based on the information from the findings and acted as facilitator in this focus meeting to ensure all matters were addressed. Some of the matters discussed were:

- Resources
- Professional Development of teachers to build scientific competence and confidence
- Development of a plan of action
- Assessment for learning
- Programme of work in Science divided in terms

This meeting was recorded and transcribed (See Appendix H). The work plan developed identified five improvement steps to enhance the Science curriculum implementation at Paradise Place Boys' School (See Appendix K). A sample of test items was given to the teachers to identify the criteria needed, to create test questions for their students (See Appendix L). The Science Programme of Work was done for each term using the existing Primary School Science Syllabus (See Appendix M).

All documents used and developed from this focus meeting was given to the teachers in this study, so that it can be implemented in the next academic year. This implementation of the plan developed is the main purpose of this case study – to enhance the implementation of the Standard Two Science curriculum at Paradise Boys' School.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

Discussion

Based on the data collected from this study, the researcher concluded that the teachers of Paradise Place Boys' School encountered barriers to the implementation of the science curriculum at Standard Two. They also expressed their ideas about some initiatives that can be used to enhance the implementation of the science curriculum. These barriers and initiatives were used in the development of a plan that is to be implemented in the new academic year at Paradise Place Boys' School to enhance Science curriculum implementation in Standard Two.

Limitations of the study

- Time constraints for interviews were very challenging.
- The study was conducted in an all- male primary school.
- Information collected is specific to this study.
- The study dealt with these specific teachers' views.
- Researcher bias.
- Teachers had limited training experience in science curriculum implementation practices
- All teachers in the sample were female.

Based on the views of Forbes and Davis (2010) that:

> Curriculum materials, which include instructional resources such as textbooks, lesson plans, and student artifact templates (i.e. worksheets), are important resources upon which teachers rely to structure both their planned and enacted instruction (p. 820).

The researcher was able to understand that from the findings of this study, teachers rely on resources to assist them in the implementation of the Science curriculum. The teachers at Paradise Place Boys' School have expressed their views that they need resources and were able to become proactive when they met together, by deciding to raise their own funds.

Also, from the findings of this study, there was a concern that the teachers needed some professional support in their content knowledge in Science; and this is in keeping with the literature reviewed by this researcher. Since according to Banilower, Cohen, Pasley, and Weiss (2010):

> Effective instruction requires skilled and knowledgeable teachers and research supports the idea that teacher understanding of content is important. Science teachers need on-going professional development to deepen their content/pedagogical content knowledge and assist them in applying what they are learning to their classroom instruction. (p. 33)

There is a need for the teachers of Paradise Place Boys' School to build their professional adequacy, attitude and interest, and knowledge. This is stately clearly by Millar, Leach, and Osborne (2000) who cite Asoko's view that:

> Primary school teachers are generalists, teaching all subjects, and many find their understanding of science challenged by the demands of the curriculum which they are expected to teach. Teachers' lack of subject knowledge in science has been documented and frequently identified as a barrier to implementation of curriculum reform and to pupil progress. (p. 79).

Science curriculum implementation can only be enhanced if teachers' competence in teaching the subject is strengthened and teachers are comfortable in their abilities. The teachers of Paradise Place Boys' School recognize this and they have created a work plan that can significantly impact on the teaching of Science.

Conclusion

Paradise Place Boys' School has been the research site for this case study for the past six months, as this researcher investigated the teachers' views of any barriers that exist in the implementation of the Standard Two Science curriculum. From the findings of this study, the researcher was able to relate it to the literature reviewed that teachers must be given professional support to enhance their teaching in the Science classroom. According to the teachers in this research study, there can be barriers to curriculum implementation in Science. But they have recognized that there are also initiatives that can be done to combat these barriers and enhance

implementation. If this is done it will have significant impacts on the Science teaching learning environment of Paradise Place Boys' School.

Recommendations

The recommendations of this study are included in the devised work plan of Paradise Place Boys' School to enhance the implementation of Science. This plan, once it is carried out, will assist the teachers as well as benefit the students of this school. Teachers will be willing to modify their present instructional strategies to cater to their students if they are given support. The teachers of Paradise Place Boys' School will gain a better understanding of classroom practice in Science and this will improve the teaching/learning milieu of the school.

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APPENDIX A

Analysis of Teachers' Views about Science

Sample Size : 3 teachers (two teachers presently teaching Standard 2 and one teacher taught Standard 2 in the past)
Use of the Likert Scale in this initial survey done to determine the teachers' views about Science.
KEY : STRONGLY DISAGREE (SD); DISAGREE (D); UNDECIDED (U); AGREE (A); STRONGLY AGREE (SA)

😐1 represents Teacher 1 😐2 represents Teacher 2 😐3 represents Teacher 3

#	Descriptors/Attitude	SD	D	U	A	SA
1	The science I am teaching at school can be linked to solving the problems of everyday life		😐2		😐3	😐1
2	I enjoy teaching science lessons to my students				😐2😐3	😐1
3	I am confident in my knowledge of the science content in the curriculum		😐2		😐3	😐1
4	I have problems in understanding some of the science concepts	😐1			😐2😐3	
5	My students enjoy my science lessons and view science as fun		😐2		😐3	😐1
6	I use hands-on activities to teach science in my classroom		😐2		😐3	😐1
7	The science I am teaching in school is helpful in understanding today's world		😐2		😐3😐1	

#	Descriptors/Attitude	SD	D	U	A	SA
8	I rely heavily on the textbook to gain information for my science lessons	😐1			😐2😐3	
9	I do additional research on science concepts to assist me in my teaching		😐2		😐3	😐1
10	I have adequate resources to teach my science lessons	😐2 😐3	😐1			
11	I give my students science notes to learn after my lessons		😐1		😐2😐3	
12	The science I am teaching in school is of great importance to my country's development				😐2😐3	😐1
13	I have some barriers to implementing my science lessons in the classroom				😐1	😐2😐3
14	I use traditional methods (paper and pencil test) to assess my science lessons				😐1	😐2😐3
15	I have attended science workshops that have been helpful to me	😐2	😐3			😐1

APPENDIX B
MY INTERVIEW PROTOCOL

Implementation of the Standard Two Science Curriculum

Introductory Remarks:

Thank you for taking the time to talk with me today. This interview will probably take about 20-30 minutes to complete. As I mentioned to you before, these interviews are being done with some of the teachers of this school to investigate if there are any barriers to the implementation of the current Primary Science Curriculum for Standard Two. The information from these interviews will be pulled together and used to inform my research project that is required for my Master of Degree in Science Education. But more importantly, the information will be used to assist in improving the teaching/ learning environment in the science classroom and I (?) will lend support through professional development workshops. This interview will be used for this purpose only and will be confidential. (I will not identify you by name in the report or in any conversations with other people.)

So let's begin with me gaining a little background information about you:

1) What is your age range? □ 18 – 25 yrs □ 26 – 35 yrs □ 36 – 45 yrs □ 46 – 60 yrs
2) How many years have you been teaching ?
3) What level in the primary school are you presently teaching?
4) Have you ever taught Std. 2? □ Yes □ No

   If yes, please tell me how many years have you taught this level?

5) Did you attain a passing grade in any O' Level Science subjects ?

□ Biology □ Chemistry □ Physics □ Human and Social Biology □ Other _____

6) Did you attain a passing grade in any A' Level Science subjects? □

Yes □ No

If yes, what are these subjects? _____

Now I am going to ask you some questions about the science curriculum implementation

7) What <u>teaching/learning strategies</u> do you use to teach science lessons in your classroom?

8) Do you like teaching Science ? □ Yes □ No Please give some reasons for your answer

9) Do you think that there are any barriers to the implementation of the science curriculum in your classroom? □ Yes □ No If yes, please state some

10) What are some of the things you may need to enhance your science lessons at your school?

11) Is there any other issue that you consider worth mentioning that I have not asked you about science curriculum implementation?

APPENDIX K

PARADISE PLACE BOYS' SCHOOL WORK PLAN

OBJECTIVE: To enhance the implementation of the science curriculum

Required Improvement	Related Intervention Programme	Objective	Time Frame Start	End	Indicators of success
Teaching Strategies in Science	Conduct professional development workshops	To develop teacher competence and confidence in Science	October 2013	June 2014	Enhanced teacher performance in science teaching
Science Scheme of Work	Departmental planning of science topics	To ensure standardization of science teaching	September 2013	June 2014	Empowerment of teachers
Leadership in Science	Peer coaching, team teaching, other collaboration of teachers	To assist teachers in their scientific knowledge	September 2013	June 2014	Competent Science teachers

Required Improvement	Related Intervention Programme	Objective	Time Frame Start	End	Indicators of success
Resources - equipment, materials, books	Specified Fundraising event	To purchase science resources for teachers	October 2013	November 2013	Availability of resources
Differentiated Instruction Support	Literacy/ interactive workshops	To improve teachers literacy techniques in the classroom	October 2013	December 2013	Meeting the needs of all students