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**Summative Assessment Practices of Solomon Islands
Year Nine Science Teachers**

**A thesis
submitted in fulfilment of
the requirements for the degree
of
Doctor of Philosophy
in
Science Education
at
The University of Waikato
by
FRANCO RODIE**



THE UNIVERSITY OF
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Abstract

The aim of this exploratory study was to investigate the perceptions, experiences, and practices of six Solomon Islands secondary science teachers, based on the types of assessment they use in their science classrooms to serve a summative purpose. The study was divided into two parts. The first part involved a baseline study which explored the teachers' existing summative assessment practices with the intent to understand how their views and knowledge of the summative assessments influenced their practices, and to identify their professional learning needs in creating assessment tools. The second part of the study involved a small-scale professional development intervention, which aimed to enhance the science teachers' skills and confidence in summative assessment as well as to identify the factors that influenced teachers' development and transfer of new assessment skills to their classroom practices in the Solomon Islands context.

The study adopted a qualitative-interpretive research approach and used methods of teacher interviews, participant observation and documentary analysis to generate data related to the teachers' existing summative assessment practices, and the new or revised processes that they adopted as a result of the professional development intervention. Various analytical procedures including thematic analysis procedures and frameworks that researchers have used previously to study teachers' classroom practices were employed to analyse the collected data.

The findings of the baseline study indicated that the science teachers employed summative assessments to compare students' ability through grading and reported their students' achievements to parents and students. The unit test is the dominant form of assessment used by teachers to assess year nine students' learning, performance and achievements in science. Examinations are administered to students at the end of each school term. An analysis of the test and examination questions indicated that teachers focused on assessing mainly low cognitive skills. Teachers' views indicated that neither they nor the school leaders have used student achievement results in the past or present time as a basis to review and evaluate their teaching practices or plan ways they might improve student achievement and school performance.

The science teachers generally expressed varying levels of satisfaction in their conduct of assessment activities but also perceived the need for professional support in certain areas of assessment such as construction of a test using a test blueprint, grading, analysis and interpretation of student assessment results. The study also identified a range of factors that influenced the six science teachers' classroom-based summative assessment practices. Factors that tend to have impacted positively on their summative assessment practices include; their initial teacher education experiences, knowledge and beliefs about teaching, learning and assessment, and colleagues in the school. However, the teachers also reported certain contextual factors that impacted negatively on their assessment practices. These included institutional and extracurricular responsibilities, heavy teaching loads, large class size, lack of clear assessment policy guidelines, lack of exemplary assessment resources, and national examination pressures.

Findings of the impact of professional development intervention indicated that the teachers made small to moderate changes in their summative assessment practice. Their involvement in the group activities during the professional development workshop made them become more reflective on their assessment practices and also indicated that the professional development activities enhanced their knowledge about alternative assessment strategies, and increased their confidence in carrying out summative assessments in class. However, the existing contextual factors that were identified during the baseline study continued to impede their transfer of new assessment ideas and procedures into their classroom practices.

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CHAPTER ONE: OVERVIEW OF THE STUDY

1.1 Introduction

This study involved six secondary science teachers who were teaching the 2008 cohort of year nine students in five secondary schools in the Solomon Islands. The study explored the teachers' perceptions and understanding of and practices in summative assessment, before and after a small-scale professional development intervention study was conducted. The teachers' existing practice in summative assessment was explored through a baseline study, to identify their views, knowledge and understandings about summative assessment and their professional learning needs. The information generated through the baseline study was used to determine the content to be covered in the professional development intervention. The professional development intervention was then conducted not only to enhance the teachers' summative assessment practices but also to explore their professional learning experiences and development. It also provided an opportunity to identify and understand teachers' changing assessment practices and any impediments to change as they worked to implement what they had learned from the professional development intervention.

The formative use of summative assessment built on strong summative assessment tasks was a focus for the study. A number of educators and assessment experts have explored how to integrate summative and formative assessment so that information obtained from internal and external summative assessments can be used to shape teaching and learning in classrooms (Looney, 2011). Bell and Cowie (2001) contended that summative assessment information may be used by a teacher to modify teaching with a new cohort of students and so have a formative function. Other scholars argue that summative assessment information can be used by teachers to set new goals for students as well as for themselves in improving their teaching (Black, Harrison, Lee, Marshall, & Wiliam, 2003; Black & Wiliam, 2004; Harlen, 2005, 2007; Kennedy, Sang, Wai-ming, & Fok, 2007). An extension of this discussion is to be found in chapter 3.2.1, under the subheading '*formative use of summative assessment*'.

Whilst most educators and researchers acknowledge the need to integrate summative and formative assessment, carrying out this process is challenging and needs careful planning. There are strong suggestions that improved integration of formative and summative assessment will require new testing technologies, teacher education and professional development programmes, and further research and development (Looney, 2011). Also of note is how teachers understand the purpose of formative and summative assessment and how this influences their decisions as to which purpose is their priority (Hattie, 2003). Harlen (2005) contends that “the distinction between formative and summative purposes of assessments should be maintained, while systems should be planned and implemented to enable evidence of students’ ongoing learning to be used for both purposes” (p.207).

Carless and Lo (2006) pointed out that formative use of summative tests is a more appropriate strategy in contexts where examinations are frequently used in the school system. They were referring to classroom practices where teachers often have access to and use questions from past examinations to prepare students for high stakes examinations. This practice is common in the Solomon Islands school system which is described by critics as an examination-orientated system. Anecdotally, teachers in the Solomon Islands often use past examination papers to revise topics and questions that are likely to be asked in the examination papers to prepare students for high stakes national examinations. The question that arises from this then is whether teachers can maximise the benefits of past examination papers in terms of using summative assessment information to inform their teaching. This study makes an attempt to help a small sample of year nine science teachers to explore formative ways of using summative assessments.

1.2 Statement of the Problem

The issue this study intended to explore related to existing assessment approaches used in the Solomon Islands secondary education system. Between 2007 and 2009 one of the policy guidelines was to improve existing assessment approaches used by teachers in the classroom to assess students’ achievement and school performance (MEHRD, 2007b, 2007c).

Critics and commentators of the Solomon Islands' assessment system have commented on the heavy reliance of schools on national examinations to select students for limited places in successive levels within the Solomon Islands secondary education system, and the administration of these examinations (Croft, 2006; Kerapuke, 2005; Mellor, Prior, & Withers, 2001; Osifelo, Wednesday, 4 March 2009; Riotarau, 2009). National Examinations are also costly to the Ministry of Education. In 2011, the National Examination and Standards Unit expended SBD\$3 million to administer the examinations at year six, nine and eleven (MEHRD, 2012a). The Ministry of Education of the Solomon Islands highlighted that in years six, nine, and eleven (grade levels where national examinations are used for selection purposes) teaching practices were typically driven and shaped by the focus on national examinations (MEHRD, 2007c). Anecdotally, it is known that students' results from both internal and external summative assessments are not being used by teachers or schools to plan what needs to be done to improve the overall achievement of students.

There is currently a lack of literature which reports on assessment practices in the Solomon Islands about the assessment methods science teachers use to assess student learning and school performance, and how they use student assessment data and information. Science teachers' understanding, skills and confidence in assessment and their assessment practices have not been researched. Hence, there is relatively little known about whether the use of assessments by science teachers for summative purpose, and the data and information derived are being effectively used to review and support improvement in the schools in terms of student learning, classroom instruction and other educational development goals.

The study involved year nine science teachers because of their role and responsibility in teaching school science to year nine students of the Solomon Islands. Year nine is currently the end of the basic education programme in the Solomon Islands, and students sit the year nine national examination to progress to year 10. The current study, therefore, sought to explore year nine science teachers' summative assessment practices to identify the methods, strategies, and procedures they use to collect evidence of their students' learning achievements, as well as to ascertain how the teachers use summative assessment information.

1.3 Aim of the Study

The aim of this study was two-fold. First, it was designed to investigate year nine secondary science teachers' existing summative assessment practices, which included their level of understanding, perceptions and experiences of assessment. It sought to identify the types and forms of assessment teachers used to measure their students' learning and achievement, as well as how they used the information obtained from the assessments. It was conducted to identify the teachers' strengths and professional learning needs in assessment. The second aim was to conduct a small-scale professional development that focused on aspects of assessment strategies that the teachers identified as most challenging to enhance their assessment practices.

The effect of the professional development on teachers' post-professional development summative assessment practices was also investigated. Underpinning the professional development intervention was the assumption that when teachers further developed their assessment literacy, they would be better equipped to adopt and apply new assessment strategies they learned in their science classrooms.

The professional learning experiences of the teachers, as well as factors that supported and inhibited teachers from transferring what they learned from professional development were therefore also explored and documented. The professional development intervention was grounded on the assumption that schools need to offer continuing professional development opportunities for teachers, to enhance their professional learning and development throughout their teaching careers, and not to wait until formal mandated in-service training opportunities are provided (Fullan, 1995a, 1995b) or when new sets of curriculum materials are introduced to the school system.

Educational research has indicated that teaching quality is a fundamental factor in raising student achievement (Darling-Hammond & Bransford, 2005; Darling-Hammond, Wei, & Adamson, 2010). Therefore, it makes sense then to offer professional development continually to science teachers so that they can expand

their pedagogy and assessment knowledge and skills to implement the best educational practice and hence become as effective as possible and succeed in their teaching career (Mizell, 2010).

1.4 My Interest in the Study

My interest in this research topic grew out of my extensive involvement in science curriculum development, assessment and examination in the Solomon Islands in my capacity as a former secondary science curriculum officer and chief examiner for the Solomon Islands year nine and preparing the year eleven National Science Examinations. These experiences, as well as my involvement in recent educational reform initiatives in curriculum and assessment have motivated me to carry out an investigation of science teachers' summative assessment practices in the Solomon Islands context.

My research interests cover aspects of science education, curriculum development, assessment, and teacher professional development. In particular, I have taken a keen interest in the relationship between science curriculum achievement objectives, assessment procedures and strategies, and students' learning achievements in science. As an examiner, I often wondered about the strategies teachers used to design their assessment tasks, and whether they planned and used a variety of assessments to measure the various learning outcomes provided in the secondary science syllabus. One of the questions that I have been grappling with was: Do teachers and school leaders use the assessment data and information to review and inform decisions that would support learning and classroom instructions hence improve the overall student achievement and school performance?

My interest in the current research topic has been influenced to a large extent by the measures that the Solomon Islands Ministry of Education has put in place recently to address the issues related to the current school-wide assessment system (MEHRD, 2007c). For example, one of the strategic objectives concerning assessment was the desire to broaden the assessment system to ensure that a wide range of students' skills and abilities are assessed. To help teachers carry out their

teaching and assessment practices effectively, the Solomon Islands Ministry of Education has pursued, amongst other reform programmes, the development of the national curriculum and assessment policy statements that aimed to provide clear guidelines on what teachers should teach and assess based on the content and outcomes of subjects offered in each level of the education system (MEHRD, 2007c). However, there are other concerns relating to assessment and examination issues that affect student learning and classroom instruction.

Over the years, I had been made aware of concerns about the national assessment examination system. Of significance were concerns that the current assessment and examination system excludes students from having a complete basic education because students were “pushed out” prematurely by decisions based on students’ results from the national examinations, particularly at year six in primary and year nine in junior secondary schools. There is wide acceptance of the suggestion that the current assessment and examination system should be overhauled and replaced with one that ensures assessment of competencies, and supports the teaching and learning process and progression of students in upper levels without them having to sit the national examinations (MEHRD, 2004b). Critics of the current education system also claim that students who leave at the end of year nine do not possess the knowledge and skills necessary to secure employment (MEHRD, 2004c; Treadaway, 2003). I am also aware of stakeholders’ and commentators’ assertions that the high-stakes examinations, particularly those used at the year nine level have conditioned teachers to confine their assessment practices to teacher-designed tests and internal examinations that imitate these examinations. As a result, teachers think of “assessment as synonymous with examination” (Pongi, 2004b, p. 19).

Finally, one of the impediments affecting teachers’ assessment practices in most schools in the Solomon Islands is lack of a clear assessment policy framework and assessment resource materials. The absence of clear assessment policy guidelines and assessment resource materials means that teachers use their own strategies and procedures to assess students’ learning. In addition, I believe, a major constraint in science teachers’ assessment practices in the Solomon Islands is access to information and resources to develop a knowledge base about

assessment. Without resource materials to build from, change in teacher assessment practice is constrained (Gummer & Shepardson, 2001). I also advocate the need for continuing teacher professional development programmes because through these programmes teachers can gain access to information and resources and build their capacities. According to Gummer and Shepardson, when teachers participate in professional development programmes that promote an intellectual base in assessment, they can gain access to assessment resources, national reform documents, books, articles and websites about assessment. With guidance, these resource materials may assist teachers in constructing frameworks for effective assessment practices.

It is my belief that the information about teachers' summative assessment practices generated through this study will provide insights into the experiences and challenges science teachers encounter in their assessment practices to which need to be aligned to the educational policy in the Solomon Islands. Changes in the school-wide assessment system are currently being called for, in an attempt to overhaul the assessment and examination system the country has adopted since it gained political independence from Great Britain in 1978. Summative assessment has an important role to play in science education. However, a much broader assessment system that can allow teachers to measure a wide range of student skills and abilities is what is urgently required.

1.5 Justification for Summative Assessment

It is well known throughout many educational systems and countries that large-scale assessments that serve a summative purpose have a significant social function not only as a process of monitoring and evaluating students' knowledge of specific learning areas, but also as a determinant of the quality of education (Gipps, 1999). However, despite the many ways educational systems and in particular school communities, students, parents, and various stakeholders have used and benefited from the data and information derived from assessments that serve a summative function. It is also worthwhile to mention the negative impact of assessments especially high stakes examinations on students' motivation for learning, which has attracted much public and academic debate (Harlen & Deakin,

2002). According to Mansell and James (2009) and others (see also for example, Stiggins, 2002; Wiliam, 2001), the current debate about assessment in general is centred around how assessment can best support learning and teaching and how assessment is utilised to provide information on the progress and achievement of students and schools. Put it another way, the challenge that schools and teachers are faced with is the question of whether assessment by teachers and the approaches adopted by them to assess students' achievement have achieved the goals and are fulfilling the intended uses of assessment set by the education system.

Recent educational reform initiatives have pointed to the need to review, rethink, and reform school-wide assessment programmes with a view to support teachers to gain new knowledge and skills in using a variety of assessment methods to evaluate and support student learning and improve classroom instruction (Earl & Katz, 2006; Harlen, 2007). Assessment specialists have called for expanding traditional modes of assessment, so that teachers can draw on a variety of assessment strategies to generate information about student learning to inform and support learning and teaching (Black & Wiliam, 1998b; Earl & Lafleur, 2000; Stiggins, 2004; Wiliam, 2001).

Modern education policy directions in assessment envisage strengthening of the use of "...evidence-based practice, the idea that decisions at all levels [of the educational system] should be grounded in data" (Matters, 2006, p. iii). These perspectives of assessment should encourage teachers to obtain or be provided with data to inform their instructional planning decisions to help students learn, and appeals to policymakers and school leaders to base their decisions on assessment data to facilitate the improvement of student achievement (Matters, 2006). Such an approach may also help to develop curriculum frameworks that will prepare students with new knowledge, abilities, and attributes to face new challenges today and well into the future (Earl & Katz, 2006; Harlen, 2008; Segers, Dochy, & Cascallar, 2003). Teachers are called upon to use student assessment information more often to inform the planning of their instructional practices and to support students' learning (Timperley, 2009).

There is a push within education systems across the world to broaden curriculum frameworks that will allow students to learn and be equipped with knowledge, understanding, and skills to face challenges they meet in their everyday life, and to help them achieve at high levels (Luterbach & Brown, 2011). In order to find out whether students will learn and master different learning abilities at each grade level and subject, different assessment frameworks will need to be designed. This is to ensure that teachers focus on teaching and assessing a variety of different learning skills in each grade level and subject. There should be a balance in teaching and assessing low and high cognitive skills and practical skills. Although recent research in science education strongly suggests that teachers should encourage students of all academic levels to engage in tasks that involve higher order thinking skills (Zohar & Dori, 2003), it is not easy to change teachers' assessment practices (Gummer & Shepardson, 2001) toward formulating assessment tasks that ask students to demonstrate higher order cognitive skills. Nevertheless, all this implies is a need to change the assessment approaches used by teachers, including standard-based tests and large-scale assessments that serve a summative purpose and to accommodate such new thinking and aspirations (Segers, et al., 2003) that would contribute toward improved student learning outcomes.

In almost every education system, summative assessment data are used to inform decisions that are likely to affect the future education and life of students and the decisions that are made do have an impact on their lives (Assessment Reform Group, 2006). So it seems necessary not only to examine factors that influence teachers' summative assessment practices but also to identify assessment frameworks and strategies that can guide good classroom practices.

The main argument for summative assessment is that it provides important data and information about the outcomes of a modern education (Harlen, 2007) and therefore should be given as much attention as the other methods of assessment which are used to serve a formative purpose in the school system. Put it another way, assessment tasks that serve a formative purpose should be viewed as central steps for checking or monitoring student understanding and skills. This is important because the information obtained can be used by teachers to adjust their

teaching and to enhance student performance. However, in the context of Solomon Islands education system, where large-scale high stakes national examination are used for selection for limited spaces in successive levels of education and for monitoring the overall quality of education, new ways of utilising summative assessment data is advocated and should be explored to improve students' overall performance and achievement. And most importantly to support teachers so that they can construct quality assessment tasks that allow students to demonstrate a variety of skills and abilities.

A key debate in educational assessment is whether assessment should be used mainly to determine student achievement by which marks or grades are used to indicate level of competencies or achievements or whether it can also be used to monitor and support the teaching and learning process. A closer look at formative and summative assessment necessitates also means looking at how they complement each other in supporting and verifying students' learning, performance and achievement (Harlen, 2006a). There is a need to strike a right balance between the formative and summative use of assessment (Stiggins, 2008), so that both can be used in an appropriate and meaningful way to assess students' learning, performance and achievement (Harlen, 2007).

Proponents of summative assessment consider it an important and necessary component of education because it "... reflects important outcomes of modern education..." (Harlen, 2007, p. 4), particularly educational developmental goals that the students ought to learn and be equipped with to prepare themselves for the challenges they are likely to face in life. Others are concerned that the immense attention given to formative assessment in the literature, as well as in education reforms, "... seemed to have a tendency to neglect summative assessment, or at least to regard it as something quite distinct" (Kennedy, et al., 2007). Bell and Cowie (2001) however have contended that summative assessment has aroused a lot of attention in "...research and development because of its status and the high-stakes involved" (p. 22). Still others (see for example, Stiggins, 2004) are concerned that teachers are still assessing their students' learning the way their predecessors have done for decades because they have not been given the opportunity to review and develop assessment strategies. Hence, there is a failure

to practice more effective and valid assessment methods to assess students' learning. This has given rise to the necessity for more professional development opportunities that focus on assessment strategies to be offered to both pre-service and in-service teachers (Stiggins, 2004).

Education assessment specialists have also pointed to the need for teachers to not only establish "a clear vision of the meaning of academic success", but also have the skills to effectively assess student performance based on the curriculum outcomes (Stiggins, 1995, p. 238). Therefore, it is necessary to explore teachers' knowledge of assessment and to identify the areas of assessment in which they need support so that they can competently design valid assessments that measure a range of different skills students have acquired.

Internationally, research in educational assessment has also pointed to the need for researchers to carry out research on teachers' summative assessment practices because of the increased use of standardised tests and high-stakes examinations to determine whether students are meeting the educational goals and requirements of the education system and for selection, admission, and scholarship awards (Harlen, 2004b). Students' results from external summative assessments are often used to decide the progress of those students within the secondary and tertiary education levels. These often have both negative and positive consequences on teaching and students' motivation for learning (Harlen, 2004b; Harlen & Deakin, 2002). Moreover, calls are being made to "identify the factors that support [or inhibit] teachers' use of summative assessment and to improve students' learning experiences..." (Harlen, 2004b, p. 70). Hence, there is merit in undertaking an inquiry into teachers' summative assessment practices in the Solomon Islands because, through inquiry, their level of confidence and skills as well as their existing views, beliefs and understanding of summative assessment could be identified and actions can be taken by education policy-makers to help teachers improve on their classroom assessment practices.

Past research has indicated that knowledge, beliefs and behaviours teachers hold about teaching, learning, and assessment influence the way they teach and assess their students, as well as affect the way students learn. There is consensus

amongst scholars that teacher knowledge, ability, action, behaviour, and beliefs have a major influence on what students learn (Darling-Hammond, 2000; Garet, Porter, Desimone, Birman, & Yoon, 2001; Timperley, Wilson, Barrar, & Fung, 2007; Wenglinsky, 2000). Research also shows that teachers' perceptions of assessment, teaching and learning affect the decisions they make in regards to the selection of science content and instructional approaches, as well as what to assess or how they assess, and how they communicate information about students' achievements to parents, students, future teachers and employers (Darling-Hammond & Bransford, 2005). Therefore, it is necessary to understand the perceptions that Solomon Islands year nine science teachers may have about summative assessment to understand how the views and knowledge that they have influence their summative assessment practices.

Summative assessment tasks will continue to be used in science education to verify that students are achieving the science curriculum standards and hence able to demonstrate their understanding and skills in the work they do in each level of the secondary education system (Atkin, Black, & Coffey, 2001). This requires teachers to develop summative assessment tasks that focus on measuring valued science content standards and are administered to students not on a more frequent basis, but rather at the most appropriate time, such as at the end of a topic or end of term (Musial, Nieminen, Thomas, & Burke, 2009). But to do these tasks effectively, teachers need to be supported through on-going professional development programmes so that they can continually upgrade their assessment skills and competencies.

A question that still takes centre-stage in education reform discussions is how teacher education and professional development programmes can be best structured so that teachers can develop a strong knowledge base, and the right attitude towards their teaching roles, in order to positively affect student achievement in various social contexts, in which they are working (Darling-Hammond, 2000). Research evidence suggests that the quality of teaching and learning in schools is directly linked to the quality of teachers (Darling-Hammond, 2000; Goe, Bell, & Little, 2008; Sato, Wei, & Darling-Hammond,

2008). This makes sense because teachers are the key implementers of educational policies, including the curriculum in any education system.

There is substantive research evidence which suggests that teacher knowledge, ability, action, behaviour, and beliefs can have a major influence on their teaching practices and students' learning outcomes (Darling-Hammond, 1997, 2000). This implies that what teachers know, do and believe can have both positive and negative impacts on students' learning and achievement – although students are also responsible for their own learning to some extent. Hence, to improve students' achievements, teachers' knowledge and practices need to be the target of education reform initiatives. Thus, the overall quality of education can be determined by the quality of professional training offered to teachers. It is recognised that significant strides in education can be made in any education system when the quality of teacher training and development is addressed (Darling-Hammond, 1997; Desimone, 2009; Sparks, 2002; Timperley, et al., 2007).

The provision of professional development programmes can potentially enhance teachers' summative assessment practices, enabling them to implement and assess science content standards in a more effective, fair, and dependable manner (Harlen, 2007). Professional development is regarded as the most effective strategy schools have to meet this expectation (Mizell, 2010; Stiggins, 2004). According to many researchers, professional development is the strategy schools need to use to ensure that teachers continue to strengthen their practices throughout their teaching careers (Dufour, Dufour, Eaker, & Many, 2010; Gilmore, 2008; Guskey, 2002; Roberts & Pruitt, 2009; Stiggins, 2004; Timperley, et al., 2007). Professional development programmes that have focused on changing teachers' assessment practices have indicated that teachers benefit in terms of knowledge and skills gained and improved performance in the classroom (Black, Harrison, Hodgen, Marshall, & Serret, 2010; Pannizon & Pegg, 2008), which in turn has improved students' achievements (Timperley, et al., 2007). According to Shepardson (2001b), professional development programmes that focus on strengthening teachers' understandings of assessment, the context of the science classroom, incorporate teacher-teacher "collaboration and teacher

reflection, and provide ongoing support are more likely to be successful in changing teachers' assessment practice" (p. 1). Bell and Gilbert (1994) contend that a good professional development programme provides an opportunity for science teachers to reflect on aspects of their teaching practices, (which includes assessment practices) and enables them to identify areas in which they need to improve.

Whilst professional development can potentially improve teachers' assessment practices and therefore contribute towards improved student learning and achievement, "prevalent in the assessment literature are difficulties associated with teachers to implement assessment policy and reasons for this include the influence of teacher's beliefs on practice" (Murphy & Mason, 2006). Also highlighted within the professional development and professional learning bodies of literature are the difficulties associated with changing practice along with important pre-conditions that must be present if professional learning is to occur for teachers (Foss & Kleinsasser, 1996; Prawat, 1992). Several researchers have argued that teachers' underlying beliefs and knowledge shape practice and as such inhibit instructional reform. In occasions where teachers have changed their practice, researchers claimed this was in accordance to their beliefs and knowledge. Some of these issues and pre-conditions will be discussed in some detail in the literature chapter (see Chapter 3/Section 3.3).

There are myriad factors that affect teacher effectiveness which can in turn negatively affect student achievement in various social contexts, in which they are working. For example, Muralidhar (1993a) reported that teachers in the Pacific Island Countries often experience heavy teaching loads and pressures from external examinations; there are parental and school expectations for teachers to help students pass examinations, and teachers do not always have the opportunity to reflect on their practices. This is why professional development is so vital to teachers, as it is to schools and students. Professional learning opportunities create an environment for teachers to reflect on their teaching practices and talk openly about their experiences and issues and what has worked for them in the classroom (Dufour, et al., 2010; Roberts & Pruitt, 2009). Moreover, research has indicated that professional learning opportunities for teachers can encourage them to work

towards their own development “... professionally, personally, and socially” (Bell & Gilbert, 1994, p. 483). In this regard, it is vitally important for policymakers, school principals, and parents to ensure that the teachers within their schools are able to engage in continuous professional learning and apply that learning in their classrooms to improve student achievement.

1.6 Significance of this Study

To date, no study has been conducted in the Solomon Islands to explore secondary science teachers’ existing summative assessment practices. Hence, very little is understood about science teachers’ views and knowledge about summative assessment. Nor is there information about the likely areas in assessment that teachers usually find most challenging. Therefore, research that provides perspectives on the status of secondary science teachers’ summative assessment views and practices, as this study has attempted to do, may contribute to the information-base required by policy-makers and implementers of education policies to decide ways to improve the school-wide assessment system in the field of science education. Given a lack of data and information relating to teachers’ classroom-based assessment practices at policy level to affirm whether current approaches to assessment is promoting effective learning, it is essential for educational policymakers in the Solomon Islands to have access to research evidence pertaining to science teachers’ summative assessment practices. The outcome of this study has identified significant implications (see chapter 8 for details) for future policy initiatives to improve practices on assessment, guidelines, and the professional development of teachers in assessment.

Teacher educators would also find the outcomes of this study useful, as the study would highlight implications on how well prepared pre-service teachers should be in terms of the assessment knowledge and skills they need to be equipped with in order to design quality assessment tasks to measure students’ learning, performance and achievements. Teacher educators also need to prepare student teachers who can operate under different circumstances, such as in schools that have insufficient curriculum and assessment resources and where they might be posted, to still use best teaching and assessment practices. The elements of

assessments that the six year nine science teachers in this study found challenging may contribute towards decisions and actions that may lead to review and re-development of assessment-related courses offered at the only teacher education institution in the Solomon Islands. This is necessary so that the courses are improved to cater for the professional learning and development needs of pre-service teachers attending teacher education and training programmes in response to and support of educational reform.

School leaders and teachers may have been looking for ways about best classroom practices that could contribute to improved student learning outcomes (Sato, et al., 2008). The findings of the study could therefore be used to inform school leaders about summative assessment practices of the six science teachers in this study; their views and knowledge about summative assessment and how they practice it in their science classrooms. The school leaders could then identify the elements of assessment that the teachers in this study found most challenging, which might be common amongst the teachers at their schools, and use these as a basis for planning and designing professional development activities to enhance their teachers' skills and confidence in assessment.

Assessment practices are changing due largely to educational reform initiatives which require that students achievements be improved, not only in terms of the basic knowledge they should have but most importantly a range of abilities which can enable students to think critically, to analyse, make inferences, and to solve problems and communicate with one another (Atkin, et al., 2001; Segers, et al., 2003). Students ought to be assisted to attain these skills but to do this requires teachers who would also need to enhance their abilities in their teaching to accommodate changes in students' learning needs as well as assessment at the national, school and classroom level. So knowing teachers' teaching and assessment practices by school leaders – why their teachers teach and assess the way they do, and understanding their views and skills in assessment will help them support teachers with the skills they need to use the most effective assessment methods and to measure students' learning, performance and achievement in their schools. The findings of this study could contribute towards international literature on summative assessment in science, particularly from a

developing country's socio-cultural context. Researchers who may be interested in teachers' assessment practices in other contexts may use the information provided in this thesis as a basis for understanding the knowledge teachers have about assessment and why they assess students the way they do. Researchers who may be interested in teachers' assessment practices could also consider the suggested topics outlined in Chapter 8 as their research topics to find out more about assessment practices of science teachers.

1.7 Organisation of Thesis

This thesis consists of eight chapters and is organised as follows: Chapter One provides an overview of the study including this section. Chapter Two gives the contextual background of the study. Chapter Three is a review of the literature on summative assessment and professional development. Chapter Four provides a justification for choosing the methodology and methods used in this study. Chapter Five outlines the overall research process and describes how the methods and procedures for collecting, analysing, evaluating, and reporting data/information discussed in Chapter Four were applied in this study. Chapter Six presents the findings of the baseline study that examined the teachers' existing summative assessment practices. Chapter Seven presents findings of the teachers' professional learning experiences and development. Chapter Eight discusses the key findings of the study and concludes with implications for policy-makers and implementers of education policies.

This thesis explores not only the existing summative assessment practices and professional learning experiences of specific Solomon Islands secondary science teachers who were teaching a cohort of year nine students in 2008, but also how contextual conditions at their schools contributed and gave meaning to their assessment practices in the five secondary schools. The study acknowledges that there is a need to understand teachers' summative assessment practices, particularly in the upper grade levels within the context of the Solomon Islands education system, where students sit external high-stakes examinations, because they influence what teachers teach and how they assess the outcomes. Both internal and external summative assessments play a pivotal role in the Solomon

Islands education system in terms of determining students' learning and achievements and selection of students to higher grade levels. However, it is important to note that teachers' summative assessment practices need to focus on those intended learning outcomes outlined in the science curriculum. In summative assessment, teachers are required to use the most appropriate assessment tools, strategies, and criteria that will yield valid, reliable, fair, and dependable information about students' learning, performance and achievements in science.

CHAPTER TWO: CONTEXT AND BACKGROUND

2.1 Introduction

This chapter presents the context and background for the current study. It is important to know about these to understand what assessment means in the context of the Solomon Islands. Specifically, this chapter provides an outline of the education system, teacher education, the assessment and examination situation, the current Solomon Islands Ministry of Education's curriculum and assessment reform initiatives and the status of professional development.

2.2 System of Education

Historically, Church missions played a significant role in the development, operation and management of formal education, including the curriculum that the schools followed during the initial stage of the development of formal education in the Solomon Islands, which is reported to have begun in the early 1950s (Kerapuke, 1991). Nowadays, formal education is the responsibility of the Ministry of Education, in partnership with provincial governments, church education authorities, and private and community groups.

The Solomon Islands school system begins with three years of early childhood education (ECE), which caters for children between the ages of three to five years. Following ECE, there are six years of primary education (years one to six), three levels of junior secondary education (years seven to nine), and four levels of senior secondary education (years 10, 11, 12 and 13). National examinations are used to determine the progression of students to the senior secondary education levels after completion of junior secondary education at year nine level (MEHRD, 2001).

The Solomon Islands school system comprises three types of secondary schools, namely: the national secondary school (NSS), provincial secondary school (PSS) and community high school (CHS). The CHSs are very recent developments. The NSSs were established between the 1960s and 1970s, while the PSSs were built in the 1980s.

Currently, the major differences between these secondary schools are: (a) both NSS and PSSs are boarding schools, while CHS are not; and (b) NSS and a few PSS cater for year seven to 13, while CHS cater for year seven to nine only, although some CHS have in recent years added year 10 and 11 classes. In terms of resources and funding, the NSS and PSS tend to have more generous financial resources and other forms of support from the national government and responsible provincial educational authorities than the CHS, which are supported by the communities that established them. However, this is changing as the government moves into providing an improved education system under the current education reform programme. Under this programme, the government: aims to improve the equitable access to safe learning environment for all students, the quality of teaching and learning, and the effectiveness of decision-making, planning, management and monitoring at all levels of the education system (MEHRD, 2007c).

The first CHSs were established around 1995 and the number has steadily increased over the years. In 2007, there were 190 secondary schools; 8 NSSs, 16 PSSs and 166 CHSs (MEHRD, 2007a). According to the Ministry of Education Digest of Education Statistics of 2007, there has been considerable growth in terms of access to secondary education between 1990s and 2000. For example, many more students are now attending secondary schools than in the past years due to the increasing number of CHS. In particular, it has been noted that the transition rates for year nine increased from 58 percent in 1996 to 73 percent in 2006 and, for the School Certificate (year 11), student access rate increased from 20 percent in 2002 to 38 percent in 2006 (MEHRD, 2005a). All these three types of secondary schools follow the same national curriculum but its implementation is entirely up to the schools and teachers.

2.2.1 Centralised system of education

The Solomon Islands Ministry of Education still carries out most of the overall management, technical, and supervisory roles and responsibilities from its headquarter in Honiara, the capital of Solomon Islands. Thus, the country still maintains a national bureaucratic education system. Teacher education, recruitment, salaries, policy and decision-making mechanisms, teacher

development, school inspection, curriculum, examination/qualifications, national training and scholarships are centralised functions of the Ministry of Education (MEHRD, 2007b, 2007c). Currently, most of the functions and responsibilities of the Ministry of Education are centralised. However, it has been the aim of successive governments and the Ministry of Education officials in the Solomon Islands to devolve some responsibilities to local education authorities so that they can assist in the management, administration, delivery, and maintenance of educational services at provincial and regional levels.

2.2.2 Teacher education

Teachers who are recruited under the Solomon Islands Teaching Service complete their teacher education programme through a teaching scholarship scheme offered by the Ministry of Education. The majority of teachers attended the Solomon Islands College of Higher Education (SICHE) School of Education, which until 2008 offered a three year Diploma Teaching (secondary) programme in specific subject areas (e.g. science). From the beginning of 2009, student teachers enrolled for a two-year diploma in teaching do early childhood education (ECE), primary or secondary education programmes. The revised diploma in the teaching programme was redeveloped with technical input from the staff of the Faculty of the School of Education of the University of Waikato, and was funded by the Governments of New Zealand and Solomon Islands (Cathewood & Taylor, 2011).

For degree and postgraduate qualifications, student teachers usually take scholarships to train at key regional universities in the Pacific, but mainly at the University of the South Pacific (USP) in Fiji, and the University of Papua New Guinea (UPNG) in Papua New Guinea. A few teachers are trained at higher education institutions in Australia and New Zealand, particularly those who pursue postgraduate qualifications under development-partnership aided scholarships.

As may be the case in the neighbouring Pacific Island countries, in the Solomon Islands, teacher graduates are posted to schools where they serve one year of probation before they are assessed and enlisted as qualified teachers, provided that individual teachers meet the evaluation requirements. To become a registered

teacher, an individual must be evaluated by the Inspectorate Division of the Ministry of Education in collaboration with the relevant education authority.

2.2.3 The national school curriculum

Since independence in 1978, the Solomon Islands have had a National School Curriculum that caters for primary (year one to six), junior secondary (year seven to nine) and up to year 11 secondary (MEHRD, 2005b). Senior secondary schools that offer year 12 and 13 can choose between external curricula produced by either the University of the South Pacific or the Secretariat for Pacific Board for Educational Assessment (SPBEA).

Nine key learning areas (or subjects) make up the secondary school curriculum and include English, mathematics, science, social studies, agriculture, business studies, Christian education, technology and design, and home economics. Of the nine subjects, four are compulsory, namely: English, mathematics, social studies and science. Students can choose two options from home economics, business studies, technology, agriculture, or Christian education. A student can take a minimum of six subjects for both year nine and eleven national examinations (currently Junior Secondary Leaving Certificate and Solomon Islands School Certificate respectively).

All subject syllabuses and some instructional materials used for teaching year seven to eleven subjects are produced locally through the Ministry of Education Curriculum Development Division, and while the division employs full-time staff, teachers are frequently involved in the development of curriculum materials. A recent report found that this has a positive impact, in that teachers are more likely to claim ownership of the curriculum materials produced (Coxon, 2008). Moreover, selected text books required by primary and secondary schools are obtained from overseas commercial publishers, and these have to be approved by the Ministry of Education, on the recommendation of the National Curriculum Advisory Board, before they are used in the school system (F. Rodie, Rore, Manerapu, Maneipuri, & Herriot, 2001).

Science curriculum

Solomon Islands secondary schools (year seven to eleven) follow the same science curriculum irrespective of the type of secondary schools. The last time the secondary science curriculum was revised was in 1999, and it will be used until the new materials are completed under the present curriculum reform programme (MEHRD, 2005b). The latest revision of the secondary science curriculum began in 2004. At the time of writing this thesis some of the revised science materials had been implemented in the schools. However, it was envisaged that the rest of the materials would be introduced before 2013 (MEHRD, 2007c).

One of the most important objectives of science education in Solomon Islands as stated in the science curriculum documents is the need to “help students develop their critical thinking skills and competencies to conduct investigations and analyse data, make inferences and use information in ways they could benefit from it” (MEHRD, 1999, pp. 3-4). This curriculum statement reflects the science education reform movement initiatives popularly spread around the world by science education experts to realise the benefits of science (Millar, 2008). Not only does the current Solomon Islands secondary science curriculum emphasise the use of more effective teaching approaches that can allow students to acquire relevant knowledge, skills, values, and attitudes, but the teachers are also encouraged to apply effective and appropriate assessment approaches.

The science curriculum emphasises the application of a wide range of differentiated assessment tasks to assess a range of learning outcomes, and to monitor their students’ progress and achievement on a continuous basis (MEHRD, 1999). Teachers are also encouraged to use alternative assessment methods that can allow students to demonstrate the science process skills and inquiry, and ability to understand the applications of scientific knowledge in real-life situations (MEHRD, 1999). However, there is a dearth of science educational assessment materials available to guide teachers in their assessment activities and so teachers have to design their own assessment tasks using the limited resources that are available to them.

2.3 Assessment in Secondary Schools

The Solomon Islands adopted its education system and introduced assessment and examination regime when formal education was introduced in the country in the late 1950s, when it was ruled by the colonial British administration. The introduction of formal schooling and its examination-oriented approach to assessment and evaluation of students' achievement of the subjects has been described by former teachers, researchers and commentators (Alamu, 2010; Croft, 2006; Kerapuke, 1991; Mellor, et al., 2001; Pongi, 2004b; Sade, 2009). The education system in the Solomon Islands and other neighbouring developing Pacific Island countries has been described as “legacies of old powers ... dominated by external summative examinations that drive a teacher-dominated didactic pedagogy” (N. Taylor, Vlassrdingerbroek, & Coll, 2003, p. 157). Such is the case in these Pacific Island countries that even when they gained their political independence, they made very few or only moderate changes (Pongi, 2004a).

At present in the Solomon Islands education system, the examination system is heavily criticised for using very restricted criteria to determine students' entrance to secondary school education, which measures only the most academically capable students who are then selected. Student access to secondary schools is further constrained by lack of space and financial resources to build classrooms fitted with facilities and equipment for teaching science, technology, and home economics (F. Rodie, et al., 2001). Indeed, because of insufficient places in the senior secondary schools, the country's education system has to resort to using national examinations to not only monitor achievement levels at the national and school levels against national curriculum standards but also use student results from the examinations to select students who are deemed capable of continuing to senior levels of the secondary education and other higher education institutions abroad (MEHRD, 2004b). Although the number of secondary schools has increased in more recent years, national examinations are still being used at key exit points of the education system, particularly at year six in primary (to be discontinued in 2015) year nine junior secondary levels, and in the senior secondary education levels (years 11, 12 and 13), to regulate the overall number of students progressing through the secondary level.

2.3.1 National examinations

Critics' and commentators' perspectives of the school-based assessment practice in the Solomon Islands are generally characterised as examination-oriented, norm-referenced, competitive and emphasise ranking and grading students' performance against their peers (MEHRD, 2007b, 2007c; Mellor, et al., 2001; Pongi, 2004a). These views of assessment are based largely on general observations of the school-based assessment and examination system, and interviews conducted with community leaders and, in some cases, practising teachers (Mellor, et al., 2001). Pongi (2004b), Mellor et al. (2001) and Thimmappa and Sharma (2003) indicate that testing is the dominant form of assessment used in the education systems of the Pacific Islands countries (including Solomon Islands) for assessing what students know, understand and can do, due partly to the adoption of and value attached to selective external examinations by those in authority since their introduction several decades ago.

According to Kerapuke (1991), the use of teacher-designed unit tests and end-of-term or end-of-year course examinations in the schools has been influenced to a large extent by the introduction of external examinations (e.g. Cambridge School Certificate, Hicks test) since they had been introduced by the British colonial administration in the Solomon Islands. These gained greater importance in the 1970s, when the need for selective examinations intensified, due partly to the limited spaces available in the school system, particularly secondary schools, and so examinations had to be used to select students who were academically capable to progress to the next stage of education. Thus, the Solomon Islands Secondary School Entrance Examination (SISSEE) which is sat at the end of year six was introduced to select students for available year seven places in junior secondary schools. Recently the SISSEE has come under criticism and there are plans that it will be phased out by 2015 (MEHRD, 2004b).

Opponents of the examination purport that it is doing more harm to the education of the majority of children who do not complete basic education and a few who get a placement and continue to progress to higher levels of education within the secondary education system (MEHRD, 2007b). Currently, externally set formal examinations are also being used at the end of year nine, in junior secondary and

in years 11, 12 and 13 in senior secondary school. The Solomon Islands Education Act 1978 and Examination policy provide some guidelines on assessment and examination to be used in the education system (Alamu, 2007). However, as this thesis was being written, work on the development of a school-wide assessment and examinations and curriculum policy had started. Despite this back-drop, there are currently new initiatives being implemented to strengthen basic education programmes for all Solomon Islands children, particularly at the compulsory levels of education (Kerapuke, 2005; MEHRD, 2007b).

The continued use of external examinations in year nine and the upper secondary education grade levels seem to have been accepted by parents and other stakeholders, although some parents are beginning to recognise the system's shortcomings, and perceive external examinations as "instruments" for terminating the education of their children at a low level of education (MEHRD, 2004b; Mellor, et al., 2001). However, there are other pertinent reasons why the Ministry of Education in the Solomon Islands has continued to use national examinations. According to the revised Education Act (1996), national examinations play important roles specific to the purpose and development of the secondary school education system (MEHRD, 1996). This policy statement clearly defends the use of national examinations, stating that they serve a sense of purpose for establishing the schools, and provide assurance of quality and credibility to the public, because they measure the work students produce against the national school curriculum goals and benchmarks (MEHRD, 1996).

A review of systems for the national secondary school examinations in the Commonwealth countries affirms the argument that safeguards the use and function of formal national examinations in developing countries including Solomon Islands. It is argued that national examination systems play a significant role, not only in exposing students' results publicly against national standards, but also in the selection of students for subsequent levels of education and employment opportunities (Bray, 1998; Bray & Adam, 2001). The findings of the study conducted by Bray and Adam (2001) suggested that educational policy-makers from the small states used national examination results as a basis for deciding on major education reforms that need to be undertaken to improve the

quality of education. While national examinations play a useful function in grading, selection, reporting and providing a mechanism for accountability, there are also negative effects associated with these selective examinations (Kerapuke, 2005; MEHRD, 2007b; Pongi, 2004a; Potter, 2005). In a review of school assessment systems in the Pacific Island countries, including Solomon Islands, Pongi (2004b) reported that “examinations and hence the selection processes have become so competitive that success in these examinations becomes the main focus of teaching and learning, as well as the standard teachers and students aim to achieve” (2004a, p. 14). There is general agreement amongst commentators in the region that national examinations in the Solomon Islands and other Pacific Island countries’ secondary schools dominate the curriculum and teaching and learning pedagogies and influence teachers regarding what and how specific subjects should be taught and assessed (Alamu, 2007; Kerapuke, 2005; Pongi, 2004a; Prior, Mellor, & Withers, 2001; F. Rodie, 1997).

Until 2006, only two subjects (English and Mathematics) of the nine learning areas offered at the year nine secondary education level were examined by the year nine national examination, and only a small proportion of the objectives were claimed to be actually examined (MEHRD, 2004b). Science examinations emphasise on the more easily tested theoretical aspects at the expense of practical skills and produce a distortion which is widely recognised in the schools. As long as examinations play such a crucial role, teachers will continue to narrow their focus and students will continue to restrict learning to what is being examined (MEHRD, 2007b).

When national examinations are used to determine students’ progress to higher levels of secondary education, both parents and schools put a lot of pressure on the teachers to ensure that the students succeed (MEHRD, 2007b; Pongi, 2004a). The backwash effect of restricted assessment practice is that teachers adjust their teaching to what the examination will cover to ensure that students score high marks, thereby distort effective teaching and learning (Biggs, 1996). According to critics of the national examination system in Solomon Islands, this backwash effect of assessment is understood to be widespread amongst year nine teachers and upper secondary school teachers (teaching year 10 and 11 classes) (MEHRD,

2007b), where national examinations are used to determine scholarship awards for students to study in overseas tertiary institutions and local students who wish to study in the local institutions.

Furthermore, commentators and critics of the current assessment and examination system argue that the focus of the national examinations may be too narrow, since other areas of the curriculum are not examined (MEHRD, 2007b). Currently, four subjects (science, mathematics, English and social studies) are included in the year nine national examinations, out of a total of nine subjects offered (Alamu, 2007). The non-examinable subjects in year nine include: agriculture, business studies, industrial arts, home economics and religious studies. The restricted school assessment practice tends to promote teacher and student attention on the subjects that are tested (MEHRD, 2007b). This leads to students and teachers undervaluing those subjects that are not tested (MEHRD, 2007b).

Other stakeholders perceive national examinations as selective tools for identifying an elite minority of students deemed suitable to continue with their schooling (Mellor, et al., 2001; Pongi, 2004a) beyond year nine secondary education. Currently, unplaced students exit at both year six primary and year nine and eleven in secondary. The majority of school-leavers return to their community, whilst others are enrolled in vocational and rural training centres, where they pursue life-skill related training.

Commentators' observations on the effect of the national examination system on teaching and learning paint a gloomy picture about summative assessment practices in the school system in the Solomon Islands. However, there is some evidence of positive cognitive benefits from summative assessments that could benefit the teachers, students and the education system as a whole (Harlen, 2004b, 2007, 2008; Shepard et al., 2005). It has been suggested that if teachers are to be supported to shift their focus on designing classroom-based summative tests by linking them to the curriculum standards and they need to learn strategies and criteria, they can improve their skills in assessment (Atkin, et al., 2001; Black, et al., 2010). Thus, teachers can develop quality summative tests that will yield valid and dependable inferences about student learning, performance and achievements.

It is therefore paramount for professional development providers to help teachers develop by working with teachers within the context of their teaching and assessment practices. Ways in which teachers' skills can be improved in developing assessment tasks that could engage their students in carrying out assessment tasks to measure their learning, performance and achievements should be promoted.

To minimise the effect of large-scale high stakes assessments on students particularly in an examination-oriented education system such as the Solomon Islands, it is necessary for teachers to consider alternative assessment methods that should be used to serve a summative purpose. Alternative assessments or 'practices of effective learning' as McTighe and O'Connor (2005) like to call them - such as essays, portfolios, performance-based assessments and project-based assessments can be used to assess a wide range of students' skills and abilities. These alternative assessments can allow students to apply their evaluating, reasoning, and problem-solving and communication skills, which neither classroom-based teacher-designed summative tests or large-scale assessments and standardised tests may not be able to measure sufficiently (Atkin, et al., 2001; Brookhart & Nitko, 2007; Looney, 2011).

2.4 The Curriculum and Assessment Reform

Over the past three decades, the Ministry of Education of the Solomon Islands has implemented several curriculum and assessment initiatives that were designed to support and improve teachers' classroom practices, considering the new curriculum and assessment frameworks that needed to be implemented (MEHRD, 2005b). The latest Ministry of Education initiative began in 2004, when it started implementing a major curriculum renewal programme. Its principle goal was to review and redevelop the national school curriculum so that it is made more relevant to the learning needs of Solomon Islands' children (MEHRD, 2004a, 2005b).

In science education, the curriculum reform is focusing on the revision and redevelopment of existing syllabuses, teacher's guides, and student books and other instructional resources for both primary and secondary schools, with the aim of improving the quality of the materials, and making them more culturally

relevant to the learning needs of Solomon Islands children. It is the belief of curriculum policy-makers, curriculum developers, educators, and officials from the Ministry of Education that the outcomes of the current reform will raise the quality of teaching and learning of students. In other words, improvement in the curriculum, teacher provision, and infrastructure development coupled with improved leadership at the school level will enable students to acquire worthwhile knowledge, skills, behaviours, attitudes and values that will allow them to contribute towards their well-being and survival (MEHRD, 2005b, 2007b).

The new approach to curriculum development in Solomon Islands is focusing on outcomes-based education. This is a major shift from the approach that the country adopted after independence in 1978, when the school curriculum was based solely on content to be taught and focused on what learners were expected to know, understand, or be able to demonstrate. This new approach affords also an outcomes-based approach to science curriculum design, with a focus on teaching and assessing student learning, performance and achievement against specified criteria (Elliott & Hughes, 1998; MEHRD, 2005b).

Specific to this reform was the objective that focused on the alignment of the curriculum, instruction, and assessment with national education goals (MEHRD, 2005b). While much is yet to be achieved in terms of the assessment frameworks and materials that need to be produced and developed for in-service professional development programmes for teachers, the policy statement that aims to address this new development has been launched (Coxon, 2008).

The relevant policy document states that review of the school assessment practices is inevitable and must be guided by effective assessment and curriculum principles (MEHRD, 2005b). Thus, under the current curriculum reform, it is envisaged that the new assessment and examination systems and support for teachers will:

- complement and support the revised school curriculum and promote improved teaching and learning practices in schools;
- provide valid and reliable information about student learning achievement;
- provide an efficient and fair assessment and examination system;

- provide formal certification for student performance achieved through a range of learning pathways;
- and provide transparent, valid and reliable data to support selection and placement processes (MEHRD, 2005b, p. 16).

There is agreement amongst educational policy decision-makers that school based assessment must focus on assessing students' competencies in their subjects to help teachers realistically assess students' abilities, provide models of good assessment practice, and lead to effective teaching which will increase students' performance and achievement (MEHRD, 2004b). The curriculum reform programme is part of a wider educational reform initiative that involves instructional and assessment reforms and professional development programmes that aim to familiarise and upgrade teachers' understanding of new curriculum and assessment frameworks (MEHRD, 2007b). An in-service teacher professional development programme can be regarded as essential to implementing the new curricula and the new assessment framework as well as to achieving lasting changes in teachers' classroom practices.

Assessment is generally seen as a vehicle for improving the quality of the country's teaching and learning (MEHRD, 2005b). However, some commentators argue that the timing of assessment reform may be long overdue in view of the existing school assessment practices, which may not be based on educational standards for today and in contrast to significant developments and changes in assessment taking place in other countries (MEHRD, 2007c).

2.5 Summary

This chapter described the contextual background to the study. It covered general information about the education system in the Solomon Islands, teacher education, the curriculum and the assessment and examination system that has been in use since the country gained independence in 1978. It provided information about the current education reform initiative that is aimed at improving the general quality of basic education in the country. Reference is made to the current curriculum reform programme which not only focuses on the development of culturally sensitive curriculum materials that aim to support teaching and learning but also

on the development of assessment policy and frameworks to help teachers better assess their students' learning, performance, and achievement in the subjects they take. This background information should help ground the reader with the context and the problem to help understand the argument presented in subsequent chapters.

The next chapter will review the literature pertaining to teachers' assessment practices and teacher professional learning and development.

CHAPTER THREE: LITERATURE REVIEW

SUMMATIVE ASSESSMENT PRACTICES AND TEACHER PROFESSIONAL DEVELOPMENT SUPPORT

3.1 Introduction

Educational researchers and educators who are concerned about the issues encountered in the educational assessment arena such as quality assessment and the assessment literacy level of teachers have called for the need to support the role of teachers in the assessment of students' learning (Assessment Reform Group, 2006; Black & Wiliam, 1998a; Gardner, Harlen, Hayward, & Stobart, 2010; Harlen, 2006b; Shepard, 2000, 2005a). According to Gardner et al. (2010) there is a need to place high value on teacher assessment needs, and to support teachers' professional development and assessment practices based on effective assessment principles and standards. Such calls are made in light of research evidence that indicates teachers are generally inadequately prepared and lack competence and skills in assessment (Mertler, 2005; Stiggins, 1991). Also, internationally, research has shown that frequent high-stakes testing influences teachers to 'teach to the test', which not only impacts negatively on students' motivation for learning, but also limits wider educational objectives (Barnes, Venkatakrishnan, & Brown, 2003; Black & Wiliam, 1998a; Harlen & Deakin, 2002).

The need for teachers to use student assessment results effectively in ways that will promote teaching and learning has also been the focus of recent debates and development on educational assessment (Timperley, 2009). An assessment data-driven approach is recommended, and there is general consensus that wide uses of assessment information can promote learning such as to provide additional support to students, and making changes to the teaching programme or curriculum, and more personalised or differentiated teaching and learning (Kirkup, Sizmur, Sturman, & Lewis, 2005).

Researchers on educational assessment have also revealed that better educational outcomes such as improved student achievement and improved policy decision-

making can be achieved, when the right kinds of assessment activities are employed and data generated from these activities are used effectively to inform teaching (Black & Wiliam, 1998b; Clarke, 2011; Heubert & Hause, 1999). Furthermore, international studies have shown that teachers need professional development support on an ongoing basis to improve their classroom teaching practices (Darling-Hammond, 2004; Darling-Hammond, et al., 2010; Darling-Hammond & Wentworth, 2010; Dufour & Eaker, 1998). Apparently, the issue of teacher assessment needs to be more valued and provision for teacher professional development opportunities remain the key challenge for many education systems (Bregman, 2008; Gardner, et al., 2010; Greaney & Kellaghan, 2008; Pongi, 2012; Ramirez, 2012; Suah & Ong, 2012).

The central argument of this thesis is that there is a need to recognise summative assessment as an integral component of classroom practice and the entire education and assessment systems. Furthermore, it is vital for education systems to provide ongoing professional support for teachers in the area of educational assessment so that they can continue to use summative assessments and the information derived to effectively inform practice and improve students' learning outcomes. This position is taken because it appears (based on the selected literature reviewed) summative assessment is being disregarded or considered as "...something quite distinct..." (Kennedy, et al., 2007, p. 6) by teachers, education stakeholders and critics of summative assessment.

Internationally, there has been a shift in emphasis on assessment focus, with less emphasis upon grading and ranking (summative) and more emphasis upon formative assessment to support teaching and learning. So there is now more emphasis upon more balanced assessment system that promotes the application of assessment methods that are the best fit for purpose to assess student learning (Harlen, 2005, 2007, 2008; Mansell & James, 2009; Stiggins, 2006). These authors argue that summative assessment tasks can be designed in accordance with effective principles and best practices of assessment and the prescribed curriculum outcomes. It is also argued that it is necessary to make high-stakes decision on students' performance using summative assessment tools and the data obtained in situations where prevailing circumstances cannot guarantee full access

for all students to both basic and higher education (such as in the case of Solomon Islands). It is also important to understand that the development and implementation of summative assessment supports standards, and subject content knowledge and skills reflect students' experiences and learning outcomes (Atkin, et al., 2001), rather than promote the negative perspectives people have that summative assessment only summarises learning and the 'backwash' effects associated with it (Biggs, 1998a; Harlen, 2004a).

The underlying rationale for this study is therefore to gain better understanding of teachers' summative assessment practices including their strengths, weaknesses and their professional learning needs, from different countries and contexts and from these, plan and implement a professional development intervention for the six science teachers that this study targeted.

This chapter begins by providing an outline of assessment of student learning achievements; what assessment means, assessment systems and the reasons for promoting the use and further development of summative assessment in the education system. This is followed by an overview of factors that affect teachers' assessment practices such as teacher preparation, teacher beliefs about practice as it relates to assessment, changing teacher practice, professional development and models of professional practice, and research studies which are related to the impact of professional development on teachers' assessment practices. The underlying intent of this review is to propose an assessment practices framework using ideas and information synthesised from the review of literature to explore teachers' summative assessment practices in the classroom.

3.2 Assessment of Student's Learning Achievements

In the literature reviewed, assessment and the terminologies that are associated with assessment are defined in multiple ways by educators, researchers, and institutions, and attention is drawn to concerns regarding the lack of consensus on the use of definitions given (Taras, 2005). A common understanding of assessment is therefore necessary so that the process and basic parameters of assessment can be considered universally and technically for most education systems and contexts (Taras, 2010).

In this study, assessment is described as the process of identifying, gathering, and interpreting information on what students know, understand, and can do, in order to make informed decisions about what to do next in the educational process (Clarke, 2011, p. 1). This definition allows us to think of assessment, as used in this study, to mean more than testing – however, it is not synonymous with examination. As defined, assessment is viewed as a process that helps teachers to obtain information about what students are learning, know, and are capable of doing so that they can be able to confirm their students' learning progress and achievement levels against a set of curriculum goals or standards, and act accordingly to those students who might perform below the expected standard. Assessment often forms the core body of information upon which teachers report on the achievement of individual learners – to students themselves, parents, other teachers and others that need such information (Brookhart & Nitko, 2007; Harlen, 2008).

To obtain information about students' learning, teachers employ a variety of assessments that attempt to link assessment forms, tasks or activities to specific curriculum outcomes related to essential subject content knowledge and skills that students are expected to learn and or master (Atkin, et al., 2001; Pellegrino, 2006; Squires, 2004). In schools and classrooms, assessment takes several forms including but not limited to; formal and informal observation, asking students questions and discussions with students, formal assessment tasks, formative assessments, summative assessment, comparing evidence of achievement with other students, and comparing evidence of achievement against a set of curriculum goals (Atkin, Coffey, Moorthy, Sato, & Thibeault, 2005; Withers, 2005).

There is increased interest and commitment shown by governments and development partners (e.g. the World Bank) in recent years to improve the overall quality of education (particularly in the developing countries) that will contribute to improved student learning outcomes. This requires more than ever, the development of strong systems for assessing student learning (Clarke, 2011; Greaney & Kellaghan, 2008). The types of assessment that are employed in a school-wide assessment system and the reasons for using them are discussed next.

3.2.1 Assessment systems, types of assessment and their purposes

An assessment system refers to “a group of policies, structure, practices and tools for generating and using information on student learning achievement” (Clarke, 2011, p. 1). Three types of assessment are typically common in an assessment system; (i) classroom assessments, (ii) examinations, and (ii) large-scale survey assessments. These assessments are used variously to inform decisions at the policy, school and classroom level. Each kind of assessment and the purpose it serves is discussed below.

Classroom assessments

Classroom assessments comprise of a variety of assessment tasks or activities that are designed by teachers and administered to students to find out what they are learning and can do. The key purpose for classroom assessment is to provide information, which teachers can then use to identify their students’ strengths and learning needs to inform their instructional decisions (Black & Wiliam, 1998a). In the classroom environment, assessment is the primary means through which assessment affects learning. It is through classroom assessment and the information derived from the types of assessment employed and analyses of the data that the teacher constructs a picture of the capabilities of individual students (Brookhart & Nitko, 2007). The next steps that a teacher needs to consider to improve his/her own teaching and student learning are planned and implemented accordingly (Alberta Education, 2006; Black & Wiliam, 1998a; Brookhart & Nitko).

It has long been argued in assessment literature that there is a strong link between high quality assessment and better learning outcomes. A review of studies on educational assessment by Black and Wiliam (1998a) revealed that students make the largest gains in terms of their performance when teachers used quality assessment tasks and information derived to inform their instructional decisions.

Classroom-based assessment is synonymous with ‘assessment for learning’ (also called *formative assessment*). Cowie and Bell (1999) describe formative assessment as “... the process used by teachers to recognise, and respond to student learning, in order to enhance that learning, during the [teaching and]

learning” process (p. 101). Formative assessment is carried out by teachers as an integral part of teaching. It is an ongoing and regular part of the teacher’s role (Harlen, 2008). Four core elements of assessment that meet the criteria for being considered assessment for learning in enhancing improvement in student learning are; (i) identifying the learning gap of students, (ii) feedback, (iii) student involvement and (iv) learning progressions (Assessment Reform Group, 1999; Harlen, 2008; Heritage, 2007). However, teachers need to have a clear understanding of each of these elements of assessment for learning to be able to employ the strategies effectively in their classrooms. It is recognised that formative assessment is not just a simple assessment process but rather “a complex educational and indeed social process”, that when applied properly by teachers, can enhance positive student learning outcomes (Kennedy, et al., 2007, pp. 5-6).

Educational assessment researchers and policy makers, to a lesser extent, have recognised the potential of formative assessment in improving learning and have allocated resources to the development of better strategies in the classroom. Teachers need to be trained so that they can confidently practice formative assessment in their classrooms (Pryor & Crossouard, 2005; Torrance & Pryor, 2001).

International studies have revealed that priority is now given by OECD and in most countries to the need for assessment to inform teaching and learning (Carless, 2005, 2007; OECD, 2005b; Torrance & Pryor, 2001). However, the challenge facing developing countries such as the Small Island States of the Pacific, including Solomon Islands (Pongi, 2004a, 2012) and others (Morris, Lo, Chik, & Chan, 2000), when formative assessment is promoted as an alternative assessment approach in the education system, is the general reluctance of teachers to shift emphasis in their assessment practices. Pongi mentions that attempts to shift teachers’ assessment practices from testing to formative assessment in many Pacific Islands countries have also been hindered to a large extent by “out-dated policies and by a non-conducive environment in which assessment operates” (p. 2). He links these factors to the dominance of examinations in many of these Pacific Island countries education systems.

Examinations

Examination and tests are often perceived as forms of summative assessment because they are administered to students specifically to draw information about individual students' overall performance or achievement at the end of a teaching period (Harlen, 2007). Therefore, summative assessment information gives an overall impression of students' overall achievement in a given course. It sums up what a student has learned, know and can do. Because summative assessment is used to evaluate what a student has learned at a particular time, it is also referred to as *assessment of learning* (Black & Wiliam, 1998a, Harlen, 2007).

At the school and classroom level, summative assessments are typically used to generate and accumulate marks so that grades can be determined to represent individual students' overall level of attainment. One of the primary purposes for using school/or classroom-based summative assessment is to obtain information/data to report students' progress and achievements to parents, students themselves, the students' next teacher, and others that may need such information (Harlen, 2007, 2008; James, 2004). In the case of external formal large-scale summative assessments (e.g. examinations), the data/information generated is used for; reporting, certification, selection and placement of students for further education, evaluation of the effectiveness of methods of teachings and curricula, and to monitor standards within the school, district, and nationally (Harlen, 2007, 2008; James, 2004). It is important to understand that the applications of summative assessment information both within and outside the school indicates that it has a central place and role in the school system and should be seen as part of a comprehensive assessment system and plan in any education system (Biggs, 1998a; Harlen, 2007).

Examinations can be grouped into two main uses - 'internal' and 'external' to the school community (Harlen, 2008). Teacher-made unit tests and end of term or end of year examinations are used internally for grading, record keeping and reporting students' achievements. In contrast, external examinations (also referred to as national or public examinations) are set by examiners outside the school community. The external uses of examinations include determining whether students have performed well enough to meet the standards set. Hence,

examination results are used to select students who are deemed capable of progressing to higher education levels, and to award certificates to confirm their achievements (Harlen). These examinations are rarely used by teachers to inform their instructional practices (Crooks, 2004) though new studies have shown that summative assessment information can also be used to formatively support learning (Black, Harrison, Hodgen, Marshall, & Serret, 2011; Black, Harrison, Lee, & Wiliam, 2004; Harlen, 2009; McTighe & O'Connor, 2005).

A serious concern raised against national examinations that are used for high-stakes decision making is its negative 'backwash' effects on what is taught and what is learned by students (Biggs, 1998a). It is claimed that national examinations can narrow the focus of the curriculum (Wiliam, 2001) and cause negative consequences on the wider educational objectives in terms of skills and knowledge profile of students (Barnes, et al., 2003; Greaney & Kellaghan, 2008; Harlen & Deakin, 2002). In the Solomon Islands, not all subjects are offered; for example, in the year nine national examinations, only four out of nine subjects are examinable (MEHRD, 2004b). This makes students to think of the non-examinable subjects as of less importance or value and are often not too keen to study them. It is crucial to treat subjects offered in the schools as of equal importance and value.

Large-scale survey assessments, which are featured in the discussion in the next section, are considered as a summative assessment type. These are tests that provide summaries of students' learning achievements in specific learning areas or subjects at the end of a course or teaching period.

Large-scale survey assessments

This type of assessment includes standardised tests that are employed in the education system to assess the level of student achievement in specific subjects such as literacy, numeracy and science. The skills from these subjects are critical to the world of learning and one of the core objectives of education systems is to ensure that all students tested are successful in these areas of learning (Clarke, 2011). If not, remedial interventions will need to be taken to improve student achievement levels.

Large-scale assessments are summative tests that are designed by professional organisations or experts outside the school community. These tests are designed purposefully to monitor learning trends at the system levels as well as to determine factors that influence students' performance and learning (Kellaghan & Greaney, 2005). According to Volante (2005), teachers use standardised test scores to identify areas of strengths and weakness of their students in specific curriculum areas. For example, content not fully understood by students provides teachers with valuable information to assess their teaching. It is important that student results from standardised tests are made available to schools and teachers in a timely manner for action. Teachers may need to attend professional development to improve their practice if there are gaps in student learning.

Standardised test results provide policy makers with evidence to judge the quality of the school programmes and policies (Volante, 2005). Thus, the information derived from large-scale survey assessments can be used to inform decisions that could oblige policy makers to enforce remedial interventions to raise student achievement levels in those key curriculum areas, where students may not have performed (Greaney & Kellaghan, 2008). One of the limitations of standardised tests is that they are often a sample of a restricted range of student knowledge and skills. Often, the mandated curriculum framework requires students to demonstrate proficiency in a range of learning areas and disciplines, instead standardised tests are claimed to focus almost exclusively on selected aspects of reading, mathematics and science (Behuniak, 2002; Volante, 2005).

There are several international and regional standardised tests of achievement that are used currently to monitor learning trends in specific learning areas across the globe. The following are examples; Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS), Southern and East African Consortium for Monitoring Educational Quality (SACMEQ) (Clarke, 2011), and Pacific Islands Literacy and Numeracy Assessments (PILNA) (Technical Working Group, 2012). These large-scale survey assessments are used for benchmarking student achievement from a number of countries who are affiliated with the international and regional testing bodies. Information generated from international and regional standardised tests

are employed alongside school data routinely to inform selection of interventions to address learning performance issues.

Large-scale survey assessments have contributed to a growing educational assessment literature, which have identified factors that have the greatest measurable impact on learning outcomes (Klenowski, 2010; Koh, 2011; OECD, 2007, 2009). The literature has pointed out that more rigorous assessment of learning can help to improve learning outcomes when the assessment information is made available to teachers, students, parents, schools and system management and the wider stakeholders. Moreover, assessment information should be used by teachers, school leaders and managers to provide guidance on how to focus resources on key elements that have the potential to make a positive impact on teaching and learning (e.g. teachers, teacher training, and professional development activities) (Technical Working Group, 2012). It is strongly recommended that information obtained from large-scale survey assessments should be used by stakeholders at community, local, and national levels to hold teachers, schools and the entire education system accountable (Darling-Hammond, 2004; Linn, 2000; Volante, 2005).

High-performing assessment systems

In a study that examined the assessment systems of high-achieving countries (e.g. Australia, Finland, Hong Kong, Singapore, Sweden, and UK) it was found that the education systems in these countries integrated curriculum, instruction, and assessment to improve the quality of both teaching and learning (Darling-Hammond, et al., 2010). The study also revealed that in an effort to expand their examination system, the high-performing education systems promoted and supported teachers to employ open-ended performance tasks and school-based assessments. These assessment tasks provide students opportunities to develop skills, which engage them to seek and organise information to solve problems, design and conduct investigations, analyse and synthesise data and apply what they learn to new situations.

The current study explored Solomon Islands science teachers' summative assessment practices within the school-wide assessment system established. It will

be worthwhile to identify the major types of assessment science teachers use to assess their students' learning and the influences that made them choose the type of assessment they actually use. It is the focus of this study to identify the types of assessment that Solomon Islands secondary science teachers choose to assess their students learning achievement with, and to find out what and how they use students' results.

Having established what an assessment system is like and recognising that examinations and large-scale survey assessments are summative in nature, it is imperative that the underlying reasons for promoting summative assessment are discussed. The reason for doing this is to reinforce the main argument mentioned in the introduction of this chapter – which is to promote and to develop a deeper understanding of summative assessment by exploring ways in which teachers can effectively use it to assess their students' overall learning achievements.

The potential of summative assessment and why it should be promoted

International trends in educational assessment promote a shift in emphasis of educational assessment – from assessment of learning/or summative assessment that focuses on grading, ranking, selection, and certification towards assessment for learning/or formative assessment, where the focus is on improving teaching and learning. This global shift in educational assessment recognises formative assessment as the most important purpose and approach for enhancing teaching and learning and has received overwhelmingly support for implementation in education system right across the world (Black & Wiliam, 1998a; Darling-Hammond, Atkin, Sato, & Wei, 2006; OECD, 2005a, 2005b; Torrance & Pryor, 2001; Wiliam, Lee, Harrison, & Black, 2004). The promotion of formative assessment in the literature and practice appears to send a message that there is reluctance to consider the issues associated with summative assessment, let alone explore ways to develop it further to support monitoring of learning against educational goals or to build teachers' capacity so that they can continue to use summative assessment; also to explore assessment strategies and procedures that might enable teachers to strengthen their practices to satisfy the purpose of assessment in the education system.

More attention is presently given to formative assessment - this has the tendency to neglect summative assessment (Kennedy, et al., 2007). In fact, the function of summative assessment in the education system has been so fiercely debated to a large extent that it is regarded as the major threat to motivation of students' learning (Black & Wiliam, 1998a, 1998b; Harlen & Deakin, 2002; Stiggins, 2002, 2008; Wiliam, 2001; Wiliam & Black, 1996). For example, Wiliam (2001, p.3) expresses the resentment critics hold about summative assessment: "Our system of tests and examinations distorts our school curricula and produces results that are of limited reliability and of doubtful validity".

Despite the controversy and disagreement critics have about summative assessment, research has consistently revealed that it is the most dominant type of assessment used in the education system in several countries across the globe (Harlen, 2004a, 2004b; Morrison & Tang, 2002; Pong & Chow, 2002; Pong, 2012). This sentiment calls for the need to not only gain a better understanding of summative assessment but also to explore new ways in which educators can harness its potential (Kennedy, et al., 2007). This way, the negative perception people hold about summative assessment can be improved in terms of how it should be used to ascertain students' competencies and achievement as well as to enhance educational processes that will enable students to gain valued educational outcomes.

There is limited literature that highlights positive benefits from summative assessment, apart from what is already known about its role and function in the education systems. Shepard et al. (2005) reported the results of studies reviewed by Crooks (1988) which revealed that students studied more and learned more when they were informed in advance that they were going to be tested. According to Shepard et al. (2005) this has three advantages related to learning. First, the preparation work that students are engaged in, before the tests are taken enabled them to review and relearn concepts they might not quite understand when it is taught to students for the first time. Second, the testing experience itself engages students to mentally process the content of what is learned – to a large extent this depends on the quality of the test items, nevertheless, it can enable students to exploit the mental process (Crooks, 1988; Shepard, et al., 2005). Third, tests

sample key outcomes that students are expected to learn and to gain proficiency, which also lay the foundation for learning future topics. Shepard et al. (2005) agree with Crooks (1988) who explains that the learning processes students undergo from lessons in class till the moment they sit the test is supported by cognitive theory. This theory suggests that students benefit from the opportunities that allow them to show their competence and to work toward increasing proficiency as defined by criteria that are used to make judgements of students' achievement (Pellegrino, Baxter & Glaser, 1999, cited in Shepard et al. (2005). The learning processes students go through in preparation for the summative assessment process are valued and students should be encouraged to use a variety of other learning strategies to benefit from their educational experiences.

Of relevance to this discussion on ways to develop our understanding about summative assessment and the need to promote it, is information revealed through a study carried out by the United Kingdom (UK) based Assessment Systems for the Future (ASF) Project team. The ASF Project team explored and identified ways in which teachers played a much bigger role in designing internal summative assessments, and in the use of summative information obtained for low-stakes decision making processes such as setting new goals for teaching and learning or to allocate much needed resources. The ASF Project team also explored with the teachers they engaged, formative ways of using summative assessment to enhance teaching and learning (Assessment Systems for the Future, 2005). According to Stiggins (2002) and Harlen (2005), it is possible to use summative assessment formatively but at the same time caution that it is important for teachers to have a clear mindset and skills to avoid conflicts associated with using assessments to serve multiple purposes, which is shared by other researchers and scholars (Crooks, 2004; Harlen, 2005). However, there is potential in using summative assessments in formative ways as discussed in the next section

Formative use of summative assessment

Boud (2005) and Chappuis and Stiggins (2008) support the use of summative assessment information such as when students receive immediate feedback on a test they have taken to know which questions they got incorrect. They can learn

from the mistakes they make immediately if they are informed. According to Stephen and Jan Chappuis (2008), teacher-designed tests can be “adapted to formative use because their results are immediately available and their learning targets have been more recently taught” (p. 15). In contrast, the results of external large-scale high-stakes examinations are often not available to teachers or if they are available this is only after some time and so they can be of no immediate benefit. Information from past examinations can however be used by teachers with a new group of students (Bell & Cowie, 2001). Research has shown that teachers have found past examination useful in preparing their students for external high stakes examinations (Black, Harrison, Lee, Marshall, & Wiliam, 2004; Black & Wiliam, 1998b; Crooks, 2004; Garrison, Chander, & Ehringhaus, 2009). Used in formative ways summative tests can be served as diagnostic tools to identify students’ weaknesses and to highlight areas that may be needed to be taught again, but only if it is not done at the very end of a course.

In studies where summative assessment information has been used to enhance teaching and learning, it was noted that using summative tests in formative ways does help students realise their strengths and weakness, and identify strategies to improve their weaknesses. For example, in the United Kingdom, the study conducted by Black, Harrison, Lee, Marshall, and Wiliam (2004) showed that the teachers who were involved in professional development that focused on using summative tests in formative ways reported positive outcomes in student learning. Their professional development intervention involved teachers in developing three main activities to make their summative tests useful. First, teachers engaged their students to make revision prior to summative testing more effective through ‘peer and self-assessments’. Second, students were given the opportunity to design their practice test questions, which they swapped with their peers and using the criteria they prepared (Black, Harrison, Lee, Marshall, et al., 2004, p. 15). Third, the students were given a teacher-designed summative test. The overall findings of the study indicated students’ learning strategies improved when they used summative tests for a formative purpose. The findings of the study also revealed that teachers felt more enthusiastic about selecting and using assessment methods to enhance their teaching and assessment practices (Black, Harrison, Lee, Marshall, et al., 2004).

In summary research and discourses on educational assessments have highlighted how teachers can use summative information formatively, in order to:

- draw students into assessment processes;
- assist students understand and become familiar with the summative assessment criteria;
- improve motivations and self-esteem;
- develop independent learning skills;
- increase students' understanding of the standards they are aiming for;
- contribute to raising standards (Primary National Strategy, 2004, p. 76).

However, it is noted that although there are possibilities for using summative information formatively, there is little research into this. Therefore there is need for researchers to explore how students might benefit from the use of summative assessments in formative ways.

So far in the discussion, we have seen that the new ways in which summative assessments are utilised help reshape its role, function and perspectives people have about summative assessment and why it should not be neglected. Perhaps a new function of summative assessment which is being pursued lies in its potential to be used as a basis for monitoring learning trends as is done with large-scale survey assessments or standardised tests (Kennedy, et al., 2007).

Large-scale assessment surveys are currently being used for system wide monitoring of learning in several countries. However, monitoring tests that can be developed at the school level as done in Hong Kong with the Basic Competency Assessment at grade three and six and in New South Wales, Australia primary schools should be promoted in other education systems. Again, these examples demonstrate new developments that promote the function of summative assessment, which involves low-stakes decision making. In other words, summative assessment information is being used formatively to support and improve teaching and learning. Such use of monitoring tests should be encouraged and there is hope that such use of summative tests can and will lessen the negative perceptions that critics have about summative assessments or the backwash effect associated with high-stakes examinations.

However, it is critical that the monitoring tests or teacher-designed assessment tasks should promote desirable learning processes and curriculum outcomes. This implies that when designing internal summative assessments, the forms of assessment (e.g. factual recall questions, multiple choice questions) that is likely to result in negative backwash effect should be avoided (Kennedy, et al., 2007). Instead, performance based assessments such as projects, portfolios, and investigations with clear criteria and guidelines for students to follow and which are likely to promote application of skills in real-life situations should be the main focus of internal summative assessment (Atkin, et al., 2001; Atkin & Coffey, 2003; McTighe & O'Connor, 2005).

Finally, the need to operate an effective school-wide assessment system which provides a range of assessment information and data is emphasised so is the urge to carry out national assessments (which are summative in nature) over an agreed period of time. Governments require student assessment data and information apart from other school information to provide feedback on “a limited number of outcome measures that are considered important by policy makers, politicians, and the broader educational community” (Greaney & Kellaghan, 2008, p. 18). It is possible for assessment agencies to collect classroom assessment data (derived from formative assessment) from schools and to provide them to policy makers and other stakeholders, who need to know whether or not students are meeting the standards set. However, concerns are often raised about the validity of classroom assessment data particularly from assessment tasks designed by teachers themselves (Black, et al., 2010; Harlen, 2004a; Stobart, 2008b; Wiliam, 2008). The concerns can be addressed provided that teachers are up-skilled and to develop valid assessments and criteria that measure learning outcomes and standards set by the curricula on offer.

Large-scale survey assessments are often considered to be more valid than classroom-based assessments (Black & Wiliam, 2006; Looney, 2011). Hence, the function of standardised tests in determining students’ performance and learning trends for remedial purposes is quite critical at present and well into the future. These are forms of summative assessment that will continue to provide vital information on the operation of the education system - ways to improve the

quality of education (Greaney & Kellaghan, 2008). Governments and policy makers in particular use national assessments to ascertain whether the quality of education at the national level has improved, declined, or remained unchanged and to consider the necessary steps that need to be taken to improve the quality of education for all citizens (Greaney & Kellaghan). As the 'push' for quality education becomes the key agenda for education systems, valid and reliable data and information and their uses becomes critically important as they tell policy makers and other stakeholders the 'health' of the education system a (Greaney & Kellaghan, 2008; Looney).

Quality of assessment

Assessment quality refers to the instruments, processes and procedures used for assessment activity (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999). Assessment quality is an important consideration that is applied in all types of assessment covered in this discussion. It set guidelines for ensuring credibility and dependability of the assessment used to measure student learning (Stobart, 2006, 2008c). Thus, assessment quality covers issues related to the design of assessment items or tasks, procedures, implementation of the assessment task, analysis of data, interpretation, formulating inferences and communicating students' results to the targeted audience (Brookhart & Nitko, 2007; Heubert & Hause, 1999; Shepard, 2000).

Several professional assessment organisations and experts have cautioned against assessment tasks or activities that do not meet the quality criteria of assessment in terms of its design and selection of items (American Educational Research Association, et al., 1999). Poorly designed assessment activities can contribute to poor decision making in relation to student learning and performance (P. Anderson & Morgan, 2008; Clarke; Stobart, 2008a). Two central assessment requirements are validity and reliability. It is essential that an assessment task produces precise data (reliability) when given to different cohorts of students (from the same grade) over time. This is an important consideration for high stakes examination and standardised tests that seek to monitor student performance and learning trends (Clarke, 2011). According to Stobart (2008c)

unreliable test scores undermine confidence in their interpretation and this can lead to misinterpretation of the scores and thus student performance. The test scores must also be valid – that is, the test scores should represent the curriculum outcomes that are valued and taught and its intended use – to report student achievement level against the curriculum outcomes. Validity therefore refers to the extent to which inferences made by a teacher in regards to the student's overall achievement being assessed or tested are accurate because the testing tool aligns with the intended curriculum/learning outcomes and the teaching and learning associated (Harlen, 2009; Stobart, 2006, 2008c; Wiliam, 2008).

According to scholars, two major threats to test score validity are; not being able to assess a full range of learning outcomes that need to be assessed (Newton, 2005), and differences between the language of instruction and the language of testing (P. Anderson & Morgan, 2008; Clarke, 2011), which can confuse students to respond appropriately to the test items. This requires teachers to think through validity considerations carefully and to select the type of assessment fit for the purpose (Mansell & James, 2009). It is important to plan a test or assessment task which should include the following activities; construction of test items or questions that measure the abilities to be demonstrated by students; its link to the curriculum outcomes and what and how the data obtained will be used (Stobart, 2008a).

The next section explores a range of factors that influence assessment practices. These factors have both positive and negative impacts on teaching and learning and, therefore, the need is to explore them as their implications have consequences to classroom practices.

3.3 Factors that Influence Teachers' Assessment Practices

There is general consensus among educational researchers that the decisions made by educators in regard to what the purpose of assessment is used for at policy, school and classroom levels is a key influential factor affecting teachers' assessment practices (Mansell & James 2009). However, it is not the only factor that affects teachers' assessment practices – there are other sources of influences that educational researchers have found that affect teachers' assessment practices

at varying degrees such as; (i) assessment beliefs, (ii) preparation of teachers and their assessment literacy levels, (iii) externally designed assessment (e.g. examinations and standardised tests of achievements) and (iv) curriculum reform and professional development. These are discussed next. But before these factors are discussed the meaning of assessment practices as used in this study is explained.

3.3.1 Assessment practices

Following Scribner and Cole (1981, cited in Saxe, Franke, Gearhart, Howard, & Crockett, 1997), assessment practices is conceptualised in this study, in terms of assessment tools, knowledge, and understanding and skills that support and constrain the implementation of an effective assessment at policy, school and classroom level. An assessment tool refers to a type (e.g. classroom assessment) and form of assessment (e.g. multiple-choice) that a teacher employs to elicit performances (e.g. assessment task or test) from students (Brookhart & Nitko, 2007). Skills refer to the actions involved in the implementation of assessment practices in the classrooms (Saxe, et al., 1997). Thus, assessment practice engage teachers to plan, design, implement assessment tasks, record and analyse data, and determine grade, interpret assessment data or information, and to communicate students' results as well as use of assessment information in accordance with the intended purpose (Brookhart & Nitko, 2007; Brooks, 2001).

In an effective assessment program, teachers are required to employ a variety of assessment tasks and tests that assess the different learning abilities of students as a result of the teaching-learning process (Black & Wiliam, 1998; Clarke, 2011). These assessment tasks and tests are given various titles according to the types of information that each assessment task or test is required to generate and to be used for. For instance, Kanu (2002, cited in Atkins, 2010) categorises three types of assessment tasks according to the type of information, knowledge and skills students are required to demonstrate as a result of learning. For example, a typical teacher-designed topic test can be employed to demonstrate students' abilities to recall facts. An information-based assessment task provides detailed information that demonstrates students' ability to reflect on and express their attitudes towards an issue or topic that affect society. It also involves students to apply their

reasoning and critical thinking skills (Zimmerman, 2006). Performance-based assessment tasks require students to demonstrate mastery of important skills and their ability to create product (Brookhart & Nitko, 2007). Performance-based assessment tasks also help students to demonstrate their problem-solving and analytical skills. Because these assessment tasks focus on assessing high order cognitive skills than recall of factual knowledge, they are highly recommended for enabling students to demonstrate deep levels of understanding (Brookhart & Nitko, 2007; Harlen, 2007).

Studies on educational assessment practices indicate that most teachers usually prefer to use tests and examinations to assess their students' learning (Airasian, 2001; Black & Wiliam, 1998a; Crooks, 1988; Pongi, 2004a; Stiggins & Conklin, 1992). Research also indicates that in the case of tests, teachers use mainly multiple choice items (obtained from other sources) and short answer questions more often than other forms of assessments (Gullickson, 1993). Assessment practices of Solomon Islands science teachers have not been well investigated, hence this study was carried out to identify the current assessment practices of six science teachers as well as to identify the factors that influence their practices. Beliefs teachers hold about teaching, learning and assessment also influence their instructional decisions and practices and are discussed next.

3.3.2 Assessment beliefs

Beliefs are "...ideas, thoughts and knowledge that individuals perceive to be true or wanted to be true. Beliefs do not need verification and often, cannot be verified (e.g. opinion)" (Murphy & Mason, 2006, p. 308). According to Bandura (1997) beliefs are thought to be the best indicators of the decisions people make throughout their lives. A substantial number of studies reveal that teacher beliefs have direct influence on their instructional practices, which could ultimately affect students' behaviour (Clark & Peterson, 1986; Levitt, 2002; Pajares, 1992; Prawat, 1992). That is, teachers' beliefs influence the decisions they make and this explains why teachers teach and assess the way they do in the classroom (Atkin, et al., 2001; Pellegrino, Chudowsky, & Glaser, 2001). The challenge to teachers' beliefs is when major curriculum and assessment reforms are implemented in the education system and teachers' are expected to adopt policy change in practice in

accordance with reform objectives (Vandeyar, Killen, & Killen, 2006). For example, in an assessment reform in Hong Kong, the teachers resisted to shift from the dominant examination and testing culture, to a more flexible assessment for learning, where teachers are expected to employ a variety of assessment techniques and to use the information obtained to support learning (Biggs, 1998b; Carless, 2005). Based on an analysis of early implementation of assessment for learning in Hong Kong, Carless (2005) pointed out that hindrance to the reform was to do with teachers' existing beliefs being not congruent with the assessment elements that were promoted to teachers. He suggested that for such reforms to be accepted by teachers would need considerable teacher development work and associated professional support. This sentiment resonates well with several studies that reported on the barriers to science education reform initiatives (Czerniak & Lumpe, 1996; Remesal, 2011), which focused on desired teacher beliefs to support changes in practice, only to find that teachers were not prepared to make considerable shifts that the researchers had anticipated (Lyon, 2011; Vandeyar, et al., 2006). Lee (2004) conducted a study to explore pedagogy that integrates culture and language with science content. He found that it took teachers time to implement the pedagogy and therefore the change was gradual and not instant. There were several reasons for this outcome; the pedagogy introduced was not only found to be demanding and required teachers to reflect on their existing practices as they tried to assimilate new teaching strategies, but teachers also required formal training, and extensive professional development support (Lee, 2004).

Furthermore, studies that explored the role teachers play in policy implementation regarding *Teacher Assessment Scheme* (TAS) in Hong Kong (Cheung, 2002; Yung, 2001) found that TAS policies needed to address teacher's beliefs in order for them to fully adopt the programme in their classroom practices. Similar findings were obtained in a study conducted by Tunstall (2001) who reported that teachers had their final say in implementing the National Curriculum Assessment (NCA) policy in England when they found that their beliefs were in conflict with the NCA policy. These and the findings of other studies have revealed that teachers in various contexts and with various backgrounds appeared to be sceptical about mandated change imposed on them by the system (Bailey, 2000).

However, other studies also reported that teachers were involved in the reform process and learned the outcomes as a result of their active and meaningful participation (Briscoe & Wells, 2002; Fullan, 2003; Hand & Prain, 2002; Horn, 2002; Sutherland, 2004; Torrance & Pryor, 2001).

Vandeyar et al. (2006) argue that it is challenging to change teachers' beliefs because their beliefs about assessment are situation and subject specific, and are unlikely to be removed from the context. Teachers can respond to reform initiative if there is convincing evidence that positive outcomes would be achieved in their classroom practices. Black and Wiliam (1998b) argue that if teachers' assessment beliefs contradict current views of effective assessment practices, those beliefs would hinder efforts to restructure assessment practices as well. Tobin, Tippins, and Gallard (1994) argued that teacher beliefs are a key determinant of variations in classroom practices.

Teachers' beliefs, experiences, and knowledge of assessment need to be examined and understood, because how teachers apply teaching in the classroom, and how they assess their students' learning, and what they believe students should learn and demonstrate at the end of teaching, is influenced by their educational experiences, knowledge and beliefs (Bleim & Davinroy, 1997; Jansen, 2001; McMillan, Myran, & Workman, 2002; McMunn, McColskey, & Butler, 2003; Pajares, 2008; Tierney, 2006). So an investigation of teachers' assessment practices in the classroom should be integrated with an examination of the beliefs teachers hold about those assessment practices and about the nature of the teaching and learning (Munby & Lock, 2000, p. 267). Teachers develop their beliefs and knowledge of assessment as a result of their educational experiences both as student-teachers and as practising teachers. The literature that indicates whether or not teachers are prepared in their roles as teachers, learners, and assessors of students' learning is examined next.

3.3.3 Preparation of teachers and their assessment literacy levels

Enabling teacher education institutions and education systems to provide quality professional learning opportunities to both preservice and in-service teachers is crucial in achieving quality teaching and learning (Darling-Hammond, Wei,

Andree, Richardson, & Orphanos, 2009). Teacher education institutions should offer appropriate courses on educational assessment that adequately prepare teachers to competently plan, design, implement, analyse, interpret, report and use assessment information to inform their teaching practices (Stiggins, 1992, 1998). Similarly, education systems need to provide continuing professional development programmes that can enhance teacher professional learning and development in assessment. However, studies conducted to determine how well teachers had been prepared in their teaching roles, in their initial teacher education programme showed mixed results. Some teachers were sufficiently prepared while others were not and needed continued support to improve their assessment literacy (Achbacher, 1999; Marson & Pigge, 1993; Mertler, 1999; Schafe, 1991; Stiggins, 1999a, 2001; Stiggins & Conklin, 1992; Wise, Lukin, & Roos, 1991).

Several reasons are given for this disparity in training teachers to be competent in assessment. For example, early studies conducted in the United States showed that teacher education institutions did not offer relevant courses in educational measurement and assessment procedures (Mertler, 1999; Stiggins, 1999b). While other studies revealed that the courses offered in assessment used traditional teacher preparation approaches that appeared insufficient in matching with what the teachers needed to know or do for classroom practices (Schafe, 1991). Studies conducted in the United Kingdom also found that teachers had difficulty designing quality assessments that were valid and reliable (Wiliam & Black, 1996). Wiliam and Black pointed out that teachers particularly found designing assessments that produced accurate results of how well their students have performed relative to the standards set, most challenging. Moreover, studies in the United States of America and Canada found that teachers designed assessments that were in accordance with some of the curriculum goals but interestingly enough, teachers considered non-performance attributes that were not related to the content or learning outcomes taught such as attendance in class, completion of set work in time and neatness in the overall determination of student grades (Gipps, 1995; Gipps & Cumming, 2003; McMillan & Lawson, 2001).

A recent study conducted in the United Kingdom to explore and develop secondary mathematics and English teachers' understanding and practices in their

summative assessments, particularly in ways to improve the validity of internal teacher-made summative assessments, found that they lacked both skills and confidence “...both in adapting the procedures and in selection from the tools available to them within the current systems” (Black, et al., 2010, p. 221). It is expected that teachers would be aware of and understand the strengths and weaknesses of the different assessment methods, and choose the one that best fits the purpose for which they want to use the assessment tool for, to assess specific students’ learning outcomes in accordance with curriculum outcomes (Mansell & James, 2009; Stiggins, 1992).

To ensure teachers are sufficiently prepared in their teaching roles, professional organisations and educational authorities particularly in the United States have established Standards for Teacher Competencies in Educational Assessment of Students (American Educational Research Association, et al., 1999). The standards require all teachers to be skilled in; choosing assessment methods, developing assessment methods; administering, scoring and interpreting assessment results; using assessment results for decision making; grading and communicating assessment results; and recognising unethical assessment practices (American Educational Research Association, et al., 1999). Professional standards for teachers are statements of what constitutes teacher quality. They make precise the elements of high-quality, effective teaching that teachers and schools will do to improve educational outcomes for students (Australian Institute of Teaching and School Leadership, 2011). Professional standards for teachers are used as tools for guiding professional learning, and as a basis for accreditation of practice and appraisal (Mayer, Mitchell, MacDonald, & Bell, 2005; M. Reynolds, 1999). The evaluation of the Queensland State of Australia, professional standard for teachers indicated that the teachers who participated endorsed and applied them in their practice. The teachers indicated the framework for professional learning provided opportunities for learning and build a sense of professionalism, and hence valued the role of professional standards (Mayer, et al., 2005).

Recent studies indicate that teacher education institutions across the globe have made significant efforts to review, develop and offer relevant educational measurement courses. This is necessary so that teachers can learn about the

different assessment methods and other areas that they need to develop their competencies as stipulated by the standards for teacher competencies in educational assessment (Lukin, Bandalos, Eckhout, & Mickelson, 2005). As well as learn other areas specific to teachers' roles and responsibilities (e.g. teachers' professional standards and policies) (Vegas, 2012; Vegas et al., 2012).

Likewise, a recent study which examined the link between recruitment, initial teacher education (ITE), and beginning teachers' experiences during their induction phase in New Zealand, revealed that the majority of graduate teachers felt that their ITE programmes had prepared them well for "planning, reflective practice, and preparation for assessment and a mix of theory and practice" (Anthony et al., 2008, p. 2). However, a recent study relevant to this study, indicated that beginning Solomon Islands secondary teachers found assessment challenging (P. Rodie, 2011), which indicated deficiency in their assessment literacy despite their exposure to assessment methods in their initial teacher education. Teachers should be assessment literate, in order to understand fully how to design assessment tools that measure students' learning accurately, possess good content knowledge and be able to align assessment with learning outcomes that are valued most (Earl & Katz, 2000; Stiggins, 1991, 1995, 1999a).

There is general consensus amongst teacher education scholars that the quality of preparation and support teachers receive during their initial teacher education, and throughout their teaching career, determine, their ability and confidence in their teaching roles and effectiveness in the classrooms (Cochran-Smith, Feiman-Nemser, & McIntyre, 2008; Darling-Hammond & Bransford, 2005). There is substantive research evidence which suggests that the quality of teachers is the key determining factor of variation in student achievement (Darling-Hammond, 2000; Wenglinsky, 2000). In other words, educational researchers have confirmed that students' academic progress depends heavily on the talent and skills of the teacher leading their classroom. This requires that teachers should demonstrate deep understanding of subject matter, pedagogical content knowledge as well as curriculum and assessment knowledge. Teachers also need knowledge of how students learn and to employ a variety of teaching and assessment strategies and practices that support learning – only then can teachers have a positive impact on

their students' performance (Darling-Hammond, 2000; Darling-Hammond & Bransford, 2005). Most importantly, teachers need feedback on how effectively they carry out their roles and responsibilities in the classroom or basically on the work they do to be able to make the necessary change in their teaching practices. Unfortunately, individual teachers receive little feedback on the work they do and hence do not grow professionally and affect their students' learning (Measures of Effective Teaching Project, 2010).

A range of studies on schooling excellence suggests that the quality of an education system cannot exceed the quality of its teachers (Darling-Hammond & Bransford, 2005). This confirms a long held view that competence levels of teachers in subject knowledge and teaching skills are key variables in the improvement of the schooling system (Bernice, 2009). In contrast, teachers who are ill-prepared in their teaching profession are bound to struggle in their teaching and may become ineffective in helping students to achieve educational outcomes. It is also recognised that teaching is a dynamic profession – meaning that teachers would need to adapt their teaching to meet new challenges and learning demands (Darling-Hammond, et al., 2010; Darling-Hammond & Wentworth, 2010) influenced by major shifts in technology, science advancement and socioeconomic developments and culture that occur and impact on students' lives and the community at large (Earl & Katz, 2006; Segers, et al., 2003). Teachers need to continuously update their knowledge-base and skills in teaching, curriculum and assessment in order to keep current with new educational developments and to function effectively as teachers.

3.3.4 Other factors

Studies have also indicated that external assessments such as examinations and large-scale survey assessments previously discussed affect their classroom practices. Teachers take for granted that these assessments represent good assessment practices and use them in their assessment programs without making changes to the items to suit curriculum outcomes, learning and context (Crooks, 1988; Pongi, 2004a). Education reforms that drive strategies, policies, and plans for school-based assessment and external tests that are aimed at supporting effective school programmes to raise student achievement can affect teachers'

classroom practices if they are not supported sufficiently (Absolum, Flockton, Hattie, Hipkins, & Reid, 2009; Poskitt, Brown, & Taylor, 2003). This can happen when new assessment policies and standards-based assessment and accountability measures are imposed on schools and teachers conflict with teachers' personal teaching philosophy and beliefs about how best they should conduct their teaching and assessment practices (Black & Wiliam, 1998a, Shepard, 2001; Harlen, 2007).

Curriculum reform policies that are enacted to implement review and re-development of teaching and learning materials and new assessment frameworks to guide effective application of assessment tasks and strategies can easily conflict with teachers' beliefs and existing practices within schools (Biggs, 2003; Harlen, 2006a). Teachers who resist change can impede the successful implementation of curriculum and assessment reform initiatives. Holden (2006) argues that quality teaching is not only about how teachers apply specific teaching strategies, but also includes the provision of appropriate learning environments and resources and how these are effectively used in the classroom by teachers.

The ability of teachers to establish a close alignment between curriculum goals, teaching, learning, and assessment practices is a key determinant of the quality of assessment used by teachers to assess learning (D. K. Cohen & Ball, 1999; Pellegrino, 2006). Cohen and Ball (1999) stress the interconnectedness between curriculum materials, teachers and students and emphasise that each of these elements depend on each other for effective teaching and learning. Lack of these elements can invalidate the inferences that are made about students' overall learning achievement.

There is wide-spread support for governments and school authorities to ensure that schools and teachers are provided with appropriate curriculum guides, textbooks and assessment resources (Gallagher, 1991a; World Bank, 2008) because these resources affect everyday classroom practices. In contexts where teachers experience large class size; heavy teaching loads, and a lack of curricula support materials, science equipment and dedicated classroom for science teaching, teachers often adopt a didactic teaching approach, and use assessment procedures that reinforce rote learning (Susuwele-Banda, 2005; World Bank,

2008). Teachers resort to teaching strategies that require less resources, for example, chalk and talk (Biddle & Berliner, 2002; Jimerson, 2006). It is also important to understand that how well teachers utilise available materials matters. In high-performing education systems, where schools are well resourced with curriculum support materials including assessment resources, science apparatus and laboratories where students can perform their investigations, teachers have benefited in terms of planning and quality of instruction and had contributed to high standards of student outcomes (Clarke, 2011; Darling-Hammond, et al., 2009; Nancy, Clarke, Charles, & Frances, 2006; Vegas, et al., 2012).

Finally, whether or not teachers plan their teaching and assessments also influence the quality of assessments designed and hence students' performance. However, if teaching and assessment plans are not accommodated in the teachers' classroom practices, teaching and assessment can be compromised. Time is also an important factor that not only influences teachers to choose the content they teach, and how it should be taught, but also influence the decisions they make regarding the 'type, frequency and assessment strategies' they use to assess their students' learning and achievement (Atkin, et al., 2001).

This section discussed the factors that are influential in teachers' assessment practices and development. These include beliefs about teaching and assessment, preparation of teachers and their assessment literacy, availability of and appropriate curriculum and assessment resources. It was stated that the nature and combination of these factors can influence teachers' assessment practices and effectiveness which can lead to positive and negative impacts on student learning. The literature points out that it is difficult to change teachers' beliefs unless they are convinced that the innovative teaching and assessment strategies introduced to them will produce results. Overall, there is lack of a strong research basis for understanding how to prepare teachers at a level agreed by all, to meet the challenges and demands of schools and the students they serve. However, it would be interesting to find out how well prepared and confident science teachers in this study felt in the assessment of their students' learning. Nonetheless, it is recognised that if teachers are better prepared and continually supported with resources and through professional development opportunities, they are likely to

carry out their teaching practices effectively and make positive impact on their students' achievement (Lieberman & Wilkins, 2006). The next section examines literature pertaining to professional development models and the role of professional development in advancing learning in schools.

3.4 Professional Development and Models of Professional Practice

In order for education systems to achieve quality teaching that positively impact on student learning, requires collaborative efforts on the part of teacher education institutions, education authorities and the school community. Preservice and in-service teachers require more effective professional learning opportunities that are intensive and ongoing than traditionally been offered (Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009). Therefore, it is important that education systems prepare and support teachers to grow professionally in order for them to possess high-order teaching skills (including assessment skills) and deep understanding of subject content as well as pedagogical content knowledge. This is a necessary step in as far as providing teachers with skills to enhance quality teaching that will enable students to possess higher-order thinking skills so that they will be able to succeed in life. This section examines the literature reviewed on professional development models to enhance teachers' teaching and assessment practices that contribute to improved student performance.

3.4.1 Professional development

This section first defines professional development. Then an outline of three key professional development models is presented, followed by a discussion on the model that appears to be more appropriate for the study.

Professional development means different things to different people. Some associate the term with images of a one-off workshop conducted in a day or several days. To others, it refers to a process in which teachers work under supervision to enhance their professional practice (Diaz-Maggioli, 2003). Yet others consider it from a more personal perspective of teacher professional learning whereby teachers engage in activities that enable them to learn new

knowledge, skills, and understandings of subject matter and pedagogical principles (Guskey, 2000).

In this study, professional development in the context of practicing teachers is defined as the strategy used to support teachers to strengthen their instructional practices throughout their career (Mizell, 2010). Hence, the term professional development as used in this study includes, but is not always limited to, the process referred to in the literature as staff development, teacher development or teacher in-service training (Muir, Beswick, & Williamson, 2010). Teacher professional development can be conducted on-site or at school. It can also occur off-site such as by attendance by participants at seminars, conferences, workshops, on-line training or modular programs over a period of time or through network activities (Rogers, 2007). The term professional learning is also used in the literature to mean teacher development and is conceptualised as “a product of both externally provided and job-embedded activities that increase teachers’ knowledge, which can shift their instructional practice in ways that support student learning” (Darling-Hammond, et al., 2009, p. 1).

It is widely acknowledged that not all professional development activities can lead to professional learning despite how well the activities are designed and delivered (Easton, 2008; Fullan, 2007). Fullan argues that the approaches applied to improve instruction are seldom “powerful, specific or sustained enough to change the culture of the classroom and school” (p. 35). He reiterated the assertion made by Elmore (2004, p. 73) that “improvement about all entails learning to do the right things in the setting where [one works]”. Easton (2008) contends that the most powerful learning opportunities include active learning embedded in teachers’ work, where students’ work are assessed to identify their strengths and learning needs. Consequently, teachers identify their own areas of learning needs and work towards improving them. Such teacher-orientation in their work, which is focused on students’ learning needs, can lead to positive educational outcomes.

To help teachers in their professional learning needs, facilitators need to consider an appropriate professional development model that takes into account both student and teacher needs. There exists no empirically tested model of teacher

professional development that has been proven to be effective across all settings (MacNeil, 2004). Nonetheless, the literature provides guidelines for teacher professional development that have broad appeal and compelling workable frameworks for designing and analysing teacher professional development programs (Elmore, 2002). These are explored next to identify a suitable professional development model for the current study.

3.4.2 Professional development models

The literature indicates that there is a range of models of professional development to choose from. Gaible and Burns (2005) categorise teacher professional development (TPD) models into three broad groups; (i) Standardised TPD, (ii) School-Centred TPD and (iii) Individual or Self-Directed TPD.

The Standardised TPD model focuses on training that emphasise sharing of skills and knowledge on specific areas of teacher needs, and is offered by facilitators through a face-to-face mode. This model involves a ‘cascade’ or ‘training-of-trainers’ approach, where one or two champion teachers at a school attend centralised workshops to learn and build their skills in an area of need. At the end of the workshop, the teachers would return to their school and conduct training to their colleagues, as well as apply what they learn to their practice. The Standardised TPD model has the advantage of exposing teachers to new ideas and new ways of thinking and doing aspects of classroom practices. It also helps teachers to meet new colleagues and open new networking opportunities to support each other. The model is also useful for a cascading approach whereby “knowledge and instructional methods” can be disseminated to a large group of teachers throughout the country (Gaible & Burns, 2005, p. 19).

The School-Centred TPD also known as Site-Based or Cluster-Based often takes place in schools, resource centres and teacher training institutions. The model is suitable for offering training activities at a central location, and involves schools to share resources in the cluster of district. Groups of teachers from the various schools that are invited to attend work with internal or external facilitators or master teachers as resource persons (MacNeil, 2004). Site-based TPD often focus on the specific, situational problems that individual teachers encounter as they try

to implement new techniques. The Site-based model is suitable for bringing teachers to address issues and needs over a period of time; it encourages individual initiative and collaborative approaches to common problems that teachers may find in their classrooms. It also allows more flexible, sustained and intensive TPD and provides ongoing opportunities for professional learning among teachers (Gaible & Burns, 2005).

As the name implies, Self-Directed TPD requires teachers to determine their own professional development goals and to select activities that will assist them to achieve the goals set. The professional learning activities that individual teachers engaged in include watching video on the topic of interest, reading books on education, field work, keeping journals, performing case studies, taking online course and observing classes taught by colleagues. Teachers often participate in informal or self-directed learning activities, for example, when they sought experienced colleagues for advice on specific topics that they are interested to know more about. The teacher takes all the responsibility for his/her own learning. According to Gaible and Burns (2005) self-directed activities are most effective with teachers who are motivated, self-starters, and who have already developed teaching skills and subject mastery. The Self-Directed TPD is suitable when there are no other organised professional development options in the setting. It should be considered when self-motivation and innovative individual teachers' opportunities for learning are not on offer. For this model of TPD to work, all required support, incentives and structures should be provided to ensure that self-directed TPD effectively meet teacher professional learning needs (Gaible & Burns, 2005).

From the three professional development models examined, the standardised teacher professional development model appeared to be appropriate model for addressing the science teachers' professional learning needs. In essence, the standardised teacher professional development focuses on training that emphasises sharing of skills, knowledge and experiences on specific areas of teacher assessment needs (Gaible & Burns, 2005). The intent of the teacher professional development in summative assessment was to assist the six science teachers from different secondary schools that participated in this study to

enhance their summative practices and improve the quality of their assessment practices and students' learning outcomes.

3.4.3 Characteristics of professional development

The studies reviewed identified some form of positive effects on teachers, especially increases in knowledge, skills and changes in classroom practices as a result of professional development activities (Garet, et al., 2001; Shepardson, 2001b; Wei, et al., 2009). In fact, a growing body of empirical research suggests that a set of key features are common to effective professional development; five of these are discussed here. These are (a) focus on content knowledge, (b) active learning, (c) coherence with other learning activities (d) duration, and (e) collective participation (Desimone, 2011; Garet, et al., 2001; Wei, Darling-Hammond, & Adamson, 2010; Wei, et al., 2009). These features of professional development have been proven to lead to improved teacher knowledge, teaching practice and students' learning achievements.

Focus on content knowledge

Effective professional development focuses on subject matter content knowledge and how students learn the content (Desimone, 2011; Garet, et al., 2001; Guskey, 2003; Timperley, 2008; Wei, et al., 2010). According to Guskey (2003), it is essential to support teachers to understand the subject content (e.g. science) they teach as well as to support them in ways in which they can help their students learn better the content taught. Timperley (2008) states that teachers should be assisted so that they can learn how to identify the pedagogical content knowledge and skills they need to assist their students to learn specific curriculum content. Timperley is of the view that teachers can integrate their knowledge about subject content matter, curriculum knowledge and pedagogical content knowledge, and "...how to teach it, and how to assess, to see if students have learned it" (Timperley, 2008, p. 11). Such steps are crucial in supporting teachers to grow professionally.

Active learning

This element of effective professional development refers to the strategies used to engage teachers to become active and responsible learners. In general, the

strategies successfully used are centered on commitment to learning. According to Desimone (2011) and others (Dufour, et al., 2010; Roberts & Pruitt, 2009), opportunities should be provided to teachers to get them involved in what they are learning through the activities they are asked to do during professional development sessions. Teachers should be allowed to observe, receive feedback, analyse their student work including their own work as well as to make presentations instead of sitting through the professional development sessions (Desimone). In the context of professional development that focus on strengthening teachers' assessment practices, Harlen (2004b, 2009) advocates that teachers should be provided opportunities to diagnose their students' weaknesses through assessments that are used to serve either formative or summative purposes and to inform their instructional decisions. Such active learning opportunities should help teachers to reflect on their practices including their experiences of what they learned (Roberts & Pruitt, 2009).

Reflective thinking, learning, and practice have the potential to improve teaching practices and student learning outcomes, and can enable individual teachers to explore a variety of ways to improve their teaching practices and students' learning (York-Barr, Sommers, Ghere, & Montie, 2006). In reference to early studies on professional learning, Wei et al. (2009) emphasise the importance of involving modelling that seeks after practices and constructing opportunities for teachers to practice and reflect on the new strategies.

Buck and Trauth-Nare (2009) in their study on preparing teachers to make formative assessment integral to science teaching and learning, found the importance of self-reflection. They suggested that teachers should be provided opportunities to contemplate the efficacy of classroom assessment practices, from initial teacher education programs and throughout the duration of in-service professional development programs. Opportunities should also be provided to teachers so that they can dialogue with their colleagues during the professional learning sessions to explore ways in which they can fully utilise data relating to their own practices and students learning (Timperley, et al., 2007).

Coherence with other learning activities

The third element of professional development that can contribute to positive impact on teachers' instructional practices is the consistency in offering professional development activities with other key learning activities such as school-wide reform initiatives and policies (Desimone, 2011). According to Wei et al. (2010), professional development can be successful if it is offered as a coherent component of school reform initiatives. This means that assessments, standards, and professional development activities that target teachers are linked.

In general professional activities and reforms in education all focus on the professional growth of teachers that can lead to improved teacher instructional practices and gains in student learning outcomes. However, the activities are often implemented on a system-wide scale. Desmond (2011) pointed out that the professional development activities designed for teachers should be consistent with the overarching knowledge, beliefs, and principles associated with school reforms and policies that aim to achieve general improvement in the quality of teaching and students learning outcomes. Studies on specific professional development activities that are aligned with school or large-scale reform initiatives show that teachers benefit professionally much to the advantages of their schools and students' outcomes (McMunn, et al., 2003; Timperley, et al., 2007; Wei, et al., 2009).

Duration

The duration of professional development is most effective when it is conducted in an intensive and ongoing manner over a sustained period (Wei, et al., 2010). In other words, it should be spread over the school calendar rather than presenting it as a one-off workshop per year. Professional development should not be fragmented and done on *ad hoc* basis, as it needs to involve ongoing inquiry, experimentation, and assessment that would enable teachers to reflect and improve on their teaching effectiveness (Roberts & Pruitt, 2009). Ongoing professional development does not mean that teachers are involved in the same workshop in a repeated number of times. Rather, it is an ongoing process involving a variety of activities that focus on teacher professional needs. Wei et al. (2009) found that common features that characterise effective professional

development practices in high achieving countries allocated ample time for professional development activities that are embedded in teachers' contexts and that are ongoing over a period of time. Not only were teachers' contexts considered but there was also collaboration built into teachers' work hours (Wei et al., 2009).

Collective participation

Studies on professional development have identified collective participation of teachers as an important feature of effective professional development (Dufour, et al., 2010; Hord & Sommers, 2008). It involves groups of teachers from the same grade, subject or school participating in professional development activities together to build an interactive learning community (Desimone, 2011; Dufour, 2004; Dufour & Eaker, 1998). The professional learning community is comprised of groups of teachers who collaboratively work together to achieve their common goals in teaching. In doing so, they share ideas, reflect on their existing practices as they are introduced to new ways of thinking and practices, and learn collaboratively from each other (Guskey, 2003; Roberts & Pruitt, 2009). Locks-Horsley et al. (2010) contend that teachers are able to transform new learning into practice when they work and learn collaboratively, rather in isolation or learn and work independently from each other. This strategy supports teachers to work together as they practice and apply new strategies in their teaching, reflect on results, and make continuous improvement. In a study to explore how teachers might enhance their competence in summative assessment in ways which might also have a positive effect on their teaching and learning, Black, Harrison, Hodgen, Marshall and Serret (2011) found that the teachers they worked with agreed that "the opportunities to work together on task construction had both improved their judgement of task quality and produced useful teaching materials" (p.457).

From the discussion, it is clear that there are certain characteristics of professional development that need to be considered when designing and implementing teacher professional development. The literature helps to identify these characteristics. The present study will adopt the core features of effective professional development described above in the design and in the implementation of the

professional development activities. However, it will be interesting to find out how individual teachers engaged in this study will respond or react to the learning environment that is going to be established during the professional development sessions.

3.5 Changing Science Teachers' Assessment Practices

It is desirable to change teachers' classroom practices which include teaching and assessment practices so that they can focus more on constructing valid and quality assessment, to assess their students' learning and to use the data obtained to support the students in ways to improve their learning achievements. Whilst there have been successes in changing teachers assessment practices whether it be to help teachers use assessments for formative or summative purposes (Black, Harrison, Hodgen, Marshall, & Serret, 2008) effectively, research has indicated that changes in assessment practice have been challenging and difficult to sustain (Gardner, Harlen, Hayward, & Stobart, 2008; Webb & Jones, 2009). For example, research conducted to support teachers to change their assessment practices that focus on assessment for learning in the UK (Black, et al., 2003), United States (Elmore, 2003), and in New Zealand (Gilmore, 2008; Timperley, et al., 2007) indicate that teachers do make slight to moderate changes, but overall it is difficult to effect such changes in large secondary schools (Hill, 2011).

This section examines research relating to teacher professional development that focuses on changing teachers' assessment practices particularly in science. It examines the enablers and disablers that determine the successes or failures of the teacher professional development initiatives.

Research on professional development in assessment in science emphasises the importance of establishing a framework for collaborating with teachers to change classroom assessment practices. According to Shepardson (2001a, pp. 1-2) professional development activities that build on teachers' existing understandings of assessment, should take into "consideration the context of the science classroom ad learners and incorporate teacher collaboration and teacher reflection", and provide continuous support are more likely to be successful in changing teachers' assessment practice. Lieberman and Wilkins (2006) share a

similar view that teacher professional development should be aligned with the needs of the school, teachers and students. These factors need to be considered because schools are so different in context, composition and need, and that the professional development model should be flexible enough to allow teachers options for individualised, grade-level, and subject area training. Wiliam et al. (2004) who adopted a professional development model that focuses on teachers as learners that actively participate in their own learning and school environment over a six month period demonstrated that the science and mathematics teachers they worked with to adopt assessment for learning strategies improved their students' achievements.

The results of three case studies by Hill (2011) in large New Zealand secondary schools demonstrated that the critical school-level factors that contributed to the shifts that teachers made to switch from summative assessment orientation to assessment for learning practices were dependent upon tailoring the professional learning to the individual school context. The school level factors included engaging school principals as key 'conductor' of change – the principals were assessment literate and aligned job descriptions and appraisal with assessment for learning as well as provided resources. Hill reported that there was also active involvement of senior staff and management team who organised professional learning activities. According to Hill, the schools provided opportunities for teachers to meet regularly to discuss and attempt new things so there was cross-curricular teacher learning about assessment for learning. Most importantly, Hill added that assessment for learning was embedded as part of the school program and culture. Hill stated that the facilitation model was tailored to the needs of each school which was comprised of assessment literate facilitators. These facilitators supported school leaders and teachers in the change process to build internal accountability systems with school policies (Hill). It can be seen that the Standard TPD model, which is the preferred model for exploring teachers changing assessment practices in this study, is dependent on the assessment literacy level of the facilitator.

Moreover, a research that was conducted to develop an understanding of the experiences of a sixth-grade science teacher with more than three years of

classroom experience to improve student learning through formative assessment indicated that the teacher changed positively to the professional development offered (Buck & Trauth-Nare, 2009). According to Buck and Trauth-Nare, the teacher changed her classroom assessment practices because professional support was provided and allowed the teacher the opportunity to question the validity of tacit pedagogical understanding, identify and understand what the students' needs were and was given opportunity to explore a more reflective classroom.

The examples on changing teachers' assessment practices demonstrate the shift in assessment emphasis—from summative assessment to assessment of learning. This study was concerned with building teachers' summative assessment practices. Hence, the literature that focuses on change that teachers experience needs to be examined. The findings of a project undertaken by Black and his colleagues (2010) that explored and developed teachers' understanding of summative assessment and its practice is of particular interest to this study. In this study, Black et al. (2010) applied both "intervention and research elements" (p.215). The intervention approach sought to explore how the teachers might improve on their assessment practices while they re-examined the validity of the summative assessment tasks. This was followed by engagement of teachers "in moderation exercises within and between schools to audit examples of students' work and to discuss their appraisals of these examples" (Black et al., 2010, p. 215). Findings of the project indicated that the "teachers' attention to validity issues had been undermined by the external examination regime" (p. 215). However, they were able to address the issues by "reflection on their values and by engagement in a shared development of portfolio assessments"(Black, et al., p. 215). This study indicated some of the steps that need to be considered when developing teachers' summative assessment competencies and skills. According to Black et al. (2010) first and foremost is the need to find out teachers' existing practices and the various factors that hinder them from taking the necessary steps to try new ways and the freedom to do so in their summative assessment practices. Teachers should then be allowed opportunity to reflect amongst and between themselves on their weaknesses in assessment, and to work together to improve not only their theories but also their assumptions that cause practice in their own summative assessment (Black et al., 2010). The present study considered and

adopted these steps as a way to explore the six science teachers' existing summative assessment practices.

As part of longitudinal study Black et al. (2011) determined how “teachers might enhance their competence in summative assessment in ways which might also have a positive impact on their teaching and learning of their students” (p. 452). To do this, Black et al. (2010) employed a strategy based on five key elements of summative assessment practices. First, the teachers were asked to design their assessment tasks and second, implement them in the classroom. Third, the teachers collected data on their students' performances on tasks through portfolios. Fourth, the teachers worked together to standardise and moderate the marking criteria and marks so that they were consistent and finally evaluated the impact on their practice (p.456-462). The findings of this longitudinal study revealed that the project enhanced teachers' competence to develop assessment related to validity issues and also used information derived from summative tests formatively to aid teaching and learning.

The study also found teachers' existing assessment practices discouraged aspects of the national curriculum and de-skilled teachers. So the assessment intervention made the teachers become more aware of and understand the national curriculum criteria. Teachers had the opportunity to discuss validity of summative assessment they designed and included open-ended tasks to replace multiple question tests. They also formulated clear specification of the criteria designed to assess their students' work. In doing so, the teachers realised they needed more time to develop shared understanding of the criteria. Finally, the teachers in the study reported through their journals that they had not resolved all their assessment needs but felt satisfied that they have learned useful lessons and suggested that other teachers would benefit from such interventions provided that extensive professional training is offered (Black, et al., 2011).

Reform agendas in science education recommend major shifts in emphasis on teaching of science including assessment. For example, the Standards movement in the United States highly recommends less emphasis on testing students for factual information in a summative manner and more information on continuously

assessing student understanding to improve their learning (National Research Council, 1996). For this to happen, Gardner et al. (2008) emphasise that in order to create sustained changes in assessment practices a number of key processes would need to be considered – which include finding out assessment literacy inadequacies of teachers, designing of innovation and delivery of professional learning activities by competent facilitators and evaluating the impact of the professional development. Gardner et al. (2008) also emphasise the need for facilitators to focus on a set of principles and standards to guide the development of effective assessment practices. Such standards and characteristics of effective professional development are suggested in this review.

The discussions reveal some success in changing teachers' assessment practices whether or not it is to satisfy a formative or summative purpose. However, it is also acknowledged that teachers do encounter challenges when they attempt to switch from traditional instructional practices to reform-orientated approaches such as to change the assessment strategies teachers used traditionally. As discussed in section 3.3, there are several factors such as beliefs teachers hold that influence their instructional practices. In order to change teachers to conform to reform-orientated approaches from their traditional instructional and assessment practices, as this study attempted to do, requires teachers to adjust their beliefs (Cavanagh, 2006). If teachers are not supported to make the necessary adjustments, they are likely to resist change and continue to maintain traditional instructional practices (Perry, Howard, & Tracey, 1999, cited in Muir, Beswick & Williamson, 2010), including the types of assessment and purposes they are used for.

Apart from beliefs, 'top-down expert' approach to teacher professional development inhibits teacher engagement in their own learning (Hargreaves & Fullan, 1992, cited in Muir, Beswick & Williamson, 2010). So there are professional learning programs that require teachers to participate in 'one-off sessions' such sessions inhibit sustained changes in their instructional practice. This is because teachers are not influenced that the change process would not benefit them. Hence, they do not see the need to adjust their beliefs and because they believe that their knowledge of teaching or assessment practices do not need

to change (D'Ambrosio, Harkness, & Boone, 2004, cited in Muir, Beswick & Williamson, 2010). Similarly, studies have indicated that teachers reject or resist professional learning opportunities imposed on them particularly when the focus is on selection of content for which they do not believe they need to learn, or when there is delay until the innovation has been superseded (Hargreaves, 1996). Nevertheless, there is wide consensus amongst experts that professional development programs do provide learning opportunities for teachers which can influence teachers beliefs and expose them to teaching and assessment practices that are consistent with the reform agenda (Shepardson, 2001b). The next section delineates the conceptual framework for examining assessment practices.

3.6 A Framework for Exploring Teachers' Summative Assessment Practices

The study adopted a conceptual framework developed by Saxe, Franke, Gearhart, Howard and Crockett (1997) who studied teachers' shifting assessment practices in mathematics education reform in the United States. However, the framework adopted was modified to suit the context of the Solomon Islands' secondary science teachers. This is based on the premise that teachers' assessment practices are influenced by several factors including their beliefs about teaching and values, classroom realities, external factors, experiences and teacher-decision making rationale and their preparedness to apply assessment knowledge and skills in their teaching practices (McMillan & Lawson, 2001; McMillan & Nash, 2000; Nespor, 1987). In order to explore and understand teachers' summative assessment practices, four key assumptions were considered for this study.

First, teachers are introduced to the principles and methods of assessment during their initial teacher education (Saxe, et al., 1997, p. 2). It is assumed that the teachers who participated in this study learned about assessment through a variety of educational assessment courses offered in their teacher education curriculum. However, the teacher education institutions that the teachers attended might have placed varying degrees of emphasis and focus on assessment. As a result, the teachers in this study might have acquired different levels of training and developed varying assessment knowledge and skills.

Second, teachers “construct and reconstruct their assessment activities on a daily basis” based on what they know and support received from knowledgeable others in their schools until they can confidently apply assessment skills into their practices as they respond to policy directions, parental expectations and personal conviction for change (Saxe, et al., 1997, p. 2). This means that the teachers develop their own ideas about assessment from past experiences and actual practices, from knowledgeable others and practiced them over time, as well, as adhering to new policies and standards set by individual schools and the school wide assessment system. These factors might have inevitably influenced the science teachers’ summative assessment practices.

The third assumption is that teachers’ assessment practices can be understood over time as “an interplay between the different assessment forms and the functions they serve” (Saxe, et al., 1997, p. 2). This implies that teachers are duty-bound to use assessments for a variety of purposes and functions in their science classrooms. However, the actual assessment practices of teachers are variably dependent upon several factors including the beliefs they hold about assessment, teaching and learning, as well as, assessment policies and guidelines that specify the purposes that assessments should serve at their respective schools.

The fourth and final assumption is that teachers can enhance their assessment knowledge and skills through professional development programs. Professional development activities in assessment have the potential to improve teachers’ teaching and assessment practices which can ultimately improve students’ performance. This study acknowledges that teacher education institutions are responsible for helping pre-service teachers to develop foundational knowledge and skills in teaching, and ensure they are competent in their teaching and assessment skills. Hence, teachers should begin their teaching careers with some degree of confidence. However, the quality of teaching and assessment practiced by teachers in the classroom and school level depends largely on the kind of teaching and learning environment provided in schools. Also, availability of teaching resources, professional support provided for teachers in schools to help them further develop those knowledge and skills they learned during their initial teacher education, and to keep them updated on current best practices in teaching

their specific subjects. This was the key reason for conducting the professional development intervention in assessment in this study. The intent was to support the science teachers build their classroom practices, particularly in performing their roles in using assessment for a summative purpose.

Previous studies have indicated that changing teachers' assessment practices through professional development does not necessarily change their teaching and assessment practices immediately (Munby & Lock, 2000). Rather, teachers develop their own ideas about teaching and assessment over time, and these and other factors influence them to adopt and practice what they believe would work best for them and in response to school assessment policies and regulations. Briscoe and Wells' (2002) study indicated that cognitive and contextual factors influenced a teacher's thoughts and actions in relation to assessment. It is assumed that the science teachers in this study were also at liberty to apply what they learned and applied them into their practice based on what they considered was best in their classroom practices. Therefore, teachers' summative assessment practices can be influenced largely by their level of preparedness, experiences, beliefs, expectations and standards set by schools and professional development support received during their professional career.

3.7 Summary

The outcome of the literature reviewed indicated that assessment is a process of gathering data that related to what students know and can do. Summative assessment is perceived variously as a process, method, and purpose for obtaining information about students' overall achievement at the end of a teaching period. Because of the high-stakes nature and consequences it has on students' motivation for learning, summative assessment is highly criticised and neglected though the literature points out that it is the dominant type of assessment used in many education systems around the world.

Justification for summative assessment as an integral component of the education system has been highlighted in the review. Although there is limited literature that reports on research that supports summative assessment, there is convincing evidence to argue for its role and function. Attention is emerging of its

development in terms of supporting teachers to strengthen the enactment and enforcement of summative assessment in classrooms as a potential tool for not only declaring students' overall achievements but also to inform decisions that will enhance teaching and learning—particularly in its use in monitoring learning trends and student achievement.

The literature review revealed that an effective assessment system comprised of classroom-based assessment, examination and large-scale survey assessment. It also pointed out that high-performing education system involve a variety of valid and reliable types of assessment, including performance-based assessment open-ended performance tasks and school-based assessments. These types of assessments help students to demonstrate not only students' knowledge but also higher thinking skills which allow them to seek and organise information to solve problems, design and conduct investigations, analyse and synthesise data and apply what they learn to new situations. High-performing assessment systems focus on data driven approaches whereby students, teacher and schools are provided feedback on students' performance to shape future learning as well as for decision making that contributes to general improvement of students' learning. Effective assessment systems also ensure close alignment of curriculum outcomes, subject content, performance criteria and desired learning outcomes.

The review identified several factors that are highly influential on teachers' assessment practice, which is not restricted to science subject but to all subject areas and disciplines. Among the factors, beliefs teachers have about knowledge, curriculum, learning and assessment have positive and negative consequences on teachers' assessment practices. These concerns elevate the need for research to explore the relationships between teachers' beliefs, knowledge about subject, teaching, learning and assessment and the impact they may have on their classroom practices. The literature review reveals the importance of providing ongoing professional development for teachers throughout their teaching career. It indicated that for education systems to be effective and successful, teacher professional development must be of a high quality and relevant to teachers' assessment needs and students' learning needs.

From the range of professional development models identified, the Standard Teacher Professional Development (TPD) model was seen to be an appropriate model for studying the professional learning and development experiences of the teachers targeted in this study. The Standard TPD model involves teachers from a school or few schools who attend workshops organised by a facilitator at a central venue to build their skills in areas that the professional development focuses on, based on a teacher needs analysis. In this model, the teachers receive training to improve their classroom practices and return to their respective schools to apply what they have learned.

In view of the key findings of the literature reviewed, there definitely appears to be a great need to conduct the current study to explore Solomon Islands science teachers' summative assessment practices to determine; (i) the types of assessment they use to assess their students' learning achievements, (ii) the views and understanding teachers possess about summative assessment and (iii) factors that influence their current summative assessment practices. It is also imperative to assess and evaluate the impact professional development has on science teachers summative assessment practices after receiving training from the facilitator and to determine (i) what and how the science teachers learn, (ii) the assessment strategies teachers implemented when they return to their classrooms, and (iii) the factors that influence the implementation of new assessment ideas and procedures in their post-professional development practices. The questions will certainly reveal Solomon Islands secondary science teachers' summative assessment practices as there is currently no study conducted and to provide evidence for decision making that will contribute toward improvement and the understanding of education assessment in general.

CHAPTER FOUR: RESEARCH DESIGN AND METHODS

4.1 Introduction

This chapter provides an overview of the methodology and methods used in this research. In particular, it justifies the choice of an interpretative-qualitative research approach and the methods of data collection that were used to gather information relating to the key research questions that guided this study.

The chapter is organised as follows: Section 4.2 presents the research questions, Section 4.3 describes the research approach and why it was chosen. An outline of the design and methods for data collection used is in Section 4.4, the data analysis techniques in Section 4.5. A description of how quality assurance for this study was established is given in Section 4.6. The ethical measures that were factored in the research to observe the rights of the participants are discussed in Section 4.7. Section 4.8 summarises the chapter.

4.2 Research Aims and Questions

This study sought to explore the summative assessment practices of six Solomon Islands' secondary school science teachers before and after a professional development intervention was conducted. Two sets of research questions (RQ 1 and 2) were formulated to guide the collection of data. To guide the investigation and collection of data relating to the teachers' existing summative assessment practices, the following questions were used:

RQ1: What are the summative assessment practices do secondary science teachers currently utilise to measure their year nine students' achievements in science?

- (a) What are science teachers' existing perceptions and understandings of summative assessment as it relates to school science at the outset of this research?
- (b) How do science teachers collect information that informs assessment of their students' performance and achievement?
- (c) What factors promote or inhibit teachers' existing summative assessment practices?

To guide the investigation and collection of data relating to the impact of the professional development on teachers, the following questions were used:

RQ2: What impact did professional development have on the science teachers' continuous summative assessment practices?

- (a) What were the science teachers' existing views of professional development and how did they learn from the professional development workshop that focused on developing new assessment ideas and procedures?
- (b) What new assessment strategies did the teachers implement when they went back to class?
- (c) What factors supported or constrained teachers' implementation of new assessment ideas and procedures in their post- professional development practices?

The next two sections discuss the research methodology and methods used in the study.

4.3 Basis for Using Qualitative-Interpretive Research

This study adopted a qualitative-interpretive research approach. It also considered a socio-cultural perspective as a framework for viewing how people make meaning and make sense of their social world based on their interactions and experiences of the environment in which they work and live. The aim of this section is to explain the basis for choosing the research approach. Section 4.3.1 examines the key properties of qualitative research. Section 4.3.2 outlines the interpretative research approaches and Section 4.3.3 looks at the sociocultural views.

4.3.1 Qualitative research approach

There are fundamental properties of qualitative research which make it a very useful research approach to gain insights and understanding of a social or human problem (Creswell, 2007). It is regarded as naturalistic inquiry, meaning that it is generally suitable for studying specific phenomena that occur in real-life settings (Guba & Lincoln, 2005). It is most suitable for exploring the "meanings people have constructed about their world, and their experiences; that is how people make sense of their experiences" (Merriam, 2002, pp. 4-5). Denzin and Lincoln

(2005) refer to qualitative research as a “situated activity that locates the observer in the natural setting, and comprises of a set of interpretive, material practices that make the phenomenon studied visible” (p. 3). Qualitative research focuses on patterns and themes, rather than the testing of hypotheses – it is an inductive approach, which is open to new ideas and theories. According to Creswell (2007), the qualitative research approach allows researchers to use their own ‘words or narratives’ to describe and interpret a phenomenon from participants’ perspectives, as opposed to the mathematical treatment of data practised in a quantitative approach.

The qualitative research approach is a helpful inquiry process for exploring a complex research area about which little is known (Denzin & Lincoln, 2005). Interpretation is the core of qualitative research and focuses on the meaning of human experience. The focus of qualitative-interpretive research is on understanding human experiences and individuals’ social interactions, and discourses are taken into account as the basis for understanding how individuals construct knowledge in their specific settings and contexts, rather than explaining and predicting behaviour. It recognises that meaning and behaviour occur within particular social, cultural, and historic contexts (Denzin & Lincoln, 2005). Qualitative research is most appropriate when variables cannot be quantified or when they are best understood in their natural settings. It is a useful research approach for studying roles, processes, and groups and when the paramount objective is to understand people’s live experiences (Denzin & Lincoln, 2005). The qualitative approach is concerned with participants’ opinions, behaviours, and experiences of phenomena from their point of view. It focuses on how individuals and groups view and understand the world and construct meaning out of their lived experiences. It often involves a small number of people, sites or situations, and the researcher might interview participants more than once (T. W. Lee, Mitchell, & Sablinski, 1999; Merriam, 1998). The mode of reporting used in qualitative research is characteristic; it is narrative, inductive, holistic, subjective and process-orientated (Creswell, 2007; Denzin & Lincoln, 2005). Merriam, (2002) contends that the product of qualitative-interpretive research is “richly descriptive” (p.5), where words and pictures are used instead of numbers to depict what the researchers have learned about a phenomenon.

4.3.2 An interpretive approach

It is recognised that an interpretive approach is not a separate mode of research from qualitative. In fact, interpretive research comes under the “umbrella of the qualitative research approach” (Merriam, 2009, p. 22). It is therefore a category of qualitative research. Interpretive research is about making meaning - it attempts to explain and describe, in order to make sense of what one studies. It is committed to understanding situations in specific contexts and the social interactions and discourses that are taken into account to explain how individuals create knowledge (P. C. Taylor, 2008). It is an inquiry that seeks to “understand a community in terms of the actions and interactions of the participants from their own perspectives” (Tobin, 2000, p. 487). The interpretive approach can enable researchers to explore, describe and interpret “...socially meaningful action through direct detailed observations of people in natural settings in order to arrive at understandings and interpretations of how people create and maintain their social world” (Neuman, 1997, p. 68). It emphasises the understanding of social reality that can be achieved through rich contextual description of the people and events that occur. Hence, interpretive research recognises the subjective nature of interpretation as an important tool. This is also one of the limitations of interpretive research as the researcher has substantial control over both the design and the analysis of data which is influenced by the researcher’s perceptions. Interpretive research is a flexible research approach which can incorporate emergent designs – meaning the researcher is able to accommodate changes when circumstances prevent the implementation of the planned activities (Tobin, 2000).

According to Taylor, (2008) interpretive researchers “embrace an open-ended research design process that allows emergent research questions, emergent modes of inquiry and emergent reporting structure” (p. 487). The emerging nature of an interpretive research process implies that it is not rigid; rather it is adaptable and provides researchers with sufficient time to rethink and strategise ways to conduct the investigation (Tobin, 2000). Interpretive researchers have been described as meaning-makers who draw on their own experiences, knowledge, and theoretical orientations to conduct inquiries in order to obtain empirical evidence of the phenomena they study and to present their understanding (Schwandt, 1994).

An interpretive research approach was selected for this study because of all the characteristics listed above. From the researcher's point of view, it is an ideal approach for researching aspects of education such as teachers' summative assessment practices in the school setting. It seemed possible that the Solomon Islands science teachers in this study developed their individual perceptions of the nature of summative assessment through teacher education programs and their teaching experiences and may place a certain amount of value on them. Supporting and improving teachers' expertise and skills in assessment, and thus the school-based assessment system, are reported to be influenced by political, social and cultural contexts (Bell, 2007; Gipps, 1999; Willis, 2009). For this and other reasons, it seemed appropriate to adopt an interpretive research approach for this study because it accommodated the political, social, and cultural contexts of the teacher participants in their schools. This study's interpretive approach was also guided by socio-cultural perspectives of studying how teachers go about their practice of summative assessment in science.

4.3.3 Sociocultural perspectives

A key assumption of this study, adopted early in the planning stages, was that cultural and social issues including school culture (Flores & Day, 2006; Gipps, 2002; Sarason, 1996) need to be considered in understanding teachers' assessment practices. Instruction and assessment need to be understood and thought about within the cultural context in which they occur (Sternberg, 2007). A socio-cultural perspective which perceives assessment as a social practice considers the "social, cultural, economic and political contexts in which it operates" (Gipps, 2002, p. 355). Several authors embrace the notion that assessment should be viewed as a social activity because it is an activity that is done with and for the students in a social context (Bell & Cowie, 2001; Davis, 2002). There is overwhelming consensus that "the cultural or social content in which assessment takes place has a great influence on both the process and product of a student's work (Aikenhead, 1997).

Black (1997) alluded to this issue of context when he discussed the reliability of performance assessments, as did Elwood (2006), who described assessment as a social activity because of the social interaction that occurs between students and

teachers when students receive feedback from the teachers, peers and themselves and because the social context influences what is assessed. Therefore, by examining and interpreting the six science teachers' summative assessment practices from a socio-cultural perspective, the social and cultural contexts that influenced their classroom assessment could be better understood (Goos, 2008; Willis, 2009).

Social and cultural contexts are powerful domains that can influence and shape how teachers go about their classroom assessment practices (Bell, 2007; Bell & Cowie, 2001; Gipps, 2002; Pryor & Crossouard, 2005; Shepard, 2001; Willis, 2009). Assessment roles and responsibilities of teachers and the activities they are involved in are often carried out under societal expectations, policies, standards, and accountability demands imposed on them (J. O. Anderson, 2005). These and other social and cultural processes such as social norms (Cobb & Yackel, 1996), institutional pressures and personal orientations in regards to their work and well-being are issues that teachers face and that may constrain their outlook and work output (Muralidhar, 1993a). Examining teachers' assessment practices based on socio-cultural perspectives can reveal how and why teachers adopt certain approaches in teaching and assessment (Atkin, et al., 2001; Atkin & Coffey, 2003; Bell, 2007; Bell & Cowie, 2001; Gipps, 2002; Willis, 2009).

Additionally, understanding the professional development needs of science teachers means that action can be taken to adopt assessment reform initiatives that are geared towards informing and improving policy on classroom assessment and practice in view of the "complexities of the social, cultural and policy contexts of schooling" (Willis, 2009, p. 1). According to Usher (1997), individuals in particular socio-cultural environments "... cannot be separated from their subjectivity, history, and socio-cultural location" (p. 32). Therefore, the goal of interpretive research should be to make sense of meanings across a range of socio-cultural contexts in which individuals in a community live and work (McIntyre, 1998). The interpretive approach with a socio-cultural sense also allows researchers to theorise assessment as a socio-cultural practice, although Bell (2007) alerts the researcher to the need to be mindful of "who is theorising and for what purpose" (p.994).

One of the aims of this study was to investigate how socio-cultural factors influence the assessment-related decisions teachers make in the classroom. It is important to gain improved understanding of how teachers in the Solomon Islands socio-cultural context both inform and are informed by their experience of assessment practices. An interpretive-qualitative research approach allows researchers and teachers to theorise together to develop “classroom practice models using their shared vocabulary” (Bell, 2007, p. 994). In addition, Bell theorises that assessment should be developed in context in order to consider what is socially and culturally valued in particular settings. Adoption of a socio-cultural perspective in this study has a number of advantages. It allows the research to explore how the school culture and society and contextual influences, for example, shape the individual teacher’s mind and thinking (Solano-Flores & Nelson-Barber, 2001). The socio-cultural influences that are likely to affect the manner in which teachers conduct their assessment practices include the “sets of values, beliefs, experiences, communication patterns, teaching and learning styles, and epistemologies inherent in the [teacher’s] cultural backgrounds, and the conditions prevailing in their cultural groups” (Solano-Flores & Nelson-Barber, 2001, p. 555).

Interpretive research is concerned and deals with issues that human beings face in life (for example, in education), which can lead to improvements of policy and practice. Hence, investigating teacher assessment practices being a human-related activity can be better understood from a socio-cultural perspective and then manipulated to inform policy and practice to improve students’ achievements in the future (Erickson, 1986). As Hull (1997) explains, it is vital to understand “human experience to reveal both the process by which people construct meaning about their worlds and to report what those meanings are” (p. 14). From a methodological perspective and when studying social and cultural factors that influence certain behaviours, it is vital to use data collection techniques that are not only culturally appropriate but also sensitive to the cultural protocols of the participants (McIntyre, 1998). Like other members of a community in any society, teachers work and live in a variety of conditions and circumstances and therefore researchers need to be sensitive to the challenges and issues that teachers face in their social world (Waldrip & Taylor, 1999).

On the basis of the frameworks described above, the research design for this study adopted strategies and specific data collection methods that were developed from the reports of previous interpretive studies that focused on classroom assessment, which will be discussed in the next section.

4.4 Design and Methods for Data Collection

A research design is a plan or strategies and procedures for conducting research so that data can be collected to answer the research questions (Creswell, 2007). Designing a research study involves taking into consideration particular worldviews and epistemological assumptions relating to the phenomena to be studied as well as making informed decisions, the most significant being to decide which design should be adopted to study a topic (Creswell, 2007). As mentioned previously, the design of this study was shaped by the interpretive-qualitative research approach as well as by socio-cultural perspectives. These theoretical perspectives framed the methodological decisions that led to the adoption of particular data collection methods and procedures taken to generate and analyse data. Figure 1 shows an overview of the research design adopted in this study.

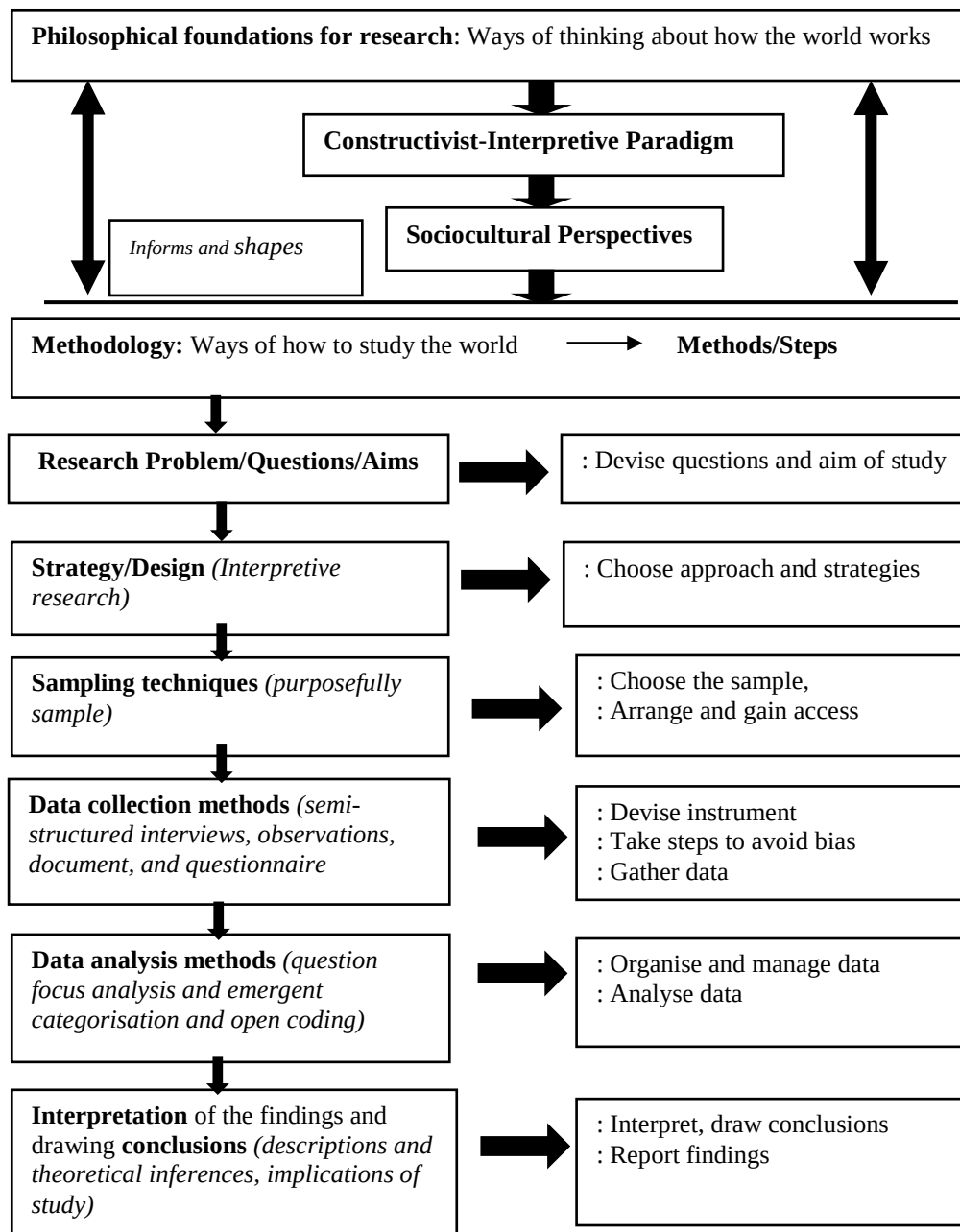
Typically, the design of this interpretive-qualitative research study focuses on the development and implementation of research strategies adopted so that each of the guiding research questions could be addressed. According to Erickson (1986) and Merriam (2009), the design should include several strategies for:

- (a) locating the data sources;
- (b) negotiating access to the site and/or participants;
- (c) selecting a sample;
- (d) addressing ethical and quality issues relating to the conduct of the research;
- (e) collecting and analysing the data, and
- (f) writing up the findings .

Interpretive researchers often utilise qualitative methods to obtain data which can lead to better understanding of phenomena of interest about which little is yet known (Merriam, 2009; Strauss & Corbin, 1998).

Figure 1: Major components of the interpretive research design

Source: Adapted from Niglas (2001, p. 4)



Qualitative research methods are preferred when the intent is to gain new perspectives on things about which much is already known or to gain more detailed information about an issue (Hoepfl, 1997). Qualitative methods have been adopted in this study because they were thought to be appropriate for collecting data as very little was known about teachers' summative assessment practices and there was a need to gain better understanding of these practices.

The next section reviews data collection methods and procedures that were deemed to be suitable for this interpretive study.

4.4.1 Methods of data collection

In this study, the methods of data collection utilised included interviews, participant observation, focus group discussions and document analysis. A review of literature on these methods of data collection is necessary to determine their strengths and limitations and their suitability to this study. The actual data collection processes using these methods of data generation is explained in Chapter 5.4.

Interviews

An interview is one of the most widely used research techniques for collecting data in interpretive qualitative research (Merriam, 2009), and was the predominant data collection method used in this study. It has been described as a communication process (Briggs, 1997), a form of discourse (Mishler, 1986) and as purposeful conversation occurring between two persons—the researcher and the participant (Bogdan & Biklen, 2007). In this study, the interview is conceptualised as a communication process in which the researcher and participant are in “deep conversation focused on questions related to [the] study” (DeMarias, 2004, p. 57, in Merriam, 2009, p. 87). There are several reasons for using an interview as a research tool. It has been suggested that interviews should be used when seeking information that could not be observed directly, such as “feelings, intentions, beliefs, perceptions, opinions, and behaviours” (Patton, 2002, p. 351). Interviews help to gain information about how people interpret the world around them (Merriam, 2009) but they can also be used to clarify or illustrate the meanings of the findings; to “test and validate hypotheses”; and in combination with other data collection methods, to probe further into the participants’ perspectives and explanations of the issue discussed (L. Cohen, Manion, & Morrison, 2007, p. 351). In this study, the interview was considered as a suitable technique for this research and was used to serve all the purposes outlined above. Interviews are distinguished by the amount of structure used in the process, varying from structured through semi-structured to unstructured or informal conversational schedules (L. Cohen, et al., 2007; Fontana & Frey, 2005;

Merriam, 2009; Patton, 2002). This study employed semi-structured one-on-one (or face-to-face) interviews. A semi-structured interview is described as an interview guide approach (Patton, 2002) and is frequently used in interpretive qualitative research (Black, et al., 2008; Gallagher, 1991b; Patton, 1990; Tobin, 2000). It is a distinct type of conversation occurring between two people or it can happen between the researcher and a group of participants (focus group interview). In a semi-structured interview, the researcher prepares questions covering the key topics in advance, but has freedom to adapt the questions, or even ask additional questions during the interview process, in order to get the respondent's views (Corbetta, 2003).

Although interviews are useful research tools for gathering data, they have limitations and weaknesses. Interviews are regarded as subjective experiences and there is the risk of interviewer influence and bias in how the interview is conducted or how the responses may be interpreted. The respondents may also influence the interview process by providing exaggerated and dishonest responses, thus affecting the outcome of the interview (L. Cohen, et al., 2007). Both respondents and interviewers therefore, influence, or introduce bias to, interviews. For example, respondents might want to please the interviewer and may give answers that they think the interviewer wants to hear, or believe the interviewer is looking for, rather than what they really feel. The respondents may tend to respond this way because they do not want to be seen as impolite or to offend the interviewer, and may therefore attempt to give polite answers (Marshall & Rossman, 2006). In certain situations, the interviewer may become too sympathetic towards the issues and problems experienced by the respondent and this could influence the type of questions the interviewer asks, which, inevitably, can impact on how the responses are obtained and interpreted. Interviewers may also over-react to the respondents' responses (for example, with expressions of surprise or disbelief), which is likely to influence the respondent to give quite different responses to the question asked (L. Cohen, et al., 2007). One way of easing bias is to conduct an interview with objectivity. This means that the interviewer should aim to gain reliable information, knowledge that has been "checked, controlled, and undistorted by any personal bias and prejudice" (Kvale, 1996, p. 64). Cohen et al. (2007) advise that the interviewer should try to control

the subjective nature of the information gathered by ensuring that the respondents verify details of what they have said through the transcriptions. Despite the limitations, interviews are considered as very useful research tools for generating qualitative data.

Participant observation

This mode of data collection technique has its origin in cultural anthropology and qualitative sociology and has been found useful in contemporary educational research projects (Marshall & Rossman, 2006, p. 100). As its name suggests, participant observation involves a researcher observing and taking account of what occurs in the setting chosen to study (L. Cohen, et al., 2007; Flick, 2009). Hence, members of the research setting (teachers in this case) are aware of the researcher's status as a researcher and probably his intentions (Patton, 2002). In this study, the researcher assumed the role of a participant observer and thus perceived observation as an act of noting the interactions between teachers during the professional development workshops whereby the teachers carried out the assessment activities and discussed what they were learning from their own perspectives (Hatch, 2002; Morris, 1973, in Radnor, 2001). A researcher is said to assume the role of a participant observer when he/she participates in the activities that the group being observed may be engaged in (Creswell, 2003).

There are, however, limitations to the use of classroom observation as a research tool. Research shows that teachers perceive observation as intrusive and threatening. Waxman and Padron (2004) reported that many teachers were unwilling to be observed because they knew the "focus of attention is on the teachers and their instructional practices" (p. 72). The presence of a researcher in the classroom, for example, may cause individual teachers (being observed) to feel anxious and may also shape their behaviour at that moment; thus, the teacher may act or behave quite differently compared to when the class was not being observed (Breakwell, Hammond, & Fife-Schaw, 2000; Mitchell, 1993; Moyles, 2002; Robson, 2002, cited in Cohen et al., 2007). Such shifts in behaviour can be addressed through prolonged observation and by using several data sources (Patton, 2002).

Another potential threat to the credibility of data collected through observation are the biases and influences of the researcher as he/she is the sole instrument for generating data in less structured observations (Patton, 2002). According to Lodico, Spaulding, & Voegtle (2006), observation bias may occur when the observer's background, expectations, or personal perceptions influence the observation, making it inaccurate. Fraenkel and Wallen (2005) suggest that threat of bias and observer influences can be reduced through conscious effort by the researcher to pay attention to those events as they happen, and to be sensitive to the problem of subjectivity as well as to justify the knowledge claims. By taking part in supporting the teacher, the researcher becomes more than a mere observer, but someone who works alongside the teacher, thus reducing the effect of the teacher's misgivings during observation.

Document analysis

In this study, data were also generated through the review of relevant documents and records directly or indirectly linked to the phenomenon under study (L. Cohen, et al., 2007; Marshall & Rossman, 2006; Merriam, 2009). Documents can generally take several forms such as "written, visual, digital, and physical material" (Merriam, 2009, p. 140). In the case of this study, it was important to examine and include information kept by teachers as records of their assessment practices (Hill, 2009, p. 318). Some researchers claim that teachers' assessment knowledge is often tacit and may not be easily accessed through interviews; therefore, they suggest that it is necessary to obtain some of the assessment records they keep (Gipps, Brown, McCallum, & McAlister, 1995). In this study, the records that indicated teachers' assessment practices and knowledge included lesson plans, schemes of work, samples of students' work, student achievement records, samples of assessments used for summative or evaluative purposes, including past science exam scripts, and standards of student achievement (year nine science curriculum). The teacher documents examined complemented the data obtained through the interviews and were used as "artefacts of the assessment practice as they were treated as text and examined for their role [in the] research process" (Hill, 2009, p. 318). Documents indirectly related to this research were school policies, science curriculum documents and the Solomon Islands Education Framework 2007-2009. These documents were accessed so that information

relating to assessment guidelines or frameworks on which teachers based their existing assessment practices, or future strategies that would improve the assessment system in the schools, could be examined.

The core disadvantage of using document analysis is that documents are not produced, in the first place, for research purposes. Rather they are produced to serve a variety of purposes and time scales, specific to the need and requirements of those who produce them. Therefore, novice researchers, in particular, may find it very challenging to determine whether the records bear a direct or indirect physical relationship to the phenomenon studied (L. Cohen, et al., 2007). Another limitation of documents is that it is not always easy to determine the authenticity and accuracy of the records (Merriam, 1998). Another weakness involves the difficulties associated with analysing documentary data; it is not always easy as there are no standard criteria to follow. A researcher has to design his/her own set of criteria for analysis, based on the purpose for using the documentary material (Muralidhar, 1993b). To address these issues, it is important for the researcher to “judge the value of the data source and to ascertain whether it contains information or insights relevant to the research questions” (Merriam, 1998, p. 124). Despite these limitations, the advantage of using documents as a research tool for obtaining information compared with observation and interview techniques is that it is “an unobtrusive method, rich in portraying the values and beliefs of participants in the setting” (Marshall & Rossman, 2006, p. 107). The next section presents an overview of measures that need to be considered in determining the quality of research.

4.5 Data Analysis Strategies

Data analysis is a process of “working with the data, organising [it], breaking it into manageable units, coding [it], synthesizing [it], and searching for patterns” (Bogdan & Biklen, 2007, p. 159). Raw data need to be treated in order to transform them into logical and meaningful categories so that the researcher can make sense of the information generated and thus be able to use it to answer the research questions (Hoepfl, 1997; Merriam, 2009). Several data analysis techniques and computer software programmes (including computer assisted qualitative data analysis software programmes such as NUD*IST, CAQDAS, and

NVivo) may be used to analyse qualitative data. Each approach has its own merits and disadvantages (Bogdan & Biklen, 2007; Merriam, 2009) but what they have in common is that they transform qualitative data into meaningful findings (Creswell, 2007; Merriam, 2009; Miles & Huberman, 1994).

The primary aim of data analysis is to transform raw data (in this case, interview transcripts and documents) into meaningful patterns, categories or themes. In this study, the raw data (textual information) generated were examined several times to identify meaningful patterns and themes to bring out information to address the research questions. The overall data analysis approach adopted was content analysis, which is a technique that allow researchers to search for “textual information (e.g. interview transcripts and documents) or recurring words and themes” (Patton, 2002, p. 453). Content analysis technique is useful for working with large databases derived from interviews and documents as it has the potential to transform textual material by reducing it to more relevant, manageable bits of data (Grbich, 2007; Weber, 1990). The process of searching for patterns or themes in an interview transcript, for example, is “distinguished respectively as pattern analysis or thematic analysis” (Patton, 2002, p. 453).

Content analysis is an unobtrusive technique as it is conducted by the researcher and not the participants. A key disadvantage of the content analysis technique is that it is labour-intensive (Grbich, 2007), requiring long hours of work to sort and make sense of the data (Merriam, 2009). Another disadvantage of this data analysis approach is that people may form differing opinions over the validity of the categories that are developed. It is assumed that different analysts can achieve acceptable agreement in categorising the data but a question remains as to the “true meaning of the categorises themselves” (Wallen & Fraenkel, 2001, p. 419).

In this study, the thematic analysis technique was utilised to examine transcripts from the participants’ interviews and information compiled from the documents, observations, and open-ended questions (L. Cohen, et al., 2007; Patton, 2002; Renner & Taylor-Powell, 2003). This technique is most apt for analysing textual information because it can help the researcher to identity emerging patterns and recurring themes from the textual information generated.

Data analysis procedures proposed by Marshall and Rossman (2006), comprising seven stages, were studied to provide a systematic approach to analysing data. They were (1) organising of data, (2) immersion in data, (3) generating categories and themes, (4) coding the data, (5) interpretation, (6) searching for alternative understanding, and (7) writing the report (p. 157). Specific data analysis techniques and procedures proposed by Smith (2000) (for example, steps in analytic research), La Pelle, (2004) (for example, data preparation strategies using Word-file) and Renner and Taylor-Powell (2003) (for example, focusing analysis on questions to group data) were also studied and adopted in this study. The content analysis procedures involving several steps provided by Miles and Huberman (1994), Smith (2000) and Weber (1990) were also studied to provide better acquaintance with the steps and processes involved.

In educational research, qualitative approaches particularly focus on “educational activities and processes from the respondent self-report” (p.132) and the account given is often used to represent a holistic account of the group or the phenomena studied (Scott & Morrison, 2006). Therefore, in relation to this study, to get a holistic account of the respondents’ views, knowledge and understanding of their summative assessment practices, it was crucial that the data were formatted logically before the content of the evidence gathered was analysed. Hence, one of the important steps in the content analysis process that allowed the researcher to see the patterns that emerge from the data was the use of codes.

A coding scheme was established to sort and “break-down” the data by examining its characteristics in detail. Details of how this was done are discussed in the next chapter. However, the key advantage of using a coding scheme is that it provides “first steps in discovering that the whole is more than the sum of the ‘parts’ (or data bits) (Scott & Morrison, 2006, p. 32). Moreover, coding is an early stage “in the researcher’s reinterpretation of other individuals’ interpretation, an activity that has been described as the double hermeneutic of educational research” (Scott & Morrison, 2006, p. 32). The discussions acknowledged that a significant feature of the data analysis process is that each stage entails a data reduction process, which involves “selecting, focusing, simplifying and transforming” the raw data generated (Marshall & Rossman, 2006, p. 10). These events are a crucial part of

the data reduction process as the primary goal is to bring them “into meaningful chunks and interpretations ... of the acts” of the teachers (Marshall & Rossman, 2006, p. 156). A more detailed description of how the actual data analysis process was conducted and the outcomes of the process are provided in Chapter 5 in Section 5.3. This section details the steps that were followed. The following section describes the steps taken to address issues related to the quality and rigour of the study (L. Cohen, et al., 2007).

4.6 Trustworthiness of this Study

All research is required to meet the benchmarks of rigour and quality criteria that are closely tied to the “paradigmatic underpinnings of a particular discipline, in which a particular investigation is conducted” (Morrow, 2005, p. 250). Guba and Lincoln (1989) and others (Denzin & Lincoln, 2005) have suggested the following criteria for assessing the quality of qualitative research: credibility, dependability, transferability, and confirmability. The aim of Guba and Lincoln’s (1985) criteria for assessing the quality or soundness of research is to account for and support the argument that data and subsequent findings obtained in interpretive qualitative inquiry are “worth paying attention to” (Lincoln & Guba, 1985, p. 300). Interpretive research relies heavily on texts as data sources and therefore the trustworthiness criteria proposed by Guba and Lincoln are the best measures for determining the quality of this research. The following is a description of how the four criteria (credibility, dependability, triangulation transferability, and confirmability) for judging the quality of this study were addressed.

The first criterion, credibility, is concerned with the extent to which research is able to yield credible, believable, or convincing results that link to the perspectives or lived experiences of the participants and the particular setting studied. Guba and Lincoln (1989) initially suggested that credibility can be achieved by employing techniques such as prolonged engagement, persistent observation, peer briefing, member checks and triangulation. The field work was spent interacting with participants, interviewing, and purposefully observing the action and pieces of work produced by the research participants. The researcher’s engagement with the participants and immersion during the field work, both as a resource person supporting them to build their assessment skills, and as an

observer, made it possible to gain a deep understanding of their assessment practices and the issues encountered in their classroom settings.

The second criterion for judging the quality of qualitative research is dependability, which is a measure of how consistently a researcher employs and accounts for the integrated processes of data collection, data analysis, interpretation, triangulation, and theory generation (Borman, Clarke, Cotner, & Lee, 2006; L. Cohen, et al., 2007; Merriam, 2009; Trochim, 2006). Strategies that were applied to addressing the issue of dependability in this study included the maintenance of organised records of the data collected. An audit trail, which involves systematic checking of raw data for their accuracy, as well as to update data, has been applied (Schwandt & Halpern, 1988, cited in Flick, 2009). The triangulation process further strengthens the data.

Triangulation is the third criterion and involves the use of multiple data collection sources (Lincoln & Guba, 1985) in order to bring more than one source of data to a single point and thus illuminate the findings and results (Merriam, 2009). In this study, the participants' views, thinking and ideas were explored through interviews, observations, and the documents they presented, which were listed and analysed. This process enabled the researcher "to corroborate, elaborate, or illuminate the research in question" (Rossman & Wilson, 1994, cited in Marshall & Rossman, 2006, p. 202) so as to reduce or eliminate the threat of bias or influence from the researcher (Flick, 2009). Therefore, the processes of multiple data generation and triangulation serve to strengthen the robustness of the study, as compared to the use of a single method of data collection (McMillan & Schumacher, 2006; Patton, 2002; Radnor, 2001). Furthermore, the inclusion of a reasonable number of research participants and more than one data collection method contributes to a study's usefulness for other settings (Marshall & Rossman, 2006).

Transferability is the fourth criterion used to assess the quality of qualitative inquiry and is concerned with the ability of research to generalise or transfer the methods and findings to other contexts that experience similar situations, "with similar research questions or questions of practice" (Marshall & Rossman, 2006,

p. 201). Using qualitative research findings to explain a similar situation in other settings is thought to be problematic, and is one of the limitations of this approach. However, Trochim (2009) argues that from a qualitative perspective, transferability is primarily the responsibility of the reader doing the generalising, and, therefore, as Creswell (2003) argues, it is up to readers to form their own opinions and learn from the research findings.

The fifth and final criterion in this discussion is confirmability. This addresses the issue of whether the research study provides sufficient evidence that confirms the findings of the investigation to the readers. It is an evaluation of whether the findings are logically linked back to the issues or problems of interest investigated through the analytical method used (Borman, et al., 2006). The issue of confirmability was addressed in this research by using multiple data sources and by triangulating the data generated, in combination with careful analysis of the data. The inferences and interpretations that were made of the situation were then studied (Borman, et al., 2006; Lincoln & Guba, 1985, 2000; Marshall & Rossman, 2006; Trochim, 2006). Maykut and Morehouse (1994) suggest that confirmability can be achieved by a researcher when the reader is given access to the raw data, including transcripts and other evidence that show the audit trail. In this study, the researcher applied member checking to confirm the information provided by the participants, who are the best people to judge the accuracy of the information provided. The researcher also adopted a participatory and collaborative approach during the entire research process, which enabled those involved to check and confirm the data and findings of this research. Ideally, research should be theoretically sound, methodologically trustworthy, and ethically transparent (Marshall & Rossman, 2006, p. 215). The ethical issues that need to be addressed in research are discussed next.

4.7 Ethical Considerations

This section highlights considerations of how potential conflicts and ethical issues should be addressed when conducting educational research in any given context, such as the context in which this study was conducted. Educational research often involves working with teachers, students, parents, and other members of a community in a variety of cultural and institutional settings in order to collect

information from them pertaining to the specific area of interest. Research that targets fellow humans as subjects requires researchers to think carefully and to put in place strategies that will address specific ethical issues in the research design. This measure should be taken in order to protect both the researcher and the participant(s) from potential harm (BERA, 2004).

In research, issues related to access, power, and ethics need to be addressed because society and the institutions that are established are stratified in various ways, each conferred with different amounts of power, expectations, and regulations that govern ethical practices (Flick, 2009). Researchers are, therefore, instructed when undertaking research to abide by the codes of ethics, which are simply guidelines that “regulate the relations of the researchers and the participants, and the field they intend to study” (Flick, 2009, p. 36).

The principles of ethics require researchers to refrain from harming (either physically or psychologically) participants that are involved in research, by respecting and protecting their rights, needs and interests (Christians, 2003; L. Cohen, et al., 2007; Flick, 2009; Kervin, Vialle, Herrington, & Okley, 2006). The welfare of the participants must be considered so as to avoid exploiting them; hence, where necessary, the participants or community studied should benefit in terms of new knowledge and insights about the issue investigated or the finding of a new solution (Flick, 2009).

Ethical issues need to be addressed when undertaking research because the researcher relies on information which arises from the “relationship initiated and developed by the researcher with the research participant” (Radnor, 2001, p. 31). Good relationships are likely to develop between the researcher and participants when the researcher initiates trust, respect, and confidence in people that he/she includes in the research (L. Cohen, et al., 2007; Flick, 2009). This study sought and received ethical approval from the University of Waikato and operated within the guidelines established by the University (see Appendix B). Permission to conduct the research in secondary schools was obtained from the relevant education authorities, including the Solomon Islands Ministry of Education (see Appendix A), which is responsible for providing research permits in the country.

The six science teachers who were invited to participate in the research and their principals were all provided with information about the intended study, as well as a consent form explaining the research process and protocol (see Appendix D). The participants' rights were protected. They were informed that participation in the study was voluntary and that they could withdraw at any time during the course of the study, with no consequences, should they choose to do so. All participants were also assured that the information obtained from them would be treated strictly confidentially. They were also assured that in the analysis and writing about data or results care would be taken to avoid any judgements on a personal level that might cause embarrassment to participants when they read the results.

4.8 Summary

This chapter justified and described the research methodology and methods adopted in this study. As the study attempted to make sense of the complex world of secondary science teachers, the interpretive-qualitative research approach was chosen as the appropriate approach to inform the choice of a methodological framework for this study. Interpretive-qualitative methods were used because they were considered to be most suitable for conducting an inquiry in natural settings, such as science classrooms, where the focus was to determine teachers' summative assessment practices. Data collection methods used included interviews, participant observation, and document analysis. The strategies that were used to address issues related to quality assurance of the methods used were discussed, and explained the ethical procedures that the researcher had to consider and adhere to during the course of the research.

The next chapter will provide details of the research processes and data description and analysis procedures followed in the investigation. The research process and data description entails the multiple data collection methods used in the study, including background information of the setting, participants involved and an account of the analysis process.

CHAPTER FIVE: RESEARCH PROCESS

5.1 Introduction

Chapter Four presented and justified the methodology and methods adopted in this study. This chapter outlines the overall research process and describes how the methods and procedures for collecting and analysing data and reporting the findings of this study were applied.

The chapter is divided into five sections: Section 5.2 begins by describing the setting where the research was conducted. It then details the procedures used to select and gain access to the schools and the teacher participants. Section 5.3 sets out the phases of the study. This section is followed by Section 5.4 which tells about the main data collection techniques employed in this study. Section 5.5 delineates the data analysis process followed by Section 5.6, which provides descriptions of the participating schools and profile of teacher participants. Section 5.7 provides a summary of the chapter.

5.2 Research Setting and Participants

This section details the procedures and criteria used to select and gain access to the schools and science teachers that participated in the research. It begins by describing the research setting and goes on to explain the selection criteria.

5.2.1 Setting

This research study was carried out in the Solomon Islands in 2008 and the setting was limited to five secondary schools from a total of 163 secondary schools in the Solomon Islands (MEHRD, 2007a). The participating secondary schools are located on Guadalcanal, the largest Island of the Solomon Islands archipelago on which Honiara, the capital city, is situated. Solomon Islands consist of six main islands and several small islands and atolls. The country lies north-east of Australia and is one of the Pacific Island countries commonly referred to as Melanesia.

Two of the secondary schools that participated in the study are classified as National Secondary Schools (NSS). The other three are Community High Schools

(CHS). No Provincial Secondary School (PSS, the third type of secondary school in the Solomon Islands) was involved in the study as they are spread out on other Islands. The geographical nature of the Solomon Islands, with islands scattered over such a large area, made it difficult for the researcher to reach the PSS at the start of the research due to communication and transportation difficulties.

Three of the participating secondary schools are located in the capital city (one NSS and two CHS), while one NSS is semi-urban and one CHS is located in a rural area. Both of these schools are accessible by road from the capital city. The secondary schools differ in several ways such as availability of teaching and learning resources, infrastructure (for example, laboratory equipment and facilities), number of staff and class size. However, all schools follow the Solomon Islands National School Curriculum and a common Year nine science curriculum is used by science teachers in secondary schools throughout the country.

5.2.2 Procedures for selecting schools and participants

This study involved six year nine science teachers who were teaching year nine level science in five secondary schools in 2008. Authorisation to engage the five secondary schools that took part in the research was sought and obtained from the Solomon Islands Ministry of Education which is the authority responsible for processing research applications and permits in the country (see Authorisation letter, Appendix A). An ethics application was also approved by the University of Waikato (see Appendix B), which entailed how the teacher participants would be protected from physical or psychological harm and to ensure that the study was conducted in an ethical manner where the rights and interests of the teacher participants were safeguarded throughout the research study.

A letter inviting schools to participate in the study was issued to the principals of 10 secondary schools in Honiara the capital of the Solomon Islands and around Guadalcanal, the Island on which Honiara is located. The letter provided information about the study; its aims and the need for teacher participants to be engaged in professional development. Only eight principals responded to my invitation letter within the timeframe I set. I used the following criteria to select

the participating schools because I could not involve all eight schools and teachers because of time and financial constraints:

- **Access** — The schools located in Honiara must be located near public transport. The schools around Honiara should have road access and about 30 minutes' drive from Honiara. The schools must also have access to telephone. Some schools do not have access to telephone during the time of my study. So I chose the 5 schools that had phone connection so that I could contact the principals and teachers.
- **Type of school** — The school selected should either be a national secondary or a community high school. Provincial secondary schools were not included because they are located in more remote areas of Solomon Islands.
- **Reputation of the school** — Consider schools which are reasonably resourced and seemed to be managed adequately.

Therefore the schools were selected based on the positive responses from the principals and the criteria.

The six year nine teachers were selected by their principals on the basis of two specific criteria. First, the teachers needed to be teaching year nine level science and be willing to participate and provide information about their personal views and experiences of assessments that are used for summative evaluation in the school. Second, the teacher should be available for the whole duration of the data generation period. In four of the secondary schools selected, the four year nine teachers selected were the only teachers teaching science at their respective schools. The fifth secondary school, School A had two teachers teaching year nine science and so both were selected and so a total of year nine science teachers were chosen to participate in the study.

The six teachers were chosen because they represented a group of science teachers that the study targeted and fulfilled the selection criteria. The sample size was small, but appropriate and realistic for interpretive research and the time available for the study to be conducted.

5.3 Phases of Study

This section describes the phases of the study, which involved three main phases as shown in Table 1.

Table 1: Phases of the study showing the components and dates of its implementation and objectives

Phases of the study	Objectives	Key data collection methods employed
1 • Planning for Professional Development Intervention (Sept-Dec. 2007)	Identify professional development model to adopt, draft workshop program and training guide	Literature review
2 • Baseline Study (February, 2008) • Adjustment of professional development (February/March, 2008)	Identify teachers' views, strengths and knowledge gaps in assessment; based on baseline analyses - finalise content to be covered in PD	Interviews
3 • Professional Development workshop and Implementation (March, 2008) • School visits (March/ April, 2008) and Implementation of new assessment procedures (April to June, 2008) • Assessment of changes in teachers' summative assessment practices as a result of PD (August/September, 2008)	Strengthen teachers' summative assessment practices/competencies Provide ongoing professional support to teachers ; also teachers apply what they learned into their practices Assess teachers' post-professional development summative assessment practices as a result of PD	Interviews, participant observations Interviews, documentary analysis and participant observations Interviews

These are; (a) planning for professional development, (b) baseline study and (c) professional development workshop and implementation. The phased approach to research was considered because it allowed the researcher to identify the resources required in each phase of the study and to take a systematic approach to research. These included choosing what to study, specifying the research problem and identifying issues and challenges that might be experienced during generation of data, organising and analysing data, interpreting results and reporting the outcomes (L. Cohen, et al., 2007; Murray, 1998). The phases of the study and the on-site data collecting techniques used are further delineated.

5.3.1 Phase One of the study: Planning for professional development

This phase involved mainly the researcher to conceptualise and to draft a professional development plan which included a workshop program and training guide. Review of the literature provided information on an appropriate professional development model to be adopted, possible ideas about the content to be covered (though the actual content covered was negotiated with the teachers and discussed in section 5.3.2) and drafting of the initial training guide and program (see Table 2 for details of the professional development planning process). The focus was on planning rapid dissemination of specific skills and content of aspects of assessment (Gaible & Burns, 2005).

The sources of information included various international literature and publications on assessment and background information about assessment practices in the Solomon Islands education system. The planning process included the activities undertaken in preparation for the field work. These included deciding the initial content to be covered in the professional development, drafting of the workshop program and designing a training guide (see Table 2). The planning process as outlined in Table 2 was helpful to the researcher in two major ways. First, having an initial professional development workshop plan provided an overview of: (a) the focus and goals to be achieved; (b) strategies to be identified to reach goals; (c) resources required to implement the strategies, and (d) possible time-frame to implement the professional. Second, there was a need to allow for flexibility in the planning of the professional development. Drafts of the professional development workshop program and training guide was developed from the start to allow reviewing and adjusting once the baseline data was analysed.

5.3.2 Phase Two of the study: Baseline study

The aim of the baseline study was to assess the teachers' professional learning needs, expectations, and experiences in summative assessment, which essentially explored the science teachers' existing summative assessment practices (methods of assessment, grading, and what they do with students' assessment information). The baseline study also involved collection of contextual data regarding the teachers' profiles and their schools.

Table 2: Planning structures and processes of the teacher professional development intervention and changes incorporated as a result of baseline study data

Stages of planning	Conceptualisation of teacher professional development	Initial Professional Development Plan	Before Baseline Study	After Baseline Study	Before Professional Development Workshops	Professional Development Workshops
Activities	Review literature on teacher professional development (particularly in science/assessment) in order to gain a broader perspective of PD models and strategies	• Draft PD Training guide • Draft PD programme and workshop guide using information from; (1) the literature review, and (2) reflections on experiences of teaching, assessment and teacher needs in the Solomon Islands context • Consider duration of PD, content to be covered and participants	• Consult and contact relevant education authorities and school principals to gain access to teachers • Meet with individual teachers to seek their consent • Organise interview schedules to obtain baseline data • Provide fact sheet about the study to participants	• Analyse baseline data and use information derived to review and finalise PD (1) workshop; and programme; (2) workshop guide including content to be covered	• Arrange venue of the PD workshop • Prepare cost of the workshop • Arrange catering • Print hand-outs • Provide workshop programme to participants who confirmed their participation	• Conduct workshop As the workshop progresses, review how well each session is conducted and address issues that arise
Decisions	A total of eight assessment topics were initially selected based on ideas and information obtained from teacher PD literature and my own reflections on assessment contexts in the Solomon Islands. The topics initially selected covered in the PD included: (1) assessment plan; (2) test blueprint; (3) grading; (4) diagnostic use of assessment; (5) rubrics; test item writing; (7) reporting formats; and (8) alternative assessments.		When the baseline data became available, the teacher PD training guide and programme were revised. A decision was made to cover only four topics or themes based on the professional learning needs of the teachers on assessment, instead of the eight topics originally selected. The final assessment topics included are: (1) assessment plan; (2) test blueprint; (3) fixed method for determining student grade; and (4) diagnostic use of assessment. The selection was based on the evaluation of elements of assessment that teachers found most challenging and for which they indicated their need for support, as well as the need to focus on a few topics.			Issues arising from each session were dealt with in the final session on each day and at the beginning of the session the following day.

Note: PD – professional development

The baseline study was undertaken so that the data obtained could be used to determine the teachers' summative practices as well as to inform the design of the professional development intervention. This was undertaken in consultation with the teachers. The researcher also negotiated with the teachers on the content of assessment to be covered in the professional development workshop. Details of how this was done are discussed next.

Adjustments made to the content of the teacher professional development

The initial content of the professional development consisted of eight topics or themes (see Table 2) which is also outlined in the professional development workshop program (see Table 3). However, as evidence of the baseline study became available, these were reduced to four topics. Details of the final structure of professional development and the rationale for including the content covered is provided in Chapter 7/Section 7.3. The content of the professional development and training guide were revised, updated and refined to cater for the specific assessment needs of the teachers. This was achieved through consultation with the teachers after a preliminary analysis of the baseline data was completed. Through the interviews, I was able to identify gaps in teachers' assessment knowledge. Each teacher was also asked what area in assessment they would like to be supported in to build their knowledge and skills to which they responded positively by suggesting the topics.

I also showed the teachers the initial assessment topics I wanted to cover in the professional development workshop and asked them individually to give me their feedback, which they did. As part of the professional development plan, I produced a list of potential areas in assessments that I thought teachers would need to learn based on my experiences as an examiner and curriculum development officer in my country. The teachers and I eventually agreed that the professional development should focus on four topics, namely, (a) designing an assessment plan, (b) designing a test using a test blueprint (c) selecting a fixed percentage method to determine student achievement grade, and (d) analysing and using summative assessment data to inform teaching and learning.

These topics were agreed to by the teachers as these were some of the elements of assessment they found most challenging and included new ideas about assessment which they wanted to learn about. There were fewer topics and so this gave the teacher participants and the researcher a shared focus on the topics. Also, fewer topics were manageable, especially in view of the time needed to complete the field work. Thus, the design of the professional development workshop and the strategies identified for implementation were tailor-made to suit the teachers' specific assessment needs and context in the classroom as well as to achieve the outcomes of the research. Despite having reached agreement, there were at least two teachers who suggested the need to include other assessment topics such as investigative projects and experiments. The two teachers settled with what the rest had agreed to after an explanation was given about time constraints and the need for the researcher (me) to prepare resource materials on the proposed topics.

5.3.3 Phase three of the study: Professional development and implementation

This section briefly discusses and justifies the professional development model adopted; its suitability and the main phases involved. The professional development program is also provided to indicate what was covered in each workshop session.

Professional development model

As explained in chapter 3/section 3.4.3, the study adopted the Standardized Teacher Professional Development model. This model focuses on training that emphasises sharing of skills, knowledge, and experiences on specific areas of teachers' professional learning needs via face-to-face approach (Gaible & Burns, 2005). In the context of this study, I, the researcher, would be sharing assessment knowledge based on my expertise and experiences as well as teachers according to their experiences in conducting assessment in the classroom. Hence, this professional development model is useful, when the intent is to adopt a centralised approach of disseminating information and skills to teachers from different schools which is what this study wanted to achieve.

The intent of this professional development was to build on the teacher participants' existing knowledge and skills in summative assessment in the

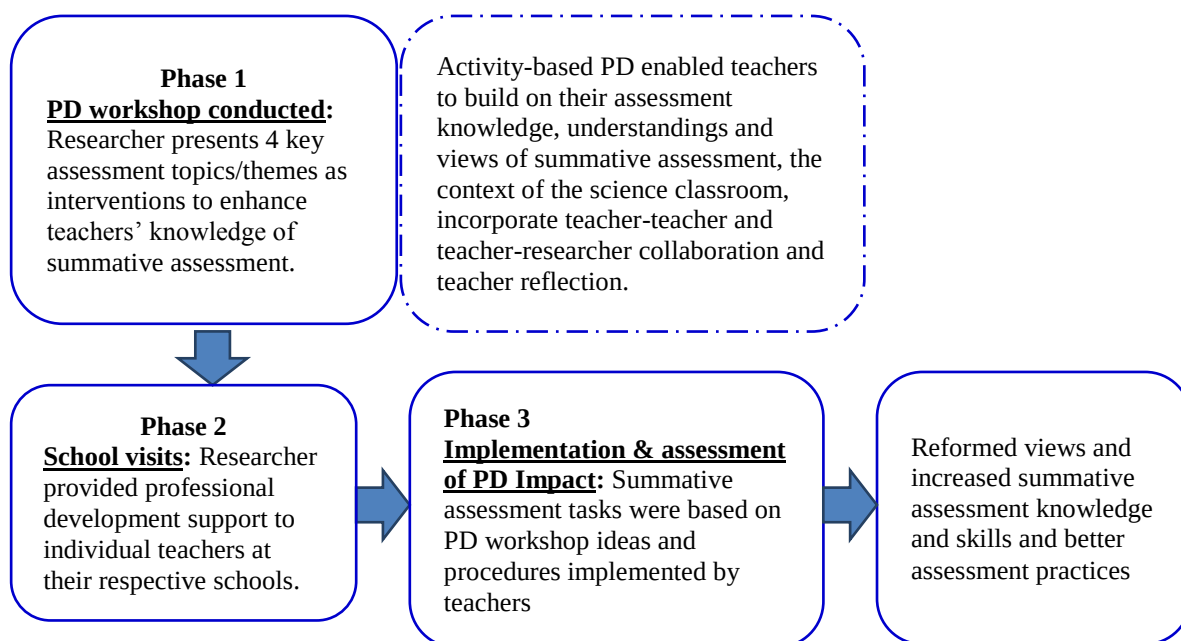
context of their science classroom practices, as well as foster teacher-teacher and teacher-researcher collaboration in the learning process (see Chapter 7/Section 7.6). Particularly, I wanted to provide to teachers an opportunity and time for them to learn aspects of assessment with their colleagues from other schools. The focus of the professional development was to build the teachers' knowledge and skills in assessment because it is viewed in the context of this study as an area of teachers' professional learning need.

The baseline study had indicated that teachers had very limited professional development opportunity in past years to upgrade their knowledge and skills in assessment. Also, teachers had very limited opportunity to work collaboratively with their peers (particularly those from others school as well as within their schools who were teaching the same subject and grade level – year 9 science) and to reflect on their teaching and assessment practices so that they would be able to make improvements on them. So bringing the six science teachers together at a central location not only opened up the opportunity for them to learn new knowledge and skills, but also to share experiences of their assessment practices collaboratively.

Furthermore, this professional development was based on the understanding that by broadening and deepening summative assessment ideas it would help teachers to not only develop better views, beliefs and conception of summative assessment, but most importantly improve their overall assessment-literacy and practices. Research has shown that teachers' assessment practices are shaped by their beliefs about their identities as teachers (Nespor, 1987). Hence, professional development in assessment for teachers needs to take their existing perceptions, knowledge, understandings and practices into consideration. This is in order to assist them position themselves towards reforming their views about summative assessment and the various forms of assessment that are available and the purpose each could be used for. Thus, it was important to engage the teachers to not only reflect on their beliefs about summative assessment but also to expose them to new assessment ideas and procedures that were likely to contribute towards their professional growth which would add value to their overall assessment practices. The professional development model adopted was implemented in four phases.

Brief descriptions of the processes involved in each phase are outlined in Figure 2.

Figure 2: Professional development model showing the phases of implementation



Phase 1: Professional development workshop

This phase involved the delivery of the professional development workshop to enhance the teachers' knowledge of summative assessment. Four assessment areas as outlined in Table 2 were the focus of the professional development intervention. These were; (1) assessment plan; (2) test blueprint; (3) fixed method for determining student grade; and (4) diagnostic use of assessment. A workshop program (see Table 3) was devised to guide the delivery of the professional development. It was important to make the program as flexible as possible to allow teachers to complete the activities as well for group discussions to take place. A four-day professional development workshop program was designed with five sessions per day and prepared content covered. Each session was one hour long which began with presentation by the researcher followed by teacher-activities and concluded with an open discussion.

Phase 2: School visits and implementation

School visits. The purpose of the follow-up school visits was to provide further professional support to individual teachers at their respective schools. The first school visit was conducted in March 2008; two weeks after the four-day

workshop had been conducted. This was followed by a second visit in mid-April, 2008.

Table 3: Year nine science teachers professional development workshop programme (3-6 March, 2008)

Day 1 Morning Sessions	Day 1 Afternoon Sessions
Opening Session: 9:00 - 9:30 am - Welcome & introduction to research/ professional development workshop - Aims & objectives of research/ professional development workshop in-house matters Session 1: 9:30 - 10:30 - Reflections and review of current assessment and examination situation in SI and abroad; views of professional development	Session 2: 11:00 - 12:00 - Purpose & guiding principles of assessment Session 3: 1:00 - 2:00noon - Linking learning outcomes, teaching, and assessment tasks - Guidelines for selecting and using classroom assessments - Summative assessments used to assess students' achievement Session 4: 2:00 - 3:30pm - Planning for assessment program Session 5: 3.30pm- 4.30pm - Group discussion
Day 2 Morning Sessions	Day 2 Afternoon Sessions
Session 6: 9:00 - 10:30 am - Recap from Day 1 - Using a blueprint to construct assessments tasks Session 7: 11:00 - 12:00 - Grading procedures - weighting scale, blueprints and fixed percentage to determine achievement grades	Session 8: 1:00 - 2:00pm - Preparing test blueprints Session 9: 2:00 - 3:30pm - Analysing, and diagnosing student answers from past summative assessments (exam papers) Session 10: 3:30pm-4:30pm - Group discussion
Day 3 Morning Sessions	Day 3 Afternoon Sessions
Session 11: 9:00 - 10:30 am - Recap from Day 2 - Using summative assessment data/ information to inform teaching and learning	Session 13: 1:00 - 2:00pm Designing an assessment plan: Teachers to design an assessment plan in order to help them select, adapt, design a variety of assessment tasks to assess and evaluate students' learning.
Session 12: 11:00 - 12:00 Planning of Year nine science unit and assessment tasks for classroom trial	Session 14: 2:00 - 3:30pm - Designing assessment plan Session 15: 3:30pm-4:30pm - Group discussion
Day 4 Morning Sessions	Day 4 Afternoon Sessions
Session 16: 9:00 - 10:30 am - Recap from Day 3 - Designing of assessment plan Session 17: 11:00 - 12:00 - Review of assessment plans	Session 18: 10:30 - 12:00 - Review of assessment plans Session 19: 2:00 – 3:30pm - Group discussion: Where do we go from here? Reflections/evaluation/End of workshop

The researcher spent one to two hours with each teacher. The time spent with individual teachers varied according to the specific agenda under discussion and

needs identified by the teacher concerned. A third visit was made in early August 2008 approximately four months after the second visit. The schools were on mid-semester break in July and resumed classes in August.

During the first school visit, the researcher discussed with individual teachers aspects of planning for assessment with which they needed further assistance. The second visit was used to provide ongoing support to the teachers as they implemented some of the assessment strategies they had learned from the professional development. The third visit was conducted to determine the extent to which the teachers applied the assessment knowledge into their assessment practices.

The school visits provided an opportunity for the researcher to find out what the teachers had been thinking about what they had learned from the professional development workshops and whether they had implemented their assessments plans; also the teachers could ask questions to clarify what they had learned from the workshops. The researcher's role was that of a colleague and mentor. The intention was to reinforce key ideas covered during the professional development workshops and provide practical advice and assistance to teachers on the issues and challenges they faced when they implemented their assessment plans.

Implementation

The teachers were asked to implement their assessment plans from April to June, 2008. The schools were on mid-semester break in July, so the next school visit took place in August. The purpose of the implementation phase was to provide on-going support and opportunities for teachers to reflect on the new knowledge and skills acquired in assessment as they implemented changes to their assessment practice.

The implementation stage enabled the teachers to put into practice their assessment plans, which included assessment strategies and procedures and tools they intended to use to assess their students' performance on specific units of the year 9 science curriculum that the teachers chose to teach during the first semester of 2008. To gather evidence of the implementation phase, the teachers were asked

to keep, for analysis, samples of the assessment tasks or instruments such as quizzes, tests or exams, students' achievement records or any other written material they used. The researcher took notes of the main deliberations of the discussion held with individual teachers.

Teachers' post-professional development summative assessment practices

It was important to assess the pattern of professional change experienced by the six teachers involved in a four-day summative assessment professional development initiative designed to extend and refine their summative assessment practices. I wanted to know what they applied in their classrooms and to identify the factors that supported or inhibited their ability to implement new assessment ideas and procedures. The key methods used to assess the impact of the professional development, that is, what they had put into practice in the classroom during the post-professional development period in the classroom, included interviews and document analysis. These are discussed next.

5.4 Data Gathering Methods Employed

The three key data collection methods used in the baseline study and professional development workshops were interviews, participant observations and examination of appropriate assessment documents that the teachers had used, including group discussions. A time-line for the data gathering methods are provided below to show the actual dates that data for this study were collected.

<u>Date</u>	<u>Type of data collected</u>	<u>Data gathering method</u>
February 2008	Baseline study	Interviews, document analysis
March 2008	PD workshops Workshop	Interview, participant observation, documentary analysis
March/April 2008	Visit teachers	Interviews, documentary analysis
August/September 2008	Post-PD teacher summative assessment practices	Interviews, documentary analysis, participant observations

Details of how the data collecting techniques were applied in the investigation are described next.

5.4.1 Conducting teacher interviews

As discussed in Chapter 4, the key method of collecting data on teachers' summative assessment practices was the one-on-one semi-structured interview. A range of questions was constructed to examine the different dimensions of teachers' summative assessment practices (see Appendix E). These included their level of understanding and perceptions of summative assessment, the different types of assessment and strategies used and how teachers used summative data.

It was important to conduct the teacher interviews in an informal way. This was necessary because the researcher needed to conform to the cultural protocols and practices of the Solomon Islands people where interview or conversation (story telling) is perceived as a communicative link between the knower and the receiver of information (Waldrip & Taylor, 1999). In order for the researcher to build confidence and trust with the teachers and thus establish mutual relationships with each one of them, it was necessary to begin each interview session with informal conversation about non-related issues of interest before addressing the actual interview questions. Next, the reasons for conducting the study and their involvement in the study were explained. Each teacher was then asked to talk through their teaching experiences. The intent here was to set the scene by establishing an informal conversation style so that the teachers could feel comfortable and talk easily about their classroom assessment roles, responsibilities, concerns, and successes. It was important to explore with the teachers what worked and what did not, and to discuss, in particular, the successes and challenges they face in teaching science.

Teachers were given the option to be interviewed either in English or Pijin (neo-Melanesian *lingua franca*) which all Solomon Islanders can speak and understand). All of the teachers preferred to be interviewed in Pijin. However, during the interview it became apparent that the teachers switched from Pijin to English and vice versa, depending on what they wanted to emphasise and which language they felt more comfortable in making their points. A digital voice recorder was used to record all teacher interviews. This device was favoured instead of a cassette tape recorder because the recorded voice could be easily stored as WAV (waveform audio) format in a personal laptop computer and

played back when convenient. Each set of interview data collected was transcribed for preliminary analysis so that the information drawn could be used to inform and adjust the professional development workshop programme, which had been drafted two months prior to the commencement of the field work. Thus, the preliminary findings on teachers' existing summative assessment practices helped to reshape the provisional professional development workshop programme, and also refocused attention on specific assessment skill needs of individual teachers who took part in this study.

Each teacher was given a copy of the transcripts of the interview when all of the data had been transcribed. This happened at the end of the baseline study. They were not only asked to read the transcripts, but also verified content, corrected errors, and if necessary asked questions so that anything that appeared to be unclear in the transcripts could be clarified for them. Overall, the teachers were willing to talk about their assessment practices because they were informed of the intent of the study. They seemed to understand the reasons why I wanted to involve them in the study and the possible benefits of the professional development intervention.

5.4.2 Participant observation

This section describes how participant observation was employed to obtain specific data related to the teachers' professional learning experiences during the professional development workshops and, to a lesser extent, the visits made to the teachers in their schools. The professional development workshops focused on (a) designing an assessment plan, (b) developing a test blueprint, (c) fixed percentage method approach for grading, (d) diagnoses of students' assessment responses. These were the key topics covered in the workshops and they included individual and group activities that were designed to reinforce the assessment concepts covered.

The intent of the participant observation was to observe what the teachers did and what they thought they learned and how they learned. As a participant, I participated in the activities that the two groups of teachers were doing as an equal active member of each group. In doing so, I asked certain questions or made

suggestions on how each group might be able to complete the tasks. As a researcher, I observed what the teachers were doing (e.g. I observed how they constructed a blueprint etc.) and how they responded to each other as they worked. I was particularly keen in looking at how the teachers worked together to complete a task, to share their ideas, and answer questions related to the tasks they were doing and/or discussed how they might do the activities.

As an observer, I made notes on specific responses such as when they reflected on their past practices and what they were learning and how they were learning new assessment strategies and procedures or whether the activity they were doing clarified some of the doubts they had about the assessment strategies they were learning about. In this way, my role as a participant observer enabled me to observe what was going on and at the same time obtain first-hand information on the actions of the participants. The notes I prepared as a result of the participant observation method of data gathering were used to report the findings in Chapter 7. The questions that guided my observation as a researcher and participant observer in each group were as follows:

- Are teachers familiar with the assessment topics introduced to them during the professional development?
- What did the teachers do in the group activities?
- What did they learn?
- How did the teachers learn from the group activity?
- As a researcher and participant, what lessons did I learn from my observations?

The participant observation method of data collection was helpful in that it enabled me as a researcher to obtain first-hand information about what the teachers did in their group activities during the professional development workshops and school visits. The focus was on how teachers make meaning of new assessment strategies and procedures and how applicable these would be in their classroom practices.

5.4.3 Documentary data

The context of the schools and background of the participants influenced the need to include documentary data in this study. It was considered important to establish whether the teachers were adequately supported in their classroom assessment practices through resources the school or respective education authorities provided such as written assessment frameworks and curriculum support materials.

Documentary data was also used in this phase so as to establish a link between what the teachers reported in their interviews regarding their existing assessment practices and evidence of their actions. Documents that proposed assessment reform at both school and national level were also sought and examined. Such documents were sought because they helped to establish a basis for comparison, contrasts, possibilities and future plans for improving classroom assessment practices (L. Cohen, et al., 2007). Documentary data also complemented data obtained through interviews and together they helped to establish a big picture of teachers' assessment practices. Both primary and secondary data sources were sought and examined.

The primary documentary data sources included:

- teacher-generated assessment materials (for example, samples of past unit tests, end-of-term exam papers and external science exam papers;
- students' achievement records; and
- assessment plans.

The secondary documentary sources included official curriculum documents such as (a) the year nine science syllabus, (b) teacher's guide and student's book; (c) the Solomon Islands Education framework 2007-2009 document; (d) examination reports; (e) the Solomon Islands Curriculum Management and Reform Programme 2005-2007 document; and (f) the Solomon Islands College of Higher Education/School of Education Teacher Education Handbook (2005). These documents were coded as shown in Table 4.

Table 4: Codes used to identify documents obtained

Category	Codes	What each code stands for
Primary source	PS-TDA	PS-Primary Source, TDA-teacher designed assessment
	PS-SAR	PS-Primary Source, SR-student achievement record
	PS-TAP	PS-Primary Source, TAP-teacher assessment plan
Secondary source		
	SS-S	SS-Secondary Source, S-syllabus
	SS-TBK	SS-Secondary Source, TBK-teacher book
	SS-ExR	SS-Secondary Source, ExR-Exam reports
	SS-SIEF	SS-Secondary Source, SIEF-Solomon Islands Education Framework
	SS-CMRP	SS-Secondary Source, CMRP-Curriculum Management and Reform Programme
	SS-SICHE	SS-Secondary Source, SICHE-Solomon Islands College of Higher Education

The codes were chosen so that each document consulted could be easily identified and distinguished from each other. Analyses of the documents were done by asking the following questions: Who drafted the document? Who was the intended audience? Why was the document written or what is its purpose? What information, that is relevant to the study, can be obtained from the document? The responses to the questions were written and stored in a computer to be used later.

5.4.3 Data from focus group discussion

Data that depicted the teachers' professional learning experiences were generated from observations of teachers learning by doing the activities, conversations with individuals and groups and discussions held with the whole group, which is referred here as focus group discussion. The focus group discussions were conducted at the end of each day of the four day professional development workshops. The focus group comprised of the six science teachers that attended the teacher professional development workshop on assessment. Each focus group discussion session was guided by a set of questions that focused on the topic covered each day. The questions were predetermined and focused, short and open-ended. Each teacher was given a chance to respond to the questions asked or make comments on the discussion information provided. For example, on day one (see Table 3/Year nine science teachers' professional development workshop programme (3-6 March 2008), the group discussion focused on existing assessment and examination situation in the Solomon Islands. So the questions used were: (i) What types of assessment do you use to assess your students in

your school? (ii) Why do you use the types of assessment you mentioned to assess your students? (iii) What are the issues you encounter with the types of assessment used and how do you address these? (iv) Is your assessment practice guided by some kind of principles or theories you might have learned from your initial teacher education, etc.? Explain. (v) Why do you think summative assessment is the most popular type of assessment used in your school? Other questions and statements evolved as the discussion progressed and these were also used to elicit teachers' views about the topic discussed. The researcher took notes on the key responses provided as well as recorded the discussion sessions using a digital voice recorder for analysis.

The focussed group discussion sessions helped both the teacher participants and the researcher to summarise each day's deliberations, and the teachers were asked to elucidate their views through the questions that were asked and this stimulated a fruitful discussion on the assessment themes. It was important to create a supportive learning environment for reflection and collegial sharing of ideas and experiences based on their existing assessment practices.

5.4.4 Data on teachers' post-professional development summative assessment practices

One-on-one, semi-structured interviews were conducted to elicit information related to the changes the teachers had made (see Appendix F, evaluation interview schedule). The interviews were framed so that the teachers could reflect on what they had implemented and how they felt about the whole professional development intervention. This helped to describe the teachers' professional growth as well as identify the associated conditions and concerns experienced during the implementation phase. Changes in the teachers resulting from their participation in the professional development intervention were also determined through examination of documents (for example, samples of tests, examinations and student achievement records) that the teachers designed and used. A matrix that was used to guide examination of the documents is provided as Appendix G. The next section describes the methods utilised to analyse data obtained from each phase of the study.

5.5 Data Analysis Process

This section describes how the data generated from this study were analysed, using the data analyses techniques described in Chapter Four under Section 4.4. The data were analysed using thematic content analysis techniques and procedures recommended by La Pelle (2004), Marshall and Rossman (2006), Renner and Taylor-Powell (2003), Miles and Huberman (1994) and Smith (2000). The data analysis in this study was carried out in four main stages. They are as the following:

- Stage 1: Managing and preparing data
- Stage 2: Generating categories and themes
- Stage 3: Developing a coding scheme
- Stage 4: Interpreting and drawing conclusions

The procedures and outcome of each stage of the data analysis process are described in subsection 5.5.1 through to 5.5.4 following this introduction. Overall, the data analysis process was conducted within the epistemological position that the researcher adopted. From the outset, it was recognised that the knowledge about summative assessment practices of science teachers which was pursued in this study was created by the teachers themselves in response to the need to find out students' levels of achievement in science for purposes defined by the education system, schools and the teachers themselves. Therefore, the intent was to seek clarification of the teachers' summative assessment practices.

In general terms, the data analysis adopted in this study was largely inductive in its approach. This implies using the data analysis techniques identified to search and identify themes by reading and combing each set of raw data generated (Hatch, 2002). This approach was in line with Strauss and Corbin's (1998) grounded theory, which states that "the researcher begins with an area of study and allows the theory to emerge from the data" (p. 12). This meant that the researcher needs to depend on his/her own intuitive knowledge and theory to identify categories, themes, concepts, and relationships from the textual material collected (Strauss & Corbin, 1998).

A thematic analysis technique was adopted and used to analyse the data gathered from the field work. In order to apply this technique effectively, Microsoft Word Programme was utilised to create separate tables into which data were processed (La Pelle, 2004). Word Programme was also used to create separate theme codebooks in tabular format according to the overarching research questions and other questions that the researcher constructed so that the analysis could answer the questions (Renner & Taylor-Powell, 2003). The tables that were constructed enabled the researcher to define the connections between the coding scheme developed, teachers' responses and the theme categories that emerged (La Pelle, 2004). The following sections provide details of the steps taken to analyse data in this study.

5.5.1 Stage 1: Managing and preparing data for analysis

Data analysis in this study began as each set of data was being collected and involved organising, summarising and developing a data management system that enabled systemic storage and tracking of data (Flick, 2009; Marshall & Rossman, 2006). A basic data management system that entailed file names and other details (for example, teacher ID, type of data collected, site, and the dates the data were collected) was thus established.

A much more detailed analysis was conducted once all the transcripts from interviews and documentary analysis were completed and compiled after completion of the field work. This approach was in accordance with suggestions provided by scholars and researchers that data should be analysed “simultaneously with data collection” (Merriam, 1998, p. 16). The first stage was a critical starting point for data analysis because how well the researcher managed and sorted out the data determined the outcomes expected in the remainder of the analysis process. This meant that all data would need to be logically formatted and scrutinised before proceeding to the next stage of the data analysis process.

The interview data obtained in Phase One and Three of the study began with a review of the notes I had written in my diary. From these notes, a summary was prepared; it included my reflections on the way the teachers answered the research questions. This was followed by transcribing the interviews. All recorded

interviews were translated and transcribed “word-for-word” from Pijin (Solomon Islands language) into English. Each transcript was then labelled with a file reference number (with teacher ID) and stored as Microsoft Word-files. Hard copies of the same transcripts were kept in a labelled envelope. The recorded interviews were stored as computer waveform audio files. Transcripts of observations and information derived from documents were also sorted and kept in an envelope and as computer Word-files. All electronic copies of the data gathered were treated this way to ensure that they were accessible and readily retrievable for the next stage of the data analysis process.

The task of immersion in data involved the process of data reduction, which is described as a process of “continual refinement, selecting, focusing, simplifying and transforming” (Miles & Huberman, 1984, cited in Warrington, 1997, p. 407) the data generated until the patterns, themes and concepts linked to the research questions are visible to the researcher (Merriam, 1998). Immersion in data was an ongoing process, which started when the first interview data were collected and analysed, and continued throughout the entire data analysis process. Thus, the interview transcripts, for example, were constantly reviewed for errors and ambiguities. Certain segments of the data collected were reduced because they did not make sense or add meaning and value to the specific research questions (Renner & Taylor-Powell, 2003). Having sorted the data in a logical format, the next task was to organise them into coherent categories in order to identify the themes or patterns that emerged.

5.5.2 Stage 2: Generating categories and themes

Following stage one of the data analysis process, the next step was to construct a four-column table using Microsoft Word table functions (La Pelle, 2004) to group each set of data into meanings or categories. The teachers’ responses in each set of data were displayed after each research question or questions that the researcher had constructed specifically for the analysis to answer (Renner & Taylor-Powell, 2003).

For the interview data, the teacher’s response was used but the analysis was based on the core questions that guided the interview sessions. In the case of documents,

open questions and observation notes, specific questions were constructed for the analysis to answer. Table 5 shows an excerpt of how the interview data were formatted into a table. The first column in the example shows the teachers' identity (e.g. T1 to T6 stand for the teachers that participated in the study), the second column indicates a coding category (this is used when a codebook is produced in stage three of the data analysis process), the third column shows the interview questions used and the responses of each teacher, and the fourth column shows the sequence of the teachers' responses.

Table 5: How interview data were formatted into tables to prepare data for the next stage of analysis.

Participant ID	Code	Interviewer Question/Participant Response	Sequence
Interviewer		<i>I would like to gather some background information about you; therefore I'd like you to introduce yourself by telling me; a) your name and school, b) where you did your teacher training, c) how long you have been teaching, d) and your general views about science teaching and assessment</i>	1
T1		T1 is my name (pseudonym- male teacher) and I am currently the only teacher teaching science at this community high school that caters for students from the surrounding communities.....	2
T2		My name is T2 (pseudonym-female teacher). I have been teaching for the last six years in this school which is run by a church. My school offers primary education up to senior secondary education (form 6).....	3
T3		My name is T3 (pseudonym-male teacher) and I teach Form Three, Five science and Form Six physics. The school is operated by a church and caters for years seven, right through to year 12 secondary education. All the students are boarders and so teachers are also responsible for looking after the students.....	4
Interviewer		<i>When you think of summative assessment, what comes to mind/or what does it mean to you?</i>	8
T4		When I think of summative assessment, it reminds me of assessment that I use to find out my students' overall achievement at the end of the year... such assessments provide a summary of what students learn as a result of what I teach my students.....	11
T5		Summative assessment is a type of assessment that gives an overview of what I teach and what students learn..., its purpose is to find out students' strengths and weaknesses related to the topic they study in science.....	12
T6		Summative assessment is a form of assessment that allows us teachers to evaluate the performance of our students....it is an important component of assessment that we administer in the classroom.....	14
†Note: T1-T6 represents teachers. Adapted from La Pelle (2004, p. 89)			

The advantage of using sequence numbers in Table (5) was that it allowed the researcher to trace the text analysed to the specific teacher's response (La Pelle, 2004). This is an important aspect of the data categorisation process because grouping the data into categories brings meaning to the words and statements uttered by individual teachers (Renner & Taylor-Powell, 2003). Data should be categorised before identifying the themes or patterns that emerge and thereafter "organis[ed]... into coherent categories" (Renner & Taylor-Powell, 2003, p. 2). As I organised the data into categories, in this case according to the interview questions, I was able to explore and identify patterns, ideas and discourse within the texts and the relationships that became apparent both within and between the emerging themes (Renner & Taylor-Powell, 2003).

5.5.3 Stage 3: Developing a coding scheme

The third stage involved coding and displaying the data in logical categories in separate constructed tables. In this study, coding of the data involved classifying sections of the transcriptions (interviews, observations and documents) into categories and labelling them with letters, words, or numbers (Gibbs & Taylor, 2005; Renner & Taylor-Powell, 2003). Thus, following on from the second stage of data analysis, two separate theme codebooks (the first table catered for the existing summative practices and the second for the outcomes of the teachers' professional learning experiences) were created using Microsoft Word-file. This was done to identify within the passages of transcripts "themes that seem to recur or that have some significance to the [research questions]" (La Pelle, 2004, p. 88).

Table 6 shows a formatted theme codebook created to present the texts that linked to theme categories that emerged from the interview transcription that focused on teachers' existing summative assessment practices. A separate codebook was created for the data that focused on outcomes of the professional development. In Table 6, the first column represents the theme categories, followed by column two, which shows the teachers' responses. The third column shows the coding scheme used in this study (e.g. T4/In1-13). Thus, in the example provided:

"T4" refers to teacher identity or teacher number 4

"In1" stands for the interview data collected during Phase One

"13" is the sequence number and links the theme to the text and the teacher

With the coding scheme established, I went through the text in each set of interviews, observations and document transcripts and placed the codes. I was able to identify the words that described the actions that the teachers had taken in their respective science classrooms.

The examples given in Table 6 show an extract of the substantive codes that linked the theme categories that emerged, such as “teachers’ perceptions of summative assessment”, “teachers’ existing summative assessment practices”, “factors that influence teachers’ summative assessment practices”, to the teachers’ responses. These themes brought meaning and understanding to the actions that were displayed by teachers in regard to their summative assessment practices.

Table 6: A theme codebook showing categorisation of teachers' responses based on the research questions

Theme categories	Participants responses	Code
Views of summative assessment	SA is an integral component of the education system that determines students’ progress to the next level of education and their future prospects	T4/In1-13
	A tool for testing how much students know, understand and the skills they learn as a result of studying the subjects in school. <i>...it is a tool I use to test how much knowledge my students have acquired as a result of them learning what I teach</i>	T6/In1-13
	Tests and exams are valued because it is part of our secondary education system – parents and stakeholders rely on tests to know how well their children are performing in school.	T5/In1-17 T4/In1-12
Roles and responsibilities in assessments	- Teachers take up their classroom assessment responsibilities seriously - Teachers identified their major responsibilities in classroom assessment as that of: constructing assessment tasks; administering assessments; scoring, providing feedback; grading, making judgment, interpreting and evaluating students’ performance; and reporting students’ progress and achievements to parents (or fee-payers) and the school.	ALL/In1-30-35
Uses of SA data/information	- To determine and report students’ grades to students themselves and parents or school-payers. - SA helps teachers to identify the concepts that students learn easily and those that students struggle with.	T4/In1-26 T5/In1-24 T3/In1-23

This third stage also involved comparing theme categories with other theme categories in order to look for differences and similarities in the teachers’ responses to the research questions. For example, each new category or theme

entered in the codebook was compared to the already coded texts to identify whether the new texts belonged in the existing category. This task was performed until all the transcripts had been coded and the categories and themes identified (Renner & Taylor-Powell, 2003). In some cases notes were added to specific transcripts to help define the themes clearly and to gain a better understanding of, or the differences and similarities in, teachers' assessment practices. As a result of the data categorisation and coding processes, several themes and sub-themes emerged. These are used to report the key findings of the research study in Chapters Six and Seven. The fourth and final stage of data analysis utilised in this study is described next.

5.5.4 Stage 4: Interpreting and drawing conclusions

The fourth and final stage of data analysis adopted in this study involved interpreting, reporting the major findings and drawing conclusions. Interpretation is critical at this final stage as it is essential that the meaning perspectives of the findings are constructed and reported according to the themes that emerge from the analysed data (Marshall & Rossman, 2006; Strauss & Corbin, 1998). Succinct notes were added to the codebook (summary of teachers' responses column, containing the findings of the study). Direct quotations from the teachers were also added in the codebook and provided rich descriptions of the teachers' experiences and insights into their summative assessment practices before and after professional development.

In order to make sense of the key findings of this study, alternative ways had to be sought to understand and explain the instances (Marshall & Rossman, 2006). This required looking deeply and critically into the data while at the same time recalling what happened. It was important to search for other possible explanations for the data and to make the necessary links among them. Not only was it necessary to establish connections among the data, it was also crucial to make connections between the data and the findings of this study and of other similar studies in the literature reviewed.

Another important task that was accomplished in this final stage of data analysis involved determining how the key findings would be presented. As the findings

would be presented in a narrative or descriptive format, it was crucial to have a complete picture of what was gained from the study in terms of data and to select words and/or images that would give weight to the account of the teachers' summative assessment practices (O'Leary, 2005). It was also important to verify the theme categories that emerged or were developed. In this study, several strategies were utilised to verify and to conclude the key findings. During the field work, the researcher provided transcriptions of the interviews to the teachers so that they could confirm what they had reported. In the analysis of the data, the patterns, concepts, relationships, themes and other logical chains of evidence were reviewed several times to ensure that there was a link between the text and the theme categories (Miles & Huberman, 1994). In order to draw conclusions, the data related to the expressed views and practices of the teachers were compared and contrasted. This way, the researcher was able to establish and reconfirm or reject findings by exploring the reasons given by the teachers for modifying the views they held about summative assessment before and after professional development. Finally, it was important that the key findings of the study would be reported by linking the findings with the significance of the study, relating the study to the relevant literature reviewed and expressing its limitations. It was also important to present the findings by linking them to the research questions, aims, context and theoretical framework that underpinned the study (O'Leary, 2005).

Data from the interviews, documentary analysis and professional development workshops were analysed to determine the six science teachers' existing summative assessment practices and their professional learning experiences as a result of the professional development workshop. The data obtained from the science teachers' existing summative assessment practices were examined in detail in order to understand the teachers' perceptions and understandings of summative assessment. This included how the teachers collected and used assessment information on their students' performance, as well as the factors that promoted or inhibited the science teachers' existing summative assessment practices.

Furthermore, the professional development workshop data was analysed to make meaning of the professional learning experiences of the six science teachers. In

particular, how the science teachers learned from the professional development workshop new assessment ideas and procedures. Also, data was analysed to determine what assessment strategies the science teachers actually implemented after they attended the professional development workshops. The factors that supported or constrained the science teachers' implementation of new assessment ideas and procedures in their post-professional development summative assessment practices were also explored.

In the process of interpreting the analysed data based on the teachers' practices and perceptions of summative assessment and professional learning experiences, I became more aware of the role I played as the researcher. The interpretive research approach adopted in this study is about making meaning and understanding the experiences of individuals in specific contexts and how individuals create knowledge (P. C. Taylor, 2008). The meaning making process involved how the science teachers made meanings of their own summative assessment experiences and also how the researcher made meaning of their experiences. The next section provides descriptions of samples used in the study.

5.6 Description of Samples

The following are brief descriptions of the participating schools and teachers.

5.6.1 Descriptions of participating schools

The five secondary schools were selected in consultation with the principals of the participating secondary schools. In summary, each school was selected based on a set of criteria which included; access, reputation of the school and that I knew the school principals (see section 5.2.2 for details). Brief descriptions of the five secondary schools where the six science teachers were teaching at and where this study was conducted are provided.

School A is a large semi-urban national secondary school. It provides secondary education from year seven to 12 for over 500 students. The ratio of teacher to students at this school is around 1:40. The school has boarding facilities and caters for a diverse group of students from different parts of the Solomon Islands. The

schools seemed reasonably well resourced with curriculum materials and other teaching aids necessary to teach the science curriculum. It also has separate science laboratories for teaching junior and senior level science. Two teachers, Jineta and Steven, who participated in this study, come from School A.

School B is a relatively small rural community high school and provides secondary education from year seven to nine. It is a day-school with a student enrolment of about 60 students, who come from the surrounding villages. The teacher-student ratio is around 1:20. A small number of students from distant villages live within the school community. The school does not have dedicated classrooms for science teaching, nor does it have basic science kits which students can use to do their practical investigations. It has very limited resources for teaching science.

School C is a community high school located in the capital city. It is a day-school and provides secondary education from year seven to 13. In 2008, the student enrolment was 735, and the teacher-student ratio around 1:45. As the school is a day-school, all the students live with their parents and either walk or travel to school by public buses. The school has junior and senior science laboratories. However, it has a limited supply of relevant curriculum materials for teaching and learning science.

School D is a large national secondary school which is located in the capital city. It is a boarding school and provides secondary education from year seven to 13. The student enrolment in 2008 was 951 and the teacher-student ratio around 1:50. This was an increase from previous years when the teacher-student ratio had been around 1:35. The school authority has decided recently to increase student enrolment in order to provide equitable access to basic education for all students because of limited spaces in the existing secondary schools. The school has separate laboratories for biology and physical sciences as well as classrooms for teaching school science. It also faces shortages of teaching and learning resources to cater for the increases number of students.

School E is a medium size community high school which is located in the capital city. It provides secondary education from year seven to 11. In 2008, the school enrolled 380 students. The teacher-student ratio in the school was 1:40. It is a day-school and all students live with their parents or guardians. The school has set aside a classroom for science practical investigations but it is ill-equipped and urgently needs a proper science laboratory. Some science curriculum materials and teaching and learning resources are available, but they are insufficient for all the students.

5.6.2 Profile of teacher participants

The teacher participants in this study were selected based on the basis of four specific criteria as discussed in Section 5.5.2. A brief description of the teachers' background is provided in Table 7 to indicate their educational background and science teaching experiences.

Table 7: Profile of teacher participants

Teacher	Gender	Qualification	Type and location of school	Teaching Level	Years Teaching
Jineta	female	B.Ed.	NSS/ rural boarding school	Year 9, 10 & 12	5
Steven	male	BSc	NSS-rural boarding school	Year 9, 11 & 12	1
Ivan	male	Diploma in Teaching	CHS- rural/non boarding school	Year 7, 8 & 9	3
Ishmael	male	Diploma in Teaching	NSS-urban boarding school	Year 8, 9, 10 & 11	5
Amelia	female	Diploma in Teaching	CHS-urban/non boarding school	Year 8, 9 & 10	6
Wilson	male	Diploma in Teaching	CHS-urban/non-boarding	Year 8, 9 & 10	3

†Note: NSS – National Secondary School, CHS –Community High School

Jineta

Jineta had been teaching in School A for five years when I met her and asked if she would be willing to participate in this study in 2008. At that time, she was teaching general science to year nine, 10, and 11 classes, and biology to a year 12 class. She was the only female science teacher at that school and was the Head of the Science Department. Jineta had graduated with a Bachelor of Education (B.Ed.) degree with a major in biology from a university abroad. She said that she liked her school because it was adequately equipped with basic teaching resources

required to teach science. She also explained that she felt very passionate about teaching science, as it had always been her wish to become a science teacher. When asked how comfortable she was with the year nine science syllabus, Jineta expressed that she was knowledgeable about the content of the science syllabus and used it adequately to prepare her lessons. However, she was of the opinion that the science syllabus was less structured in terms of the content students need to learn first, before they learn the content currently offered in the upper grades. When asked if she had any general issues about assessment, she pointed out that she generally felt satisfied with the way she had been assessing her students and managing her assessment activities. However, she also expressed her desire to learn more about other methods of assessment that she could apply in her teaching.

In regards to professional development activities, Jineta mentioned that her school had recently established a professional development programme with assistance from an overseas teachers' association. The group had formed a partnership-relationship with the school with the aim of up-skilling teachers in their professional areas of responsibility. The recent professional development workshop had focused on supporting school communities. The topics covered included: science teaching styles and the provision and usage of science kits. The workshop also focused on topics pertaining to leadership and management issues.

Steven

Steven taught at the same school as Jineta, had completed one year of teaching experience and was beginning his second year of teaching at School A when he participated in this research study. He was teaching year nine and 10 general science and year 12 physics. Steven completed his undergraduate studies at an overseas university, where he graduated with a Bachelor of Science degree, majoring in mathematics and physics. However, because he did not have a teaching qualification he was currently regarded as a provisionally registered teacher. Despite this, Steven said he liked teaching students and hoped to make a difference to the way his students viewed and learned science. His aim was to teach students that science is a practical subject which they could all enjoy and have fun in learning. As a novice teacher, with no teacher education background,

Steven felt that he needed support in understanding how the science syllabus is structured and to be able to translate the year nine science achievement objectives into meaningful lesson plans, class activities, and assessment tasks. Despite identifying limited knowledge in pedagogy and the science curriculum, he felt quite enthusiastic and committed to his teaching role. He was also aware that it was important for him to base his teaching on the syllabus objectives, and to assess his students through the use of tests and examinations, or by observing students perform practical investigations.

Steven had not attended any professional development in any aspect of teaching including assessment during his first year of teaching. This may imply that he based his teaching on his experience of how he was taught by his former science teachers when he was in high school. He also stated that he assessed his students using the method of assessment that his former teachers used when he was a student. In regards to professional development activities in the school, he was aware that his school runs a professional development programme for teachers and indicated that he looked forward to participating and learning about teaching and assessment. He also recognised the need for him to learn about effective assessment strategies and tools and to pursue a teaching education qualification as soon as possible. He believed that undertaking a relevant teacher education programme would enhance his knowledge and skills in teaching. This would help him to become an effective science teacher as he already possessed a bachelor's degree in science.

Ivan

At the time of this research study, Ivan was beginning his fourth year of teaching science at School B. He was trained at the Solomon Islands College of Higher Education School of Education (SICHE/SOE), and graduated with a Diploma in teaching (secondary) science. As he was the only qualified science teacher at his school, he had to teach all the science classes, from years seven to nine. Apart from his teaching role, he was also the school deputy principal. Later in the same year (2008) he was appointed the school principal because the former principal had left to take up another job. As a school principal, he was responsible for the overall operation of the school and to ensure the Ministry of Education guidelines

were followed. Ivan stated that he found both his teaching and principal roles not only demanding but also very challenging. He admitted that being a school principal was not an easy task as he had no previous training or experience in managing a school. In regard to teaching science, he expressed confidence in using the science syllabus to guide him in his lesson planning and preparation.

Although Ivan was passionate about teaching science he admitted that his role as a school principal and an extreme lack of basic science equipment and relevant science curriculum materials in his school had affected his teaching of science. He said that because he had to spend time on administrative and management tasks at his school he was left with little time to prepare well for his science lessons. He also stated that an aspect of teaching science that he still needed some support were planning and designing assessment tasks. Ivan said that his school had set up a teacher professional development programme with the help of the outgoing principal and other resource persons that they invite to assist in the professional development. So far the professional development had focused on continuous assessment. Ivan stated that the short-term goal of the professional development was to help teachers manage their assessment activities and to follow the school guidelines on grading and reporting. Discussions were also held to emphasise the school's initiative to shift its assessment practices from norm reference assessment to criterion referenced assessment.

Amelia

Amelia had been teaching at School C for six years when this study was conducted. She was the only female science teacher in her school at the time of the study and was teaching year eight, nine, and 11 science classes. Amelia had a Diploma in teaching (secondary) science, which she earned from the SICHE/SOE. She chose to become a science teacher after she completed year 11. She was very passionate and enthusiastic about teaching science. According to Amelia's own observations, her students were very keen to learn about science. She stated that her students found science fascinating and were curious about how things around them work. She also spoke highly of her students whom she described as well-mannered with a positive attitude toward schooling. With six years of teaching experience, Amelia claimed she was familiar with continuous assessment

requirements at her school though she expressed her objection to some of the procedures used. For example, teachers needed to consistently apply the same grading system in all subjects. She also seemed confident in the way she had been assessing her students or managed her assessment activities. However, she expressed a number of concerns with performance assessment, particularly in designing practical investigations, about which she expressed a desire to learn more.

School C has a professional development programme and Amelia had attended professional development activities in 2007 and 2008. The professional development activities were jointly organised by the school administration and the education authority that manages the school. Amelia recalled having attended sessions on aspects of assessment in previous professional development workshops. However, she stated that the workshops just re-emphasised what she already knew about assessment. She had also represented her school at other conferences and seminars related to general education.

Ishmael

Ishmael was teaching year eight (one class), nine (two classes), 10 (one class) and 11 (one class) science classes in School D when this study was conducted. He had been teaching at the school for five years. Ishmael pursued his teacher education at SICHE/SOE and graduated with a Diploma in teaching (secondary) science. Ishmael stated that he chose to become a science teacher because it was a career he believed would allow him to pursue his interest and love for science. He stated that being a science teacher meant a lot to him: “It is through science teaching that I would help to develop students’ love for learning science and hopefully make a positive impact on their lives”. He said that he believed that all students have the ability to do well in science.

Furthermore, he pointed out that it is the teachers’ responsibility to motivate their students and enhance their learning in science. Ishmael taught two streams of year nine classes at his school. However, he shared the other classes (year eight, 10, and 11) with his colleagues. There were 50 students in each stream and he found teaching large classes challenging due to limited space and inadequate teaching

resources. He said that keeping a large group of students actively engaged in their learning in a congested classroom was difficult.

Moreover, Ishmael claimed that in addition to a huge teaching load he was involved in extracurricular activities at the school. He pointed out that a heavy teaching load meant that he required more time to prepare extra teaching and learning resources, as well as to mark students' work. Ishmael said that he had not attended any professional development since he graduated from SICHE/SOE. He also expressed his desire to upgrade his qualification to a degree, and to attend professional development workshops that would enhance his teaching and assessment skills. Ishmael mentioned that there was no professional development programme currently offered at the school and so teachers rely on the in-service training opportunities offered by the Ministry of Education through the Curriculum Development Centre and National Examination and Standards Unit on aspects of the national curriculum and assessment.

Wilson

Wilson had been teaching science for the previous three years in School E when I met him and invited him to participate in this research study. He was teaching science to year eight, nine, and 10. Wilson possessed a Diploma in teaching (secondary) science qualification, which he earned from the SICHE/SOE. Prior to taking up teaching as a career, he was employed in another job, but was so passionate about science teaching that he applied to undertake teacher education in order to become a science teacher. Wilson also stated that it was his former secondary science teacher who had influenced him to choose teaching as his career.

Wilson found science teaching interesting but challenging because his school has inadequate teaching resources. He considered that the only science classroom set aside for science teaching is insufficiently equipped with the apparatus and consumables required to teach science or for students to carry out practical investigations. In regards to professional development, Wilson indicated that his school had a professional development programme. However, he said that he had not attended any professional development on assessment since he graduated from

SOE/SICHE, and was hoping for an opportunity to upgrade his knowledge and skills in this important aspect of teaching.

According to the teacher profiles provided, the six science teachers that were engaged in this study had teaching qualifications ranging from Bachelor of Education/and Science degree to Diploma of teaching (science) and science teaching experiences ranging between one year to six years. All the teachers expressed different levels of confidence in teaching and assessment. It was also clear that the teachers had received different levels of professional support from within and outside their schools to upgrade their teaching and assessment skills. It appeared that the teachers were not current with new developments in assessment and needed professional development support in assessment.

5.7 Summary

The purpose of this chapter was to provide the necessary background to the research process, particularly to justify the criteria used in the selection of schools and teachers who were involved in the study, and how the data were generated and analysed so that the reader can follow the presentation of the key findings of this study. This chapter outlined the research process. Description of the research setting and the methods used to generate data provided the contextual background of the study. The study was conducted in four phases. Organising the investigation in phases allowed the researcher to identify resources required to conduct the research and to establish a data management system that tracked and retrieved the data more easily. Data were generated through interviews, documentary analysis, and questionnaires. These data gathering methods were chosen because they were situated within the methodological, theoretical, and epistemological perspectives that underpinned this study. A thematic content analysis technique was used to analyse the data. The next chapter (six) presents the key findings of the baseline study.

CHAPTER SIX: FINDINGS OF THE BASELINE STUDY

YEAR NINE SCIENCE TEACHERS' EXISTING SUMMATIVE ASSESSMENT PRACTICES

6.1 Introduction

The purpose of this chapter and chapter seven is to present key findings of the study that investigated six Solomon Islands secondary science teachers' summative assessment practices. The study was divided into two parts: a baseline inquiry that examined the six teachers' perceptions of existing summative assessment practices; and a professional development intervention that aimed to enhance their summative assessment practices. The findings of the latter component of the study are presented in Chapter Seven. This chapter presents the findings of the baseline study that sought to determine the existing summative assessment practices six secondary science teachers utilised to assess their year nine students' learning and achievements based on the year nine science course. The baseline study was conducted to inform the design of the professional development intervention study that aimed to build the teachers' assessment understanding and skills so that they could continue to play a significant part in summative assessments of their students. The findings were generated from an analysis of the data from the interviews with the teachers and the documents examined. Relevant excerpts from the interview transcripts are used throughout the presentation of the findings to communicate the science teachers' voices: perceptions, experiences and actions of their existing summative assessment practices.

This chapter is divided into six sections. The key findings of the baseline study are organised into the main themes that emerged from analysis of the data generated and are presented under the following section titles. Section 6.2 presents findings related to the teachers' perceptions of summative assessment including the definitions of and differences between formative and summative assessment, as well as their views of purpose and uses of summative assessment. The major influences that shape the teachers' views of summative assessment are

also highlighted including the teachers' nexus between teaching and assessment. Section 6.3 presents findings of the teachers' summative assessment practices. In Section 6.4, the contextual factors that influence the teachers' summative assessment practices are presented, followed by Section 6.5 that identifies the professional learning needs of teachers in assessment. Section 6.6 provides a summary of the key findings.

The next section presents the key findings of the baseline study. It commences with the presentation of results on teachers' perceptions of summative assessment.

6.2 Teachers' Perceptions of Summative Assessment

This section presents the key findings of the baseline study that are linked to the research question: *What are science teachers' initial perceptions and understandings of summative assessment at the onset of this research?* It was important to explore the teachers' perceptions of summative assessment and establish the factors that shape them and how those perceptions impact on their assessment practices. The first part (section 6.2.1) describes the teachers' definition of summative assessment.

6.2.1 Teachers' definition of summative assessment

Teachers were asked about their general views and understanding about summative assessment as well as their views of the key differences between formative and summative assessment, and their overall feelings and satisfaction in conducting assessment. Overall, five out of the six teachers' interview responses indicated that they had a general understanding of summative assessment and defined it in terms of its function - grading and reporting. One teacher however defined summative assessment in terms of general assessment activities he administered to his students (whether these served a formative or summative purpose). He argued that "all assessment activities he conducted summed up what each learner had learned" (Steven). All teachers in this study recognised summative assessment as a formal form of assessment they designed and administered to their students after they had completed teaching a segment (for example, topic/or unit) of the year nine science course, and to find out whether or

not their students understood the material taught relative to the year nine science curriculum goals. The following quotations illustrate a range of what summative assessment meant to them:

When I think of summative assessment, it reminds me of assessment that focuses on finding out a summary of what students have learned in a unit that I taught. (Ivan)

It reminds me of assessment of student learning that focuses on an overview of the topics I teach over a school term or year. (Amelia)

My view is that it is a form of assessment which is used to determine students' performances in class – what they understand or do not understand about the topics they are taught. (Steven)

The teachers defined summative assessment as a summary of learning but they did not elaborate what this summary of learning was comprised of. Also, two out of the six teachers' understanding of summative assessment included finding out what students have failed to learn or did not understand, as expressed by Steven in the above statement. Four out of the six teachers described summative assessment as a means of comparing students according to their performance or ability so that both low-achieving and high achieving students can be identified in order to support them further in their learning. However, teachers were unable to elaborate explicitly on how they were able to diagnose the weaknesses of students in terms of the marks they attain from a test other than from diagnoses of students' answers in the test. The teachers referred to summative assessment as a data gathering process. They conducted assessments with the intent to record students' marks, so that they could subsequently use them to calculate their grades that represent their overall achievement in science at the end of each semester in a year.

6.2.2 Teachers' perceptions of differences between formative and summative assessment

Concerning the relationship between formative and summative assessment, the teachers perceived formative assessment as a form of assessment that enables them to obtain information about students' learning that they could use for

remedial purposes and, in particular, to reinforce concepts that students do not understand well during teaching. However, three of the teachers asserted that formative assessment involved unrecorded informal processes such as questions that they asked their students during the lessons they taught or when students carried out a class activity. Although the teachers were able to make a general distinction between formative and summative assessment in their descriptions of formative assessment, four out of the six teachers were unable to articulate specific properties and processes involved in formative assessment. There was little evidence to suggest that the teachers practised much formative assessment in their classrooms. For example, the teachers mentioned using formative assessment informally through asking questions during lessons and class activities, but they did not suggest how they used the information obtained to inform the next step of their teaching to support or improve students' learning.

Moreover, the teachers seemed at times to be confused about why they would want to use specific assessment for either a formative or summative purpose. For example, teachers believed that a test is a specific tool for carrying out only a summative function, and therefore cannot be used to serve a formative function. When asked whether there was a difference between formative assessment and summative assessment, one teacher stated, "I use a test, which is an example of a summative assessment and ask questions verbally that I can think of [or prepare], while I am teaching, as a form of formative assessment". While teachers indicated their preference for using specific assessment tasks for either formative or summative purposes, their understanding of the differences between these two terms reflected the emphasis they placed on summative assessments.

Not only did teachers talk about what summative assessment meant to them and how they used it, they also indicated their level of satisfaction and confidence in their own ability to conduct assessment to find out what their students learned. Of the six science teachers interviewed, three teachers expressed confidence in their overall assessment practices, two teachers stated that they felt reasonably comfortable with the type of assessments they used in their class, although they said that at times they found designing assessment tasks quite challenging. One teacher felt that he was still grappling with the assessment procedures at his

school. However, he added that his confidence would improve as he progressed in his teaching. He expressed that with more practice in designing assessment activities for his students he would eventually perfect his skills. The teachers expressed varying levels of confidence in their assessment practices and also stated their desire to learn new assessment ideas and strategies so that they could also apply these to assess their students' learning achievements. As one teacher stated:

This is my third year of teaching and I still feel uncomfortable with the assessment methods I use. I need support but there seems to be no one around in my school to help me with the issues that I face. (Ivan)

The next section outlines the findings on the teachers' perceived views of the purpose of summative assessment.

6.2.3 Teachers' views about purpose and uses of summative assessment

The teachers were asked to explain the use and purpose of summative assessment during the baseline interview to gain information about their existing assessment practices. The teachers' responses indicated that they perceived summative assessment as a very useful tool for determining how well their students' have mastered the science content taught. They identified five common educational reasons for using assessment for summative purposes. They stated that they learned these perceived reasons from their teacher education and teaching experiences (see Table 8).

Table 8: Year nine science teachers' perceptions of the purposes for using summative assessment

Summative assessment is a tool for
• Testing student knowledge, understanding and skills • Determining students' final grades • Reporting student achievement • Measurement against achievement standards • Motivating students and to set future goals

Summative assessment a tool for testing student knowledge, understanding and skills

Five out of the six teachers held the view that summative assessment is an important educational tool that enabled them to find out their students' existing knowledge and skills in science. All the teachers believed that the primary aim of summative assessment is to measure students' learning outcomes against the year nine science syllabus achievement objectives. They believed that knowing what their students have learned, or did not learn, would enable them to identify their academic strengths and weaknesses in specific science units they teach. This implied a formative function of assessment. Furthermore, teachers believed that it was their responsibility to identify content areas that students struggle with, and to provide further opportunities for learning. This belief is shared by Amelia, who explained:

I basically use summative assessment to find out what my students have learned as a result of my teaching. The results that students gained from this form of assessment have helped me to identify which of my students were coping well with their studies and which students were struggling and needed my help. (Amelia)

The teachers stated they used summative assessment information to reflect on their own teaching. For example, Jineta pointed out:

It is an important evaluative tool that enables us to gauge our students' learning as well as our own teaching although I hardly use summative assessment to evaluate my teaching. (Jineta)

Although one teacher perceived summative assessment as a means of gathering and accumulating students' marks that are used to evaluate and make decisions about their students' learning and achievements, she did not elaborate on the evaluative strategies she employed to ascertain how effective her teaching strategies were in assisting students' to achieve the learning outcomes.

Teachers also viewed summative assessment as a diagnostic tool that enabled all of them to identify students' strengths and weaknesses. They believed that identifying the students' level of performance allowed them to compare their

ability levels with those of their peers, and with the syllabus achievement objectives. Thus, teachers reported having used summative assessment to distinguish between low-achieving and high-achieving students, as Steven explained:

I think summative assessment is an important way of measuring students' capabilities. Initially, a teacher may not know which students are capable, and which ones are not ... so by conducting a summative test and the results they get can tell which students are bright and which ones are not.... It is through summative assessment that I can find out which concepts or topics my students are struggling with and who needs my support. (Steven)

The teachers' responses showed that they valued summative assessment as a testing tool, and so the means to verify what they had taught their students. They also viewed summative assessment as a tool for comparing students' abilities through the grades they assigned to them.

Summative assessments as a tool for determining students' final grades

Teachers shared their views about summative assessment as a tool which they used to determine students' grades at the end of the semester or year. The teachers indicated that they used the grades not only for reporting their students' achievements but as a basis for deciding and confirming students' progress to the next grade level. The teachers reported that they used grading systems set by their schools, as Jineta commented:

I use a pre-determined grading guideline set by our school to calculate and determine my students' grades in science. At our school, we use letter grades to denote individual students' achievement in each subject area. The grade is based on students' overall performance in the summative tests and examinations they take in a semester. (Jineta)

Although teachers mentioned using pre-determined grading procedures set by their respective schools for determining students' final grades, three out of the six teachers also suggested ways that they might improve the procedures used. For example, teachers' responses showed that their views about the number of assessment tasks they need to consider towards determining their students' final

grades varied. Four of the teachers believed that schools should decide on the number of assessments teachers should use for grading purposes, while others suggested that individual teachers should be allowed to determine the number of assessments that should be administered within one reporting period, in order to establish consistency in the school grading system.

One teacher reported a case where one of his colleagues used only the results of an end of term examination to determine and report her students' final grades in the previous year. He strongly disagreed that students' overall grade in any one subject should be decided by one assessment task alone. He said it was unfair to the students, and suggested that several assessment tasks should be used to give a fair impression of students' overall achievement in science.

When asked to describe what a grade indicated and their reasons for using it, four out of the six teachers explained that a grade is an outcome of their professional judgment of their students' overall performance in the assessment tasks they did. Ishmael described his views about what a grade represented:

A grade indicates students' ability or level of performance in a number of assignments that I assign to them. It shows what a student knows or understands... therefore it indicates what a student is capable of achieving.
(Ishmael)

Ishmael's comments were representative of the rest of the teachers, and suggest that they understood what a grade meant. However, they also suggest that the teachers felt it was up to teachers to judge their students' performance in the assessments based on the criteria they devised, so that they could accurately document and report their students' achievements.

The teachers also acknowledged that grading of students' achievement was influenced by various factors, including: their own "judgment of the ability of individual students" (Jineta); the "grading guidelines they use" (Amelia); their perceptions of whether other factors such as "student effort" should be included in determining grades and the "overall concern for their students' future" (Wilson and Ivan). Teachers also said that they often encountered instances of bias,

particularly in relation to the cut-off points of the grading scale they used and how they marked their students' tests. Overall, the teachers reported that they were satisfied that the grades they awarded to their students were based on their professional judgment of their students' performance and the grading criteria used by their respective schools.

Summative assessment as a tool for reporting student achievement

The teachers in the study acknowledged that one of the purposes of summative assessment is to generate information about student performance in order to provide feedback to students, teachers, and parents. In the Solomon Islands, teachers twice a year prepare student reports that are sent to students and their parents. The teachers said that they were obliged to assess and to communicate to their students their achievements, at the end of each reporting period, as illustrated in the following comments:

At the end of the semester or year, I'd like to say to my students, this is the level of achievement you have attained, and I am proud of your fine achievements so you should keep up the good work, or point out to the low achievers that this is where you stand and therefore you need to put a bit more effort into your work to improve your grade. (Amelia)

Of the several communications they could think of between their school and parents, five out of the six teachers mentioned that reporting student achievement was considered to be the most important purpose for summative assessment. Wilson pointed out that summative assessment information provided a basis for further discussion with parents and students about their achievements:

Our school takes reporting student progress quite seriously because it is a means by which the school and teachers are able to inform parents and students how well the students have performed in the subjects they study in a term. At the beginning of the semester, our school organises a student-parent-teacher session to inform parents of the achievement of the students from the previous term. On this occasion, parents are accompanied by their child (student) and both the parent and student can ask any questions of the teacher so that he or she can clarify any issues relating to the student's report. (Wilson)

Four out of the six teachers believed that the teacher-parent interview provided an avenue for the teacher to discuss face-to-face the student's performance with parents and the student. The teachers considered that their role in classroom assessment was not confined to teaching and administering assessments but included reporting and explaining students' achievements to parents and the students themselves. They also believed that teacher-parent interviews usually send a positive message to students and their parents. The teachers noted that some of their students who had not performed well in previous terms put extra effort and commitment into their studies after receiving information about areas they needed to work on. As a result they produced better results in the following term. The teachers also believed that students themselves needed to be informed about their learning achievements so that they could take responsibility for their own learning. When asked what action they would take to help students improve their academic performance, the teachers suggested that they would need to work closely with the class, by revising their work regularly, doing extra exercises, and using test-taking strategies and skills and techniques to improve performance.

The teachers highlighted issues regarding sending students' reports to parents who live in isolated parts of the country. The teachers were concerned that parents needed to receive information about their children's learning achievements in time or before the beginning of a new semester but it was difficult to send students' results to their parents due to transportation difficulties. However, while the teachers in this study said that they prepared their students' reports in good time, they also pointed out that this was not the case for all the teachers. Some of the teachers claimed that sometimes their schools were unable to send their students' reports to parents because some teachers took longer than expected to mark, grade and write their students' reports. The teachers said that students were allowed to see their reports before they were posted to the parents.

Summative assessment as a measurement against achievement standards

The teachers considered summative assessment an integral component of the secondary education system. They believed that summative assessment provided the means by which schools could identify students who have achieved the learning outcomes outlined in the science syllabus. The teachers perceived both

internal and external summative tests as measures of the Solomon Islands national curriculum standards for specific subject areas. This is demonstrated in Jineta's comments:

It is a form of assessment that allows us [teachers] to monitor our students' achievements against the curriculum goals or the standards our school has set and which we strive to achieve. The topics we teach are based on the curriculum goals, and the assessment data help us to see if we are meeting the requirements of the science curriculum we teach. (Jineta)

The notion of summative assessment as a traditional school practice that had been used since schools were established under the colonial administration was also acknowledged by the teachers. The teachers agreed that testing was a normal practice in their schools. They valued summative assessment as an essential part of the Solomon Islands secondary education system. They believed that summative assessment still served its purpose of grading, selection, placement and progression of students to higher educational levels. The teachers' responses seemed to indicate that they agreed with the notion of "teach to the test". They believed that such assessment practices were necessary if students were to move on to the next higher level. This is demonstrated in a comment by Ishmael:

Summative assessment is an important part of our secondary education system as it helps teachers to measure whether students have achieved the standards that are set by the system. At year nine, external examinations are used for placements as they are limited places in the existing high schools (Ishmael)

Teachers recognised that secondary schools were established to provide education for the students. Schools are where students can learn and achieve the expected educational outcomes related to the subjects they study. Thus, summative assessment was seen by the teachers as a measure that enables teachers and schools to monitor students' learning and achievements against the curriculum standards and other benchmarks set by the schools.

Ivan perceived summative assessment as an important part of education because it provides data information about the quality of education in a school. Thus, when

students perform well, for example, in the national year nine examinations, it reflects favourably on the school and motivates teachers (and students) to support students so that their school can maintain or aim to achieve a good academic standing compared to other schools, as Ivan pointed out:

I feel more satisfied when most of my year nine students are selected to do year 10. For the past two years, our school has done reasonably well in terms of the students that passed the year nine national examinations. Just last year [2007] alone, over three-quarters of our year nine students passed the national examinations and are currently doing year 10 in other secondary schools that accepted them. (Ivan)

Teachers seemed to understand that the tests and examinations they employed indicated what students know and that the results were used to judge whether or not the students have met the curriculum goals. There was agreement amongst the teachers that students should be assessed regularly at certain intervals in order to ascertain where their students were against the achievement criteria they set.

Summative assessment a tool for motivating students and to set future goals

Five out of the six teachers viewed summative assessment not only as a means for measurement against achievement objectives but as a factor that motivates students to learn and to perform better in the next unit test, end of term examinations, or the national year nine examination. Teachers seemed to believe that summative assessment has both intrinsic and extrinsic motivational value to students' learning. It can motivate students to work hard in order to achieve better grades, or it can motivate them to work harder because they want to earn rewards or prizes at the end of each year. Ivan pointed out that unit tests and examinations motivate his students to work hard, as illustrated in the comments below:

I think it is important to give tests and examinations to students because they show what students have learned in school. Tests and final examinations are means by which students can tell their capabilities.... Without a test it may be difficult to tell what a student knows. Tests make students want to study and learn the material well and so students work hard to achieve their goals. (Ivan)

On the other hand, teachers expressed that assessment also has extrinsic value, as Jineta said:

At our school, we use student grades as incentives for further learning and to recognise and celebrate the achievement of our students. Students that worked hard during the year and achieved well in the subjects they took or showed exceptional improvement and contributed positively to the school are rewarded prizes during the annual speech-prize giving day. (Jineta)

The teachers viewed summative assessment as an extrinsic motivation for students who obtained good grades through hard work, commitment and self-discipline. They also believed that when students are motivated they are able to put extra effort into their studies; they work hard, extend their learning strategies or even seek help from their teachers when they fail to understand the topics they are taught. The teachers also felt that the importance of the national examinations that students sit towards the end of year nine was a major factor that motivated students to work hard and teachers to dedicate their time to help students pass their examinations. According to Ishmael, his year nine students often worked hard in their science subject throughout the year because, as he put it: “Their future depends on the outcome of their performance in the year nine examinations”.

Overall, the teachers believed that tests and examinations motivate students to work harder in order to pass their examinations and progress to higher levels of education. However, they considered that external examinations also put a lot of pressure on their job in the classroom, as well as on the students. The teachers also stated that they usually worked extra hard to prepare their students and students often felt anxious about how they would perform in the examinations.

6.2.4 Influences that shape teachers’ views about summative assessment

The teachers were asked to identify some of the factors that have a positive influence on their summative assessment practices in their schools. In particular, the question was focused on getting their views about their preparedness and ability to apply different assessment strategies in their classrooms for the benefit of the students. The teacher interview responses indicated that the major

influences that seemed to have shaped or in their opinion had made a positive impact on their assessment practices were; (a) initial teacher education experiences, (b) working with colleagues, (c) former teachers, (d) years of teaching experience and (e) professional development.

The teachers' comments showed that they were able to implement a variety of assessment strategies to evaluate their students' learning achievement because they stated that they had the knowledge and skills to design and conduct assessments. They linked their acquisition of knowledge about assessment to the points identified above. Foremost amongst these were their initial teacher education experiences. The teachers indicated that the knowledge they gained from the courses on assessment helped them to apply some of the assessment techniques they currently used to assess their students. However, they also stated that their initial teacher education programme did not cover every aspect of assessment – hence they were not fully aware of other alternative methods of assessments. The teachers also indicated that contextual factors, such as a lack of exemplar assessment materials, had limited their assessment practices and restricted them to the use of a few assessment procedures. The issues that seemed to have constrained teachers' summative practices are discussed in Section 6.4.

Teachers' comments also indicated that their assessment practices were influenced to a certain extent by the methods of assessment used by their former teachers. They used forms of assessments their former teachers had used when they were students because they were familiar with those methods, and they provided the kind of information the teachers needed to gauge how well their students had learned the units taught. For example, Steven, a beginning teacher, recalled that the forms of assessment tasks his former science teacher used included demonstrations, projects, tests, examinations and written assignments. Steven said that he had used them or had thought about how he might use these forms of assessment to assess his students.

Given their years of teaching experience, teachers believed they had gained some level of confidence in using the strategies they applied to assess their students. Another important factor that teachers believed would have a positive impact on

their assessment practice was professional development. Teachers' comments showed that they believed professional development has the potential to improve their assessment practices. However, the teachers reported that they had been offered very little or no professional development opportunities that emphasised classroom assessment. They valued teacher professional development programmes that build on their current skills in assessment. The next subsection describes teacher' perceptions of an assessment plan.

6.2.5 Teachers' views of the nexus between teaching and assessment

Considering that assessment is an integral component of the teaching and learning process, teachers are expected to prepare at the beginning of each school term, or at the beginning of a unit, a teaching plan such as a unit's scheme of work and a series of lesson plans. It was therefore interesting to find out the views teachers held about an assessment plan. Interviews held with the teachers in this study about their views of preparing not only teaching but also for assessment revealed several ideas.

The teachers considered effective planning to be an important basis for successful teaching that would lead to better student outcomes. For example, Jineta pointed out the following reasons why she thought it was essential to plan ahead a unit she was supposed to teach and assess:

It is important because I cannot just teach any topic I want.... There is a limit to what I can teach in any lesson. I also add to my teaching plan notes about how I would assess my students. I specify the types of exercises or tests in my plan so that I can prepare and use them to measure what my students have learned. (Jineta)

It seemed clear from Jineta's comments that one of her key reasons for preparing a teaching and assessment plan was to identify the content area that she was going to teach, and from this to work out her instructional and assessment activities for her students. On the other hand, Wilson viewed planning for assessment as an integral dimension of the teaching and learning process. He stated that he was aware of how important it is to create a plan from which he could prepare his lesson plans and assessment activities for his students. He could envisage how

such a plan would help him implement classroom instruction and assessment of students' learning. He believed that this would allow him to read through the topics in the unit he would teach and be able to reflect on his understanding of the topics while preparing for regular classroom instruction and assessment of student learning.

The teachers spoke generally about their views of a teaching plan and identified ways in which they would incorporate assessment activities into their plans. Not only did they say that an integrated teaching and assessment plan would enable them to have “a sense of direction in the delivery of [their] lessons” (Ishmael) but they recognised that such a plan would direct them in the kind of assessments they would use to assess their students, what content area they should assess, and when they should start preparing the items for their tests, based on the unit learning outcomes that they taught (Jineta).

Three out of the six teachers' views indicated that they perceived planning for assessment as an integral essential part of their teaching programme. The science teachers in this study also took planning quite seriously because they felt that they needed additional “*preparation time, in order to cater for regular classroom instruction and laboratory-based instruction*” (Jineta). Not only do science teachers need to plan, or design experiments that they want their students to do, but as Jineta stated they also have to “get the pieces of equipment from where they are stored, and make them available to the students”. Jineta added that science teachers also need to “carry out the experiment to see if it works before students can carry out the investigations”.

Overall, the findings on the six science teachers' perceptions of summative assessment indicated that they had established a fairly good understanding of summative assessment – its purpose and how they were used in their schools. They were able to distinguish the difference between formative and summative assessment though their explanations indicated that they had surface knowledge of the processes involved and how best information derived from these types of assessments could be better utilised to inform and support student learning. Interestingly, the teachers perceived the assessment process as largely summative

and are a concern. Nevertheless, the teachers recognised summative assessment as an important part of their teaching work, and what the schools expected of them to carry out as teachers. They identified the key influences that enabled them to develop their knowledge and skills in assessment, which included their initial teacher education, their colleagues at schools, former teachers and years of teaching experiences. Most importantly, analysis of teachers' interview strongly indicated that these factors influenced their current summative assessment practices. The next section presents the key findings that focused on teachers' actual summative assessment practices.

6.3 Teachers' Summative Assessment Practices

This section presents the key findings of the baseline study that focused on exploring the assessment processes and procedures that the six secondary science teachers used to assess their students' performance and achievement in science. The findings are related to the question: *How do science teachers collect information that informs them about their students' performances and achievements?* Data pertaining to teachers' summative assessment practices were obtained through examination of samples of summative assessments (for example, past topic/unit tests, internal examination and external examination papers), curriculum documents, records of student achievement, and interviews with the six teachers and group discussions during the professional development workshop. The results pertaining to teachers' summative assessments are reported under seven broad categories that were based on the four areas identified for the professional development to focus on. These are: planning strategies used; resources used to design assessment; types of assessment used; development of assessment tasks; recording, marking, and reporting procedures; feedback and uses of summative data.

6.3.1 Planning strategies used

The teachers' response indicated that they were aware of the theoretical aspects of a teaching and assessment plan. They also indicated that an assessment plan was an integral part of their teaching programme. This section reports on whether teachers designed and followed their assessment plans.

The teachers were asked if they were happy to share their teaching plans and to briefly talk through the elements they had included in their plans, in order to ascertain what assessment details they provided. Three teachers (Amelia, Jineta, and Steven) shared their teaching plans, while the other teachers preferred to discuss details of their plans without showing them. The plans presented were mostly drafts in various stages, often brief, and consisted typically of daily lesson plans that included a list of topics, reference to learning objectives, and student activities, including homework they set for their students each day. Jineta tells:

I produce my term plan, which shows a list of units/topics I teach and other relevant information I need to guide my work. This plan is linked to my daily lesson plans. (Jineta)

Steven and Jineta shared a unit scheme of work, displayed in a table with four columns that listed dates for teaching the topics in each unit, student objectives, student activity and comments and reflections on how well the lessons were presented. The plan not only showed schedules for teaching each topic in a unit, it also linked the student objectives to the instructional activities, including details of homework. Steven and Jineta were the only teachers in the group that had a prepared unit scheme of work. They mentioned that their school had a mechanism that required every teacher to produce a unit scheme of work which was checked on a fortnightly basis by their respective heads of departments. The rest of the teachers explained their lesson planning process and mentioned the assessment strategies they used to develop their assessment tasks. Ivan, Ishmael and Wilson stated that they only scheduled assessments and did not prepare a written assessment plan. Instead, they thought about and decided on how many tests they needed to conduct in a semester based on the number of science units there are in the science course they taught in each grade level. When Ishmael was asked whether he devised an assessment plan for the units he taught in a term, he responded:

Assessment for me happens at the end of each unit and at the end of the term. This seems to be the practice here in my school so I never had an assessment plan. (Ishmael)

The discussion with teachers and samples of teaching plans sighted indicated that the teachers did not design a specific assessment plan. It became clear that specific assessment activities were typically organised at the end of each unit so they could find out the extent of student learning about the unit they had studied. The teaching plans that some of the teachers showed or reported to have produced were daily lesson plans at various stages. They did not include a variety of assessment methods nor provide much detail of strategies on how the teacher would assess each of the units in a term. Moreover, teachers did not indicate weighting of the components of assessment they would use to determine students' grades.

Overall, the teachers indicated that they would do assessment at the end of the unit. It appeared that most of the teachers planned their assessment strategies "in their heads" including the steps they followed to design the assessment tasks they chose to set for their students. The teachers emphasised deadlines in their teaching plans when they would administer the formal assessments to their students. There were inconsistencies between teachers' perceptions about the importance of planning an assessment and what they had actually planned and prepared on paper. They were aware of the importance of planning for assessment but they did not practice it. Instead they conducted their assessment practices without an assessment plan.

6.3.2 Assessment Resources

In this section, the findings on assessment resources that were available to teachers to aid their assessment practices are reported beginning with government assessment resources. The teachers relied on the curriculum support materials supplied by the Ministry of Education through the Curriculum Development Centre to prepare their instructional activities. However, there was a serious lack of relevant assessment resources to which they could refer to guide their assessment practices. Table 9 provides a list of curriculum materials and other resources (including resource persons that teachers consulted for assistance) that teachers used to plan units of work and assessment tasks.

Table 9: Sources of support and curriculum materials teachers used for planning, teaching, and construction of assessment tasks

Curriculum materials and sources of support	Number of teachers who indicated using the source
Locally produced Form 3 science teachers' books (Book 1 to 4)	6
Locally produced Form 3 science students' books (Book 1 to 4)	6
Materials accumulated from Initial Teacher Education Programme courses	6
Own teaching and learning materials from past years	6
Science textbooks (overseas textbooks for teacher reference)	6
Library (science textbooks)	2
Internet resources	2
Other teachers/lecturers	2

Teachers from the community high schools felt that they had access to less variety of curriculum reference materials compared to teachers from the national secondary schools. However, Table 9 shows that the teachers all used the same type of resources, except for the library and internet that was only accessible for the urban school teachers.

From the interviews with the teachers it became clear that all six teachers depended on the locally produced science curriculum materials, as well as a few overseas science textbooks that the schools had been supplied with, to prepare their teaching units and to help them construct unit tests and end of semester examinations. This meant that the teachers could not do without them, as Ivan pointed out:

There are scarce resources in my school. I basically utilise locally produced year nine science curriculum materials (teachers' books and student books) that are made available to us by the curriculum development centre. I also have used my own materials, which I refer to from time to time to plan my lessons and to guide me to construct assessment tasks. (Ivan)

Besides government funded curriculum resources, some of the teachers have access to other assessment resources. Apart from using locally produced science curriculum materials to plan their teaching and assessment, teachers also reported

that they used materials they had received during their initial teacher training. These included lecture notes, photocopied materials and examples of lesson plans and assessment tasks they did for practice. Teachers also mentioned using test papers that they had designed and used in previous years to help them decide the structure of the tests they constructed or to select questions. One teacher (Steven) mentioned that he used test items from past science tests and examination papers that he kept from his own high school days to help him construct the tests he administered to his students. He mentioned that he planned to refer to these materials in the future as there are limited assessment resources at his school.

The availability of computers in some of the schools though very limited had helped teachers to type their assessments. Four of the teachers indicated that their schools have computers, which were shared amongst other teachers in their schools. However, they were not connected to the internet and so they were unable to access resources that are available on the internet. Two teachers mentioned using the public internet cafe occasionally to search for assessment materials and had used them for planning and teaching purposes.

Jineta and Steven were teaching year nine science at the same secondary school and Jineta was providing professional support to her colleague. Steven, a beginning teacher with no teaching qualification, stated that he benefitted a lot from the advice and guidance he received from Jineta, because of her experience as a science teacher. Steven stated that he valued the collegial relationship the two established. He stated;

It opened up a range of other opportunities between the two as well our other colleagues in the science department, such as the exchange of ideas, feedback, and sharing what works and what does not for beginning science teachers like me. (Steven)

Amelia expressed similar experiences of the collegial working relations between members of her science department at her school. She recalled how she and her colleagues shared ideas, and talked informally about general school matters as well as matters that pertain to their work and students whenever they have a science department meeting. She generally described the support she received

from her colleagues as “fruitful”. However, she was of the opinion that the school leadership in her school should be more proactive in providing guidance, so that the subject departments could be made more functional in leading and supporting teachers in implementing the curriculum, as well as helping them to improve teaching and students’ achievements.

Unlike the rest of the teachers, Ivan’s reflections on the experiences of his teaching and assessment activities revealed the unique challenges of a teacher who had a dual role as school principal and the only science teacher in a community high school. The biggest challenge Ivan faced was how best to incorporate the science curriculum into instructional activities with extremely scarce resources and no science equipment. Occasionally he sought expert advice from the Curriculum Development Centre. He was of the opinion that it would have been helpful had his school recruited another science teacher to help him teach science and with whom he could work closely on a day-to-day basis.

Teachers’ assessment practices were related to their teaching backgrounds, years of teaching experiences, school culture, positions they held at the school level, the availability of curriculum materials and relationships with colleagues. They reported that summative assessment was the dominant assessment technique they used to assess their students. However, it seemed that a highly developed technical culture of assessment was lacking. A scarcity of exemplar assessment resources and an incomplete understanding of assessment made things harder for teachers. Teachers who had taught longer seemed more resourceful and knowledgeable about what was available in their schools. Despite a lack of appropriate assessment resources, there was a general feeling of ease amongst the teachers about summative assessment. While teachers expressed how genuinely they cared for their students’ learning and had strategies for teaching and assessment, they generally had different ways of achieving this, which is the focus of the next section.

6.3.3 Types of assessment

Information about the types of assessment used was obtained from the teachers through interviews, samples of tests and examinations and records of student

achievements. The sample of tests examined and records of students' achievements kept by the teachers showed the types of assessment used by teachers to assess their students' knowledge and to grade their performances so that they could report on their students' overall achievements in science. Some teachers shared samples of their unit tests, end-of-term examination papers and mark books to demonstrate the types and examples of assessment tasks they mentioned during the interview. Table 10 provides a summary of the types of assessment, format of questions, and sources that the teachers reported they used to construct each type of assessment task. It is clear from the interviews and sample of tests examined that the teachers rely greatly upon the tests they designed themselves to assess their students' learning.

Table 10: Types of assessment tasks used by the six secondary science teachers for purposes of grading and reporting in the past year (2007)

Teachers	Total	Type of assessment used	Assessment items or questions	Source
Amelia Steven Jineta Ishmael Ivan Wilson	6	Unit test	Short answer questions Multiple choice items Matching items Fill in the blanks	Teacher-made Textbooks Past unit tests and year nine science examination papers
Amelia Steven Jineta Ishmael Ivan Wilson	6	End of semester examination	Multiple choice items Matching items Filling in the blanks Short-answer questions Essay	Past year nine science examination papers Textbooks
Amelia Ishmael Jineta	3	Written assignment	Set of questions Short essay	Teacher-made Textbooks
Steven Amelia Jineta	3	Lab/practical investigation	Set of tasks and questions	Textbooks
Ivan Wilson	2	Topic tests	True/false Matching items Short-answer questions	Teacher-made Textbooks
Steven Amelia	2	Quiz	Short-answer questions True/false	Teacher-made Textbooks

Teacher-designed tests

The teachers provided several reasons to justify using a test to assess their students' achievements in science. One of the reasons teachers gave was, "because it is the most familiar form of assessment that students and teachers in the school

are aware of” (Ishmael). Ivan preferred using a test because he said “it usually took [him] less time to mark the tests” he set compared to the length of time it takes “a social studies teacher to mark an essay type question”. For the previous three years Ivan has had fewer than 20 students in each of the three science classes he was teaching (year seven, eight and nine), compared to the other teachers who had between them 40-50 students, so he had fewer test scripts to mark than the rest of the teachers in this study. Overall, the main reasons teachers reported for using a test were its suitability to students, subject content that needed to be assessed, and the context in which the teaching and learning process occurred. There was general consensus amongst the teachers that testing was a driving force that motivated students to study and learn in their schools.

Other types of assessment tasks used for summative purpose

Written assignments were occasionally used by half of the teachers (Amelia, Ishmael, and Jineta), not only to consolidate and extend classroom learning but also as a measure of assessment of learning. The teachers described forms of written work such as sets of questions and short paragraphs on a specific topic related to a unit they had taught. Commenting on their students’ performances in the written assignments, Amelia and Jineta stated that most of their students seemed to do well in their written assignments because they often helped each other by discussing the answers to the questions and were given ample time to complete the assignments. However, the teachers also reported that some students copied other students’ work or copied passages from the sources they obtained their information from, instead of paraphrasing them.

Only three teachers, Amelia, Steven and Jineta, reported having considered assessment of laboratory activities for grading purposes. The rest of the teachers mentioned organising practical investigations for their students, but their students’ results did not contribute to their grades. Ivan stated that he generally prepared only a few practical investigations for his students because of “a lack of a science laboratory and equipment in his school”. However, he stated that whenever he engaged his students in practical work, he did not assess his students’ work because he said that their “written English was not up to standard”. Another important reason why Ivan was hesitant to assess practical work was that

whenever he organised his students to work in small groups to conduct the practical investigations, “it was always the group leaders, and one or two students in the group, who actually carried out most of the tasks, whilst the rest observe”. For this reason, Ivan said that he would only consider assessing individual students’ performance, rather than using group work as a form of assessment to measure group performance.

6.3.4 Development of assessment tasks

Discussions with the teachers indicated that they usually spent a reasonable amount of time constructing their tests. However, the teachers reported that they rarely developed a test blueprint or examination specification to help them construct questions or items for a test or examination. Two teachers appeared not aware of what a blueprint is, while others knew about them but did not seem to be using them. Instead, the teachers mentioned using test development strategies and procedures they knew about or had heard of to construct test items or questions. All the teachers stated that they often would select test items from other sources to include in their tests. Table 11 shows a combination of steps the teachers followed when they constructed a test.

Table 11: General steps teachers follow to construct their tests

Step 1:	Decide structure of test (e.g. short-answer questions, multiple choice questions, matching, fill in the blanks etc.)
Step 2:	Refer to syllabus objectives and from this make a list of the topics covered in a unit to be assessed
Step 3:	Decide on the number of questions to be constructed from each syllabus objective for the unit to be assessed, and allocate questions according to the format decided in step 1.
Step 4:	Construct questions or select items from sources identified, in accordance with the syllabus objectives (or student learning outcomes) covered
Step 5:	Decide on the allocation of marks for each question

It should be noted that the teachers did not have a written procedure and that not every teacher in the study followed the same order to construct their tests as presented in the table.

One of the first tasks the teachers said they undertook in the test construction process was to decide on the structure of the test. The teachers seemed to have a

liking for particular test structures or formats, with most of them preferring multiple choice items/questions, short answer questions, matching items and filling in the blanks formats. However, the teachers stated that they were flexible in terms of choosing which format they wanted to adopt each time they prepared a test. Thus, they did not always seem to stick to the same test format all the time. For example, three teachers (Ivan, Ishmael, and Amelia) mentioned using tests that comprised a mix of short-answer questions, matching items, and fill in the blank items.

Other times the teachers reported that they would switch back to short-answer questions. However, Amelia said that she sometimes changed her test format in the next unit test she designed. Her decision to rotate the test formats depended on her ability to prepare the type of questions she wanted to include in her test. Hence, if she felt that she was unable to generate matching items, she would just have short-answer questions. Two teachers, Wilson and Ishmael, stated that they designed tests that consisted only of short-response questions. Wilson favoured using short-response questions because he said that they were “easy to make” or to “select from the science textbooks”.

Jineta said she used both multiple choice items and short-answer questions. However, she also stated that she included only a few multiple choice items and the rest were short-answer questions. At other times, she included only short answer questions in her test. The majority of the teachers stated using multiple choice items only for the end-of-semester or end of year examination. However, the teachers reported that they did not construct the multiple choice items but obtained them from past year nine national science examination papers and science textbooks.

It seemed that all the teachers found writing multiple choice items difficult compared to other formats of assessment such as short answer questions, matching items and filling in the blanks items. Once the teachers had decided the test format they consulted the science syllabus document. Thus, the syllabus was utilised not only as a guide for planning lessons but also as a reference for test item construction.

Other important factors the teachers mentioned that influenced constructing a test was the length of time teachers spent to teach the unit objectives, the importance of the content, the level of science knowledge and skills, students' ability levels, and time allowed for students to write the tests. Ivan stated:

I consider the length of time it takes me to teach a unit. If I spent more time on one topic, then I would include more questions on that topic. Some topics have more objectives and take much longer to teach than others. It is only fair that I design questions on those topics that I spent more time teaching. I also consider the rate at which my students' answer question. Some students write more slowly than others and so I am quite conscious of the numbers of questions I include in my test. (Ivan)

From Ivan's statement, it seems likely that the content area or syllabus objectives that he spent more time on teaching were given more attention and these learning objectives got more thoroughly assessed than the other objectives. Like Ivan, Steven seemed conscious of the time it would take students to write a test and so he estimated the time and decided the number of items he included in his test. He contested that students are given only a limited time to write a test, and so he often prepared a short test for his students.

Jineta agreed that time is a constraint and so the best she could do was to "identify the most important science domains" related to the unit she has taught, and that she believed students should be tested on, and then construct questions from those content areas. Jineta also alluded to how she estimated the time it would take her students to write the test so that student anxiety about not answering all the questions was kept at a minimum:

The other thing I'd do is to look at the difficult level of the questions. If it takes me say 30 minutes to complete the test, then I know it might take my students more than one hour....So I sort of work around the questions so that students can complete the test in the time that I decide. (Jineta)

As well as content area, Amelia made students' ability level one of her criteria when constructing questions for a test. "It would be unfair to my students if the questions or items I include in the test are beyond the comprehension level of my

students”, she said. She was conscious of the need to write questions “using simple sentences that students would be able to understand”. This is an important criterion for setting tests in Solomon Islands as English is spoken as a second or third language by students.

Although teachers were of the view that constructing a test is a daunting task, they seemed reasonably prepared to design their tests. For instance, Ishmael pointed out that a teacher-designed test has advantages over external tests, because “it is the teacher who constructs” and has “control over what gets assessed”. Jineta summed up her perspectives about constructing a teacher-designed test: “It gives me the flexibility to select or write my own items based on what I teach as well as the curriculum materials that are available and that I use to teach and prepare activities for my students to do”. She also stated she generally felt more satisfied after she had constructed the test because she knew that the items or questions she designed were the results of her own work, giving her a feeling of ownership and pride in her work. The rest of the teachers also shared similar views as Ishmael and Jineta.

Structure of tests and instructions for students

Samples of past topic/unit tests and end-of-term science examination papers were examined to identify the general layout, as well as to identify the nature and clarity of the instructions teachers provided to students. Analyses of the test items showed that teachers used a variety of different assessment tasks that included multiple choice items, short answer questions matching items and fill-in-the blanks (see Table 10). From the perspectives of the researcher, the items/questions included in the tests were fairly well constructed and were deemed suitable for the level of students targeted. However, it was found that the test items were obtained from past year nine science national examination papers (specific to unit examined), text books and past end of term/year science examination papers. Three of the schools stored past science examination papers for teachers’ references.

There seemed to be no major differences in the design of the tests. However, there appeared to be slight variations in the production, mode of delivery and detail of

instruction provided to students. Two teachers (Ivan and Wilson) mentioned that they sometimes wrote quiz questions on the chalkboard, while other times they would just read them aloud and students would be asked to answer them in their workbooks. Students would then be asked to swap their workbooks and mark each other's work, while the teacher read aloud the answers. At other times, the two teachers said that they would have the quiz questions typed and students would write down their answers beside each question. One of these two teachers stated that he sometimes wrote the questions of a topic test on the chalkboard. The teachers reported that they would usually give students verbal instructions on how to fill in the tests. The rest of the teachers had their assessment tasks typed using a computer. Each student in the class would write down their answers on the test paper.

One of the things emphasised in past reforms related to the need for teachers to include brief information about the composition of a test or examination and directions on how students should answer the questions (MEHRD, 2005b). This study found that almost half of the unit test samples examined had little or no written instructions for students. One teacher (Steven) said that the tests he set were usually short and therefore he did not see the need to provide written instruction. However, Amelia argued that it was more helpful to students when teachers include brief "instruction and information in writing", including how many "marks each question or section is worth" so that students can "organise how much time they should spend on each question or section".

Samples of past end of semester examination papers indicated that all teachers provided written instructions for students on the cover page of the examination papers. These instructions included the length of time students were allowed to write the test, including reading time, a brief outline of the sections that make up the examination, the marks allocated to each section and the total mark and the number of pages. Three samples of the 2007 end of semester examinations that three teachers designed were composed of questions that were obtained from the 2006 year nine national science examination paper. This indicated that school-based examinations seemed to imitate external examinations.

Number of items or questions included in the teacher-designed tests

The total number of questions or items teachers included in their tests varied slightly from one teacher to another, with short tests such as quizzes making between 5-10 items and topic tests between 10-15 items. The unit tests included between 20-30 items, while the end of term examinations had between 35-40 items. The teachers felt that those numbers were adequate. However, the question arises whether the number of questions included adequately in each test actually measure the key learning outcomes and content area covered in the science syllabus. It seemed likely that the teachers constructed or selected questions or items for their tests on the basis of what they wanted to “observe or what knowledge or skills” (Jineta) they wanted their students to demonstrate. In other words, teachers generally felt that their students’ performance in the assessment tasks was influenced to a certain degree by “what they covered in their teaching” (Wilson).

Teachers were also aware that there were other factors that influenced their students’ performance, such as their “motivation” (Amelia), “how prepared they were to take the test” (Ishmael), their “test-taking skills” (Jineta) and the level of difficulty of the questions. These factors are believed to have implications for how the teachers viewed the quality of their self-developed tests, as well as their notions of whether the tests they constructed were fair to their students.

Teachers’ views related to validity and reliability of their tests

All the teachers seemed aware of the importance of constructing test items that are linked to the syllabus objectives. They believed that the tests they designed were a valid measure of how much their students know or understand about science and is linked to the intended learning outcomes they taught. To achieve this, Ishmael stated that he selected or constructed questions out of the “curriculum materials” he used to teach. To him, the process that enabled him to “link the syllabus objectives to the instructional activities” and the “development of questions” that he included in his test demonstrated the validity of his test. Another teacher, Jineta, felt “confident and trusted” that the tests she designed were valid (Jineta). The teachers generally expressed that their self-developed tests measured important “science content outlined in the syllabus” (Ishmael) that they believed

was “worth assessing” (Wilson). The teachers also believed that their tests were reliable because they asserted that the items they constructed or selected were obtained from science textbooks and past tests or examination papers that had been used several times. The teachers thought that because the questions were from textbooks they had to be valid or reliable items as textbooks were regarded as scholarly works. When asked if they re-used past tests to assess their current students, some teachers reported they did, while others said they did not. Those who stated that they modified the questions said that this was to ensure that they were relevant to the content area they taught. Also, as Wilson explained, it is important “to prevent students from cheating as some students have access to copies of past tests that they got from past students”. It was apparent that the teachers were of the opinion that their self-constructed assessments yielded an accurate and fair result of their students’ achievements.

Levels of knowledge assessed through teacher-designed tests

Test item analysis

A general test item analysis was carried out on four teacher-designed test samples made available to determine the extent to which the test items measured the learning or knowledge levels, based on Bloom’s taxonomy of learning (L. W. Anderson & Krathwohl, 2001; L. Cohen, et al., 2007). The questions that guided the item analysis are provided as Appendix 5D (Item 8: item analysis). Each item or question in the teacher-designed tests was judged against the year nine science syllabus objectives for specific units in order to identify the knowledge level each question in the test represented.

Analysis of a sample test (see Table 12) indicated that the teachers included questions that mainly focused on knowledge and comprehension level which are the lowest of Bloom’s taxonomy. The teachers included very few questions that required their students to think critically or to demonstrate application of knowledge to real-life situations. In contrast, the science curriculum places an emphasis on students acquiring science process skills as well as reasoning and problem solving skills (MEHRD, 1999). From the item analysis carried out, it seemed that the teachers’ examples of summative assessment practices were

content based rather than competence-driven. Moreover, the teacher-designed tests were dominated by questions that asked students about their knowledge or to recall facts. Test items that tested students' comprehension level were limited and there was clearly a lack of items that asked students to show their abilities to apply, analyse, synthesis and evaluate what they may have learned in science.

Table 12: Example of an item analysis (teacher-made test)

Questions/items	Level 1	Level 2	Level 3
1. The table below shows the diameter of the planets in the solar system Venus 12.10 km Mercury 9.90 km Mars 6.80 km Jupiter 142.80 km Earth 12.75 km Saturn 120.0 km Uranus 51.0 km Pluto 2.30 km Neptune 49.0 km (a) List four (4) planets correctly arranged to their diameters sizes from the smallest to the biggest.	Knowledge		
2. Draw the diagram of earth's different cross sections (regions) and correctly label them.		Comp	
3. The Earth's layers said to be molten would be...	Knowledge		
4. List two (2) different methods of catching fish that would ensure fish as a renewable resource.	Knowledge		
5. Where in the atomic structure are neutrons located?	Knowledge		
6. Periodic table of elements provided. Using your knowledge about groups and periods of the periodic table, identify the following: (a) Two (2) elements in the same group (b) Two (2) elements in the same period (c) Collective name for group 7 elements (d) Collective name for the group 8 elements	Application		
7. Silicon is the second most important element in the earth's crust. List two (2) commercial uses of silicon	Knowledge		
8. Briefly explain the two types of resources with an example for each.	Knowledge	Comp	
9. Name the three types of commonly found in the Solomon Islands	Knowledge		
10. Define a mineral and list two important conditions for mineral formation.	Knowledge		
"Comp" stands for comprehension			
Questions used to determine the knowledge levels of teacher-designed test items			
Level 1: Is it a practice item that require students to reproduce factual information or known knowledge?			
Level 2: Is it a comprehension item that requires students' explanation?			
Level 3: Is it an application item that require student to apply known knowledge?			
Level 4: Is it a synthesis item which asks students to demonstrate their skill in bringing together and integrating diverse areas of knowledge?			

Interestingly, interview results indicated that the teachers were generally satisfied with the level of difficulty of the questions they included in their tests. The teachers claimed that the questions they asked allowed their students to

demonstrate different levels of learning. The following statement describes what one teacher stated, when asked what level of knowledge the questions he constructed measured:

The questions I construct are based on the science syllabus objectives so I try to formulate questions that allow students to demonstrate the kind of knowledge and skills gained. I also include comprehension and some application level questions. (Wilson)

A close examination of the test that Wilson referred to indicated that he had obtained most of the questions from the past year nine science examination papers and textbooks. Another teacher, Amelia, also claimed that she assessed her students' knowledge and understanding in regards to the unit or topic she taught. She said that she also used laboratory activities to assess other science processes and skills that are associated with science teaching. "I also assess the skills that students exhibit in carrying out practical investigations", she remarked. While Amelia said that students who conducted experiments could apply science knowledge in real-life situations or practical activities, there was no evidence of this in Amelia's teaching and assessment plan or the resources she brought with her.

The science topic tests were generally well targeted and assessed the full range of the specific curriculum outcomes. The importance of testing a variety of student abilities is fundamental. However, it was found that the teacher-designed tests focused more on testing students' knowledge (low cognitive skills) and there was little evidence to suggest that the teachers included questions that asked students to demonstrate higher order thinking skills and application. Analyses of students' responses on a topic that the test examined showed that the students answered all the items/or questions and there were no items omitted; that is evidence that the items included were within the ability and learning of the students and deemed to be easy for students to answer. The tests were generally short and students appeared to have ample time to complete them and this was verified by the teachers. All in all, teachers gained some confidence in constructing their own tests. However, they relied more on using questions from the textbooks and past examination papers.

6.3.5 Frequency of testing

Teacher interview responses that were verified by examination of records of student achievement showed that a unit or topic test was the type of assessment most frequently used to assess students' understanding of science (see Table 13).

Table 13: Frequency of testing by types of assessment

Teachers who indicated using type of assessment	Total	Type of assessment	Frequency
Steven, Amelia	2	Quiz	Fortnightly
Amelia, Steven, Jineta	6	Topic test	Monthly
Ishmael, Ivan, Wilson		Unit test	Once in two months
Steven, Amelia, Jineta	3	Lab reports/practical	Occasionally
Amelia, Ishmael, Jineta	3	Written assignments	Occasionally
Amelia, Steven, Jineta	6	Examinations	At the end of semester
Ishmael, Ivan, Wilson			

A unit or topic test is commonly conducted after teachers have completed teaching a unit or a topic. All the teachers administered an examination to their students at the end of the school term. Written assignments and laboratory/practical activities were less frequently used. Two teachers reported using quizzes and all reported conducting topic tests once a month. A unit test was given to students on a two-monthly basis.

Written assignments and practical work were also used occasionally by half of the teachers. All the teachers administered two examinations that wrapped up the units covered in a semester; the first one was conducted at the end of the first semester, and the second one towards the end of the year. As with all Solomon Islands schools, year nine students sit the year nine national examination during the month of October each year. Students' results from this examination are used to select students for the available year 10 placement.

Records of student results were examined and these provided a detailed picture of assessment activities that the teachers in the study and their students were involved in. Ivan's Mark Book (see Table 14) shows that for the period between February and May in the previous year (2007), he had conducted seven tests.

Table 14: Ivan's Mark Book showing topic/unit tests being the most preferred form of assessment he used to assess his students' achievement in science

Year 8		Subject: science			Year: 2007		Semester: One			Term: 1 and 2				
Date	17/2/07	23/2/07	6/3/07	10/4/07	27/4/07	5/5/07	28/5/07							
Type of work	Topic test	Topic test	Unit test	Topic test	Unit test	Topic test	Unit test	Attendance(†)	Examination	Total of topic/ unit tests	Examination %	Term or half term total	Term or half term grade	
Topic	Small structures	Cell	Structure	Earth changes	Earth changes	Energy	Energy							
Marked out of	6	18	35	23	28	24	16	77day/%	77	150				
Student Names								77 days	10%					
CE	[0]	[0]	9	9	6	17	6	66	8.0	26	15.7%	14%	37.7%	E
DB	[0]	[0]	6	12	16	12	[0]	60	7.7	17.5	18.6%	9%	35.5%	E
GO	2	6	15.5	12	16	17	14	73	9.4	40	26%	20.7%	56.7%	C
GL	[0]	1	4	5	16	17	14	73	9.2	18	14%	9%	34.2%	E
KB	[0]	8	13	9	7	14	3	61	7.9	50	18%	25.9%	51.8%	C
MS	[0]	6	17	8	10	16	6	66	8.5	40	21%	20.7%	50.2%	C
OB	4	4	25	18	24	14	13	74	9.6	41	34.3%	21.7%	64.9%	C
RN	2	6	20	[0]	8	20	[0]	71	9.2	39	18%	20%	47%	D
SZ	[0]	20	9	9	11	20	12	71	9.2	42	24%	21.8%	55%	C
TK	3	6	21.5	19	12	20	13	77	10	58	31.5%	30.1%	71.6%	B
TF	[0]	14	16	14	19	16	7	67.8	7	50	28.6%	25.9%	68.2%	C

(†) Note that the teacher also assessed students' attendance and it contributed to 10 per cent of the total possible mark allocated. [0]Student did not sit for the test

Of these, three tests focused on the same content area and were conducted during the same month. When asked why he gave his students a few topic tests before he administered a unit test on the same content area, Ivan said:

I was conscious of how much material my students can handle at any given period of time. Some of the units have many topics and so I have to spread them across [the month or term] in order to teach one topic at a time, and give a test before moving on to the rest of the topics. (Ivan)

Ivan was concerned that if he gave a test to the students after teaching a unit with so many topics, students might be more likely to cram what they learned and would not be able to perform as he would have expected. He argued that students should be assessed “when their minds are still fresh with the topic they have just learned”. Hence, Ivan opted to assess his students’ learning immediately after he had completed teaching a topic to determine his students’ overall performance in the unit.

Frequent testing seemed popular amongst the teachers. For example, Wilson conducted topic tests on a monthly basis and approached it in much the same manner as Ivan assessed, “when their minds are still fresh with the topic they have just learned”. Teachers supported the notion of testing students’ understanding of what they are taught on a regular basis and frequent testing was considered an acceptable practice in the school system. Amelia and Jineta, for instance, argued that students should be tested regularly because the test results enabled them to gain a deeper understanding of individual students’ competencies. This view was also supported by Steven, who argued that “teachers should assess students at intervals during the teaching period, in order to determine their progress and achievement until the unit is taught completely”.

For this reason, Steven gave a quiz to his students on a fortnightly basis until completion of the unit. He stated that he used the quiz results to help students relearn some of the concepts they did not quite understand by going through the questions in class. The decisions and thoughts shared by teachers demonstrated a general belief that it is possible to use summative assessment to measure student achievement while the teaching of a science unit is in progress. In other words, the

teachers did not think it was necessary to wait until a whole unit had been completely taught or wait until the end of the term to find out what the students had learned. This finding is consistent with their reported beliefs about summative assessment as a tool for not only measuring students' existing knowledge but also to test students regularly to track their progress.

6.3.6 Recording, marking, grading and reporting procedures

Teachers reported that they followed general assessment and examination procedures and guidelines on assessment to mark, record, grade, and report their students' attainments in science. Details of their experiences and practices on these aspects of assessments are discussed in the following sections.

Recording of students' results

This study also examined the teachers' records of their students' achievements (or mark books, as the teachers preferred to call them). Except for one teacher (Steven) who used a computer programme to keep a record of his students' results, all teachers kept a record of their students' attainments from the tests, quizzes, assignments, laboratory reports and examination marks in a mark book. The teachers regarded record-keeping of their students' results as an ongoing and cumulative process that they seemed to be managing reasonably well.

Four teachers were able to show their mark books (or student achievement records/sheets), allowing details of students' results and types of assessment used to determine students' final grades to be examined. A closer examination of the mark books indicated that teachers only recorded students' marks from summative assessments. Another notable feature of the mark books was that they contained columns of numbers but no qualitative data except for the letter grades assigned to students (see Table 14). Teachers mentioned that they did not keep a record of their students' marks from other assessment tasks that they used for formative purposes. Although two teachers (Steven and Amelia) also recorded some of their students' marks from the quizzes they organised fortnightly.

There were two teachers whose mark books showed that they had not entered a couple of their students' marks in a few of the topic tests administered. When

asked why they had not entered the students' marks, the teachers replied that they had decided not to give marks to the students because they did not attend class the day when the test was given. When one of the teachers was asked why he could not arrange another time so that the students could sit the tests, the teacher reported that the students were absent without any valid reason so they had to be given a zero mark. In the second mark book examined, at least three students had their assignment marks reduced by some points for failing to submit their assignments when it was due. Here the teacher seemed to use assessment as a form of punishment for bad behaviour – students forfeited marks for failing to submit their assignments when it was due.

The teachers seemed to agree that students who skipped tests or submitted assignments late for no good reasons should be penalised. However, one teacher said that she usually gave an average score to students who missed her tests or reduced the total possible marks (based on the total number of tests the students had taken) when she determined her students' grades at the end of the term. The case about students being given zero marks raises questions about the accountability of the teachers, given the fact that a few zero scores can drastically affect the overall percentage score and hence the grade a student is awarded in science at the end of the term.

Marking criteria

When teachers were asked if they prepared and used answer criteria, four of the six teachers responded that they only used them when they marked their students' end of semester examinations. The same four teachers also indicated that they did not use marking criteria when they marked a quiz, a unit test or assignment, instead they used their own "professional judgment" (Jineta). There were two teachers who used their professional judgement to mark their students' test or examination scripts. Various reasons were given by teachers to explain their decisions not to use marking criteria. For example, Ishmael argued that he did not write up the answers to the questions to the unit tests he gave to his students when he was marking their scripts because he said the answers were easy and that he made his own judgment on how many marks he should give to each response

provided based on each student's responses and the mark allocated for each question.

Amelia acknowledged that "a marking criteria is important" even for a short test because she said that it "enables teachers to list the possible answers to the questions or items" they include in the tests and use them to guide their judgement on how well a student has answered each question. She also said that it helps teachers to allocate "marks for each correct answer a student gets according to the criteria" they set. This feedback suggests a need for more consistency in the use of marking schemes for all forms of assessments that are assigned to students to ensure consistency in assessing and judging the students' answers.

Those teachers who developed marking criteria to judge students' work or test, did not have their assessment tasks or criteria moderated to ensure quality assurance or requirements of the curriculum area. There was also no evidence to suggest that the teacher-made assessments and criteria used to judge the quality of student work were moderated. Individual teachers took responsibility to ensure they develop quality assessments under the terms of reference they followed.

Grading

The teachers used the marks students attained from the unit tests, quizzes, laboratory reports, written assignments and examinations to determine students' grades for reporting purposes. This occurred at the end of each school term. All the teachers except two (Ivan and Wilson) used academic achievement factors (such as tests, assignments and examinations) in awarding grades to their students. The two teachers considered two non-academic achievement factors (for example, attendance and participation in class activities) in addition to the test marks when they determined grades. One teacher allocated 10% of the raw marks to attendance (see Table 14), while another teacher allocated 5% for effort (for example, students who completed assignments on time). The two teachers felt that student effort and behaviour were important factors, as well as academic achievement, and decided to include them in the report card grades. The rest of the teachers did not perceive non-achievement traits as important because they thought that such traits were not necessarily linked to students' learning of the

subject content. Teachers also reported that they followed the school guidelines on how much weighting to assign to the components of a grade.

The two most common components of grades and weighting scale that teachers claimed to have used as a guide to assign student grade in schools, according to four teachers (Amelia, Jineta, Ivan, and Wilson), were continuous assessment (40%) and examination (60%). Continuous assessment included unit tests, quizzes, assignments and laboratory reports (assessment tasks that the teacher administers at the classroom level for grading purposes). However, there were discrepancies in the way teachers interpreted the weighting scales in the calculation to determine a student's overall percentage score. It appeared that while the teachers calculated the averages of each student's marks they did not include the percentage weighting.

Teachers reported the difficulties they encountered in relation to a lack of uniformity in the application of the weighting scales to calculate the aggregate mark for each student. This was evident in the four samples of teachers' mark books examined. For example, the two teachers (Ivan and Wilson) who included non-academic achievement factors used the weighting percentage to convert the marks they awarded for students' attendance but they did this only for that particular component. They did not apply the weighting percent of 40 percent (for tests) and 60 percent (for examination) when they calculated the overall percentage score for each student. Instead, they combined their students' raw marks from the continuous assessments and examinations, added them together and divided by the total possible mark. This yielded them the aggregate percentage score, instead of the calculations being made separately according to the given weighting percent allocated for the two major components of assessment they used to determine student grade. The rest of the teachers who considered only achievement factors calculated the percentage score exactly the same way as the Ivan and Wilson.

Every school in the study used letter grades (A, B, C, D, and E), except for one school that used a stanine point system. Table 15 shows the grading scales the six teachers used to determine students grades.

Table 15: Grading scales in the secondary schools that took part in the study

School	Grading Scales
1	80–100 = A, 60–79 = B, 50–59 = C, 30–49 = D, 0–29 = E
2	80–100 = A, 60–79 = B, 50–59 = C, 40–49 = D, 0–39 = E
3	80–100 = A, 60–79 = B, 50–59 = C, 40–49 = D, 0–39 = E
4	This school uses a point system called stanine, for grading and so the teacher allocated numbers from 1 to 9 (1 is the highest grade and 9 is the lowest) (85–100 = 1), (80–85 = 2), (78–75 = 3), (74–65 = 4), (64–60 = 5), (51–40 = 6), (41–35 = 7), (34–30 = 8), (29–20 = 9)
5	80–100 = A, 60–79 = B, 40–59 = C, 20–39 = D, 0–29 = E

†Note: All numbers are expressed in percentage (%).

A = Excellent, B = Very good, C = Good, D = Unsatisfactory, E = Not achieved standard

A closer examination of four teachers' mark books, however, indicated that teachers showed lenience in the award of grades to students. For example, there were several students whose percentage scores had been adjusted after consideration of their achievement at or near each grade cut-off. The problem that arises from this is that teachers have to decide to either round off the fraction (percentage score) to the nearest whole number or leave it as it is. For example, in one of the mark books examined, a student's calculated percentage score was 58.5%. The teacher awarded a B grade to the student that falls in the cut-off grade range of 60–70%, instead of a C grade (40–59%). The teacher admitted rounding off the student's score to the nearest whole number and he said that he based his final decision on the student's overall positive attitude towards his study. This suggests that teachers use a combination of test scores and professional and personal judgement for final grading.

All in all, the teachers in this study followed the recording, marking, grading and reporting procedures of their respective schools. All teachers kept a record of their students' scores in the tests they had given. All in all, the teachers in this study followed the recording, marking, grading and reporting procedures of their respective schools. All teachers kept a record of their students' scores in the tests they had given. Although teachers do not usually use a marking scheme when they score their students' responses in each of the tests, which is of concern, teachers appeared to have a lot of trust and confidence in themselves in terms of

their judgment of their students' performances in those tests. There was a lack of clear written guidelines on recording, marking and reporting of students' performance procedures in each school and this could be the reason for the differences observed in the strategies used by teachers to manage their assessment practices.

6.3.7 Summative feedback

In the context of the present study, feedback is thought of as a means by which students receive information from their teachers about how well they have performed in an assessment task that they were given. Seen as a process, feedback may also involve students in making corrections. This can include the thinking that is involved to review work, the decisions to changing strategies or test-taking skills and preparation for future assessments. Teachers agreed that it was important "to provide feedback to students on any piece of work they are assessed on" (Jineta). They thought that students would then be able to see "where they stand against the curriculum objectives" (Ishmael) and perhaps "reflect on how they have performed and rethink their strategies" in order to improve their performance (Amelia). Interview results indicated that the teachers provided some form of feedback to their students after their work, tests, and assignments. The following is a summary of the types of feedback teachers provided to their students.

Numerical feedback

All teachers reported that they returned students' assessments (test, quiz, assignments, laboratory reports and end of term examinations) soon after they had been marked. The marked assignments, for example, unit tests, include the mark a student received out of the total that could have been achieved in the test.

Written feedback

Out of two of the teachers stated that they also provided written comments to their students in the assessment tasks they did. Typically this feedback was meant as encouragement for students to do better in the next test. If a student performed well and gained a high mark in a test, the teachers would write comments such as "Excellent effort" or "Keep up the good work". An average performer is either

given “good” or “no comments at all” (Ivan). If a student gained a poor score, the teachers wrote, “You can do much better, try hard next time”. All the teachers mentioned that they also write such comments in individual students’ achievement report cards. One teacher admitted that he hardly even includes written comments apart from writing the total mark a student gets from a test or examination.

Teachers also indicated that they did not correct their students’ mistakes in the actual test or examination scripts. Instead, they just place “ticks” and “crosses” to indicate correct and incorrect answers. They preferred to go through the questions with their students in class. A few of the teachers mentioned that they sometimes put up the unit topic solutions on the bulletin board inside the science classroom so students could copy them during their own time.

Verbal feedback

All teachers said that they went through the questions from the test or examination verbally with the whole class. Some teachers stated that they often read out the answers in class or would write down the answers on the chalkboard while students copied the correct answers into their workbooks. Two teachers also mentioned allowing their students to appeal if they wished to have their marks reconsidered, during the feedback session. This was done so they could ask questions or make comments and clarify issues. Although teachers provided solutions and helped students to correct the mistakes they made, they did not “organise extra work for students who performed poorly” (Jineta) in the unit test in particular. Instead, they “encouraged them to work hard in the next test or examination” (Wilson). Amelia, however, stated that she usually met individually with students who had performed poorly and would go through some of the work they seemed to have not understood well, including giving extra activities so that they could relearn the concepts.

From the discussions held, it appeared that the teachers assumed feedback was a way of helping students to do their corrections. Teachers seemed to believe that if “students corrected their own work they were likely to learn from it” (Amelia) and at the same time “think of ways they might want to approach the assessments” (Jineta) in the future to maintain or even improve their performance. However, the

numerical or written feedback did not seem to provide much guidance as to what the students could do specifically to improve their performance because soon after feedback was provided the class was ready to start a new unit.

6.3.8 Uses of summative data/information

Teachers were asked how they used summative data or information that they gathered about their students' performance from quiz, test, assignment and examination scores, as well as the items/questions and responses students provided. The ways in which teachers used school-based summative data for internal and external purposes are summarised in Table 16.

Table 16: Summary of how teachers used school-based summative data

Internal uses of summative data	External uses of summative data
• Generate and keep a record of students' marks for grading and reporting • Evaluate and communicate to students their achievements in science, in order to show them where they stand at the end of each unit or at certain points in time. • Compare students' abilities against their peers in the class	• Communicate students' grades to their parents • Reward and celebrate students' academic achievements during the school's speech and prize-giving day • Facilitate student transfers from one school to another • Certification (completion of junior secondary school – Yr.7 to 9)

Internal and external uses of summative assessment information

The baseline interview results indicated that, overall, the teachers confined their use of summative data primarily to produce grades that depicted how well the students performed in the units of science they studied so that they could be reported to the students themselves, and to parents and for record-keeping in the school. All the schools sent student report cards to parents twice a year. The findings also indicated that teachers did not use a variety of reporting methods. Out of the six teachers, only two teachers indicated that their schools hosted a formal parent-student-teacher interview session usually in Term 1 and 3 (mid-April and mid-June). The rest of the teachers said that the students were shown their achievement report cards in class where they were also asked to put them in envelopes and write the addresses of their parents before they were posted to parents by mail. These teachers were unable to hold parent-student-interviews because the majority of parents/guardians lived in the provinces.

Most teachers in this study reported that they did not use summative assessment data to inform or review instructional materials. Nor did they mention using summative assessment information to plan future assessment tasks or help them identify additional curriculum materials they might need to teach the science units in the following year (if they were assigned to teach the same grade-level). The teachers also reported that students' achievement data collected over the past years that were kept in their school offices had not been used by the schools or teachers themselves to evaluate the effectiveness of the science teaching programme they ran in the school; nor did they use the data generated over the years to inform decisions on how students' achievement could be improved. There was no evidence to suggest that the teachers in the study communicated the students' record of achievements from the previous year to the current teachers. Wilson reported that he usually prepared his student reports during the reporting period and submitted them to the school secretary who made copies for the school file before she mailed the original reports to parents. But he said that it was uncommon for him to show copies of the reports to the next teacher who would be teaching the class or even the other teachers.

Ivan and Jineta summarised some of the reasons teachers provided to explain why they did not use summative data/information to review their teaching strategies or curriculum materials. Ivan stated that he was aware that "summative assessment data was supposed to be used for reporting students' overall achievements" through the grades students are assigned. "Thus, I have been able to satisfy that role only", remarked Ivan. Jineta explained that as soon as she had "assessed her students on a unit and given her students feedback, it was time to move on to the next unit". Thus, there was little time for her to reflect or to review her instructional materials immediately after she had given a test or examination or after she had given feedback to the students. She had to devote her time to preparation and teaching of the next unit. Another reason why teachers felt they did not use summative data effectively was because they were often allocated different grade-levels to teach the following year. Teachers get "transferred to another school" each year but even those who remained at the same school are "assigned different grade-levels to teach the following year" (Ishmael). Therefore, teachers argued that they did not have much control over teaching the same grade-

level in any given year. Hence, they did not have the urge to review their teaching programme or instructional materials from the previous year. Since summative assessments were conducted at the end of a unit and towards the end of the term or year, as in the case of examinations, students' results were infrequently used by the teachers in the study for the purposes listed in Table 16. Thus, teachers used assessments primarily for producing grades in order to communicate them to students and their parents.

Student Achievement Report Cards

The report cards used by each of the schools to communicate students' results to their parents, guardians, and students were also examined. Apparently, the format of the report cards used in all the five secondary schools had not changed for the past three decades. The reports contained columns that presented the grades students had attained in each subject, with very brief qualitative statements from each teacher about the student's overall achievement or progress and a simple evaluation of the student's abilities. In the column next to the student's grades percentage scores for each subject and the student's ranking in class were given. As discussed earlier (see Table 15) there tended to be a very strict percentage range for marking that placed students in high, middle or low achievement streams/bands. The report cards did not give much explanation about the depth of knowledge or practical skills that students had attained in a unit of study or domain of science they had studied.

Teachers said that there were no repeaters in their classes. This meant that students who did not meet the curriculum standards (for example, in years seven, eight and 10) were not retained at the same grade level but progressed to the next grade level until they sat the national examinations at the exit points of the education system (such as year nine and 11). The implication of the current school-based assessment and examination system is that some students who progress to the next higher grade level do so without achieving the required learning outcomes and may not cope with the work at the higher level.

All in all, the reflections of the teachers on their assessment practices suggested that teachers held strong views about the importance of planning assessment.

However, there was not much evidence to suggest that their views matched their actual assessment practices. Thus, they did not seem to prepare a written assessment plan at the beginning of the term or at the beginning of the unit. Assessment of year nine students' achievements in science in the five secondary schools that participated in the project seemed to be very much dominated by tests, examinations and, to a lesser extent written assignments, laboratory and practical assessment activities. While these forms of assessment had played a part in revealing what students have learned as a result of their learning, they were mainly used for reporting, ranking and determining progress of students to the next higher grade level. The next section presents the contextual factors that seemed to have supported or inhibited year nine science teachers' summative assessment practices.

6.4 Contextual Factors

This section provides an overview of some of the influences that affect teachers' day-to-day summative assessment practices in their respective schools. The findings are related to the question: *What are the factors that promote or inhibit teachers' existing summative assessment practices?* Teachers reported several factors and conditions within the schools that supported or constrained their assessment practices. These included their initial teacher education programme (ITE), leadership issues in the school, institutional and external examination pressures, lack of coherent assessment policy and guidelines, exemplar assessment resources and assessment-related professional development opportunities.

6.4.1 Initial teacher education programme

When teachers were asked if they felt their initial teacher education programme (ITE) prepared them well for the roles and responsibilities in classroom assessment, most teachers responded positively. However, when asked to describe in detail aspects of assessment they had learned and how well they had learned them, they indicated that they still needed support and training about alternative methods of assessments, particularly in “designing laboratory-related practical tasks” (Amelia). They also felt that they needed support in “designing small research projects, which their students could do individually or in groups”

(Jineta). Ivan and Wilson reported that the ITE programme prepared them well in some areas of assessment such as managing students' records of achievements (marks), and marking and reporting students' grades. However, teachers generally felt that they found designing assessment tasks for a range of cognitive skills more challenging. One teacher (Steven) has had no prior teacher education but he seemed to be coping well with the challenges he encountered in his teaching as he was receiving a lot of support from the head of department who was also a participant in this study. However, he also identified elements of assessment that he was not comfortable with, most of which are listed in Table 16.

Overall, all the six teachers reported that their teacher education training not only influenced their views about their existing teaching practices in general but also their perspectives about learning and assessment. The teachers' views were elicited through the semi-structured pre-assessment teacher interviews where they reported their self-reported beliefs about teaching, how students learn science and how to assess their students' learning. Analyses of the teachers' views about assessment seem to explain their assessment practices. For example, Jineta, the most senior of the six teachers engaged in the study was of the view that her teacher education training helped her to understand and apply appropriate approaches to teach certain topics and not to use the same teaching approach all the time, she believed that her students learned science through her teaching and the classroom activities she set for her students. She also reported that the assessment strategies she learned from her teacher education helped her in her assessment practices. The rest of the teachers appeared to share similar views as Jineta about how their teacher education influenced their views on teaching, how students learn and how the students should be assessed.

6.4.2 Leadership in assessment

The teachers were asked whether they saw their school leaders (for example, principal, deputy principal, head of science department) as assessment leaders. Their responses indicated that they identified their principals as the most significant influence to initiate leadership in assessment in their schools. However, the more experienced teachers in the study seemed to hold the view that school leaders cannot implement their ideas alone, but would need support from

teachers, as well as knowledgeable others from the Ministry of Education such as curriculum developers and examination officers whom they tended to believe had expertise in curriculum and assessment. The teachers' interview responses suggested that they considered the school principal and heads of subjects had a major role to play. For example, two teachers viewed a school leader as "someone at the helm, who not only support[s] and advise[s] teachers on their assessment activities" (Ishmael) but also "initiate[s] staff development opportunities and inform[s] teachers continually of new developments" about assessment (Amelia).

It was clear that the teachers were aware of their school leaders' roles and responsibilities and had expectations of what they should do to help professional growth and improvement of the schools. Teachers generally felt that school leaders should be able to "set directions and goals for the school" (Jineta) in all aspects of school development, and to put in place necessary mechanisms and strategies that teachers were aware of so that they could all contribute towards helping students to achieve the intended educational outcomes.

6.4.3 Institutional pressures

The teachers identified other responsibilities apart from their teaching and examination pressure as key factors that affected their teaching and assessment practices. Extra responsibilities and heavy teaching loads seemed to reduce the time they were allocated to prepare for their lessons and assessment tasks. Thus, teachers tended to end up using their own time to complete their instructional activities that added to the institutional pressure they dealt with on a daily basis.

Jineta talked about her experiences of teaching in a boarding school that was common amongst the teachers that participated in this study:

Every teacher in my school is put on a duty roster to oversee the day-to-day operation of the school; teachers supervise students; they are also involved extracurricular activities. After classes, some teachers supervise students in the gardens. I teach four different classes and preparing lessons and laboratory instructional activities require time and self-discipline; it can be frustrating at times but that's what I am paid to do. (Jineta)

Jineta's account provides a glimpse of the roles and responsibilities that the teachers experienced in boarding schools. They taught under intense institutional constraints with pressure from a heavy teaching load, timetabling issues, extracurricular responsibilities and their own families to look after. They also mentioned external pressure such as parental expectation of teachers to help their children pass examinations.

When asked what they felt about the external year nine examinations, all the teachers shared common feelings and views about the effect of examinations on their classroom practices and the pressures associated with it. The key impacts of the external examination on their teaching included increased workload and uncertainty over the performance of their students in the examinations. Three of the teachers had previously taught year nine science course and were able to share their experiences of examination-related pressure. The teachers said that parents set high expectations in general of the school and the teachers, in particular those who teach year nine students. Wilson noted the desire of parents to have their children continue with secondary education to year 10. This had been shown during recent student-teacher-parent interviews that his school had organised:

There are limited spaces in secondary schools and parents seemed worried whether their children would be selected to progress to year 10 the following year. So I always try to work extra hard by preparing mock examinations so that my students can get lots of practice and get familiar with the likely questions that may come in the examinations. (Wilson)

This teacher hoped that more practice using mock examinations would enable his students to succeed in the examinations. The teachers who taught students in year nine and 11 usually worked extra hard, giving extra classes to go through past examination papers with the students.

6.4.4 Lack of assessment policy framework

None of the five secondary schools who participated in the study had a comprehensive assessment policy framework to guide teachers in their assessment practices. Instead they had partially written instructions of assessment that included the grading criteria they use and how assessment should be administered

and reported. These instructions did not include principles of assessment, nor were there directions on the assessment methods and strategies teachers would use to construct assessment tasks. There also were no instructions on how data or information on student learning should be managed, processed, interpreted, and what purpose it might serve. Interestingly, some of the teachers were not aware that their schools had any form of assessment instruction. One teacher admitted that he had not sighted a copy of the assessment guideline since he started teaching at the school:

What I am aware of is that the principal and his deputy provided verbal instruction on assessment procedures to the teachers. I learned about the grading scales and reporting procedures we use in the school from my colleagues. (Ishmael)

Similar sentiments were expressed by the rest of the teachers, who confirmed that their schools had no assessment policy, and they knew only of the assessment instructions on administration of tests and examinations, and the grading scale and reporting procedures that teachers must conform to during the reporting period. However, the general school policy in each school stipulates that teachers should assess their students on a regular basis in order to determine their progress and to report their achievements to students and parents. The teachers' interview responses also indicated that there was general lack of effective monitoring mechanisms that would ensure teachers worked towards developing high quality assessment tasks.

6.4.5 Lack of relevant assessment resource materials

Teachers reported a lack of up-to-date reference materials, such as textbooks, education journals, magazines and research articles on educational measurement that they could access to expand their understanding of and skills in assessment. There were also very limited resources for practical experiments and textbooks in all the schools studied. This was one of the reasons why teachers like Ivan reported they were not keen to use practical activities for a summative purpose. The Curriculum Development Division supplied science curriculum materials (as well as other textbooks for the other subjects) to the schools once in a while (usually as a result of curriculum reform, which occurs once in 10-15 years), but

according to some teachers, they did not have sufficient copies for a class set, and the best they could do was to ask students to share whatever was made available to the school. The teachers said that this lack of appropriate textbooks had contributed to their practice of writing notes on the chalkboard for students to copy. The locally produced year nine science curriculum materials were available but these do not provide assessment guidelines or exemplars that teachers could use to construct their own assessment tasks. As shown in Table 9, lack of assessment resource materials in particular is challenging and seemed to have confined teachers' assessment activities to using items or questions from the same science textbooks and past examination papers, instead of expanding their knowledge of assessment through exemplars and being able to try other ways such as using authentic assessment tasks to assess their students.

6.4.6 Professional development support in assessment

Four of the six science teachers said that some form of staff development that was geared towards professional growth of teachers had taken place at their schools in the past year. They reported on the frequency of such activities, the topics covered, the resource persons involved and the problems they faced in implementing what they learned from the training opportunities they attended. According to Jineta, Amelia and Ivan, professional development was a fairly recent arrival. When they began their teaching careers at their present schools, there were no professional development programmes in existence. The only way that the teachers said they had been able to interact, share, and discuss matters pertaining to teaching, student achievement and other school matters was through staff meetings or informal conversations with their colleagues in the staffroom or science department.

Jineta recalled that the professional development programme in her school started in 2007 when her school established a partnership with a team of teacher educators from an overseas country to work with local teachers to organise annual education conferences that would contribute to their professional development. Jineta mentioned that the initial teacher-training workshop the group organised involved every teacher in her school and covered a range of topics such as pedagogy, generic teacher assessment activities and classroom management,

amongst many others. Although the professional development was not specific to assessment, Jineta believed it contributed to “building capacity in effective education in the school”.

Amelia reported that her school also provided a professional development programme that involved not only teachers from her school but from other schools under the same education authority. The resource persons in this annual teacher training conferences were all locals, and Ministry of Education officers. According to Amelia, the conference usually lasted two to three days and covered a wide range of topics including assessment topics. However, Amelia said that she already knew most of what was covered.

Ivan and Wilson also reported some form of organised professional development activities in their schools, mostly on a needs analysis basis. However, both teachers mentioned that it was not ongoing, but occurred only when the need arose. The principals usually organised the professional development activities. However, they mentioned that the frequency of such sessions depended on the availability of their school principals and their expertise. For example, Wilson mentioned that his principal was very much in control of how professional development was organised and how frequently it occurred. He recalled that his school usually had one staff development activity per semester, meaning that his school organised professional development activities twice a year. Ishmael said that his school currently did not have a professional development programme. However, some of the senior teachers who were involved in teaching years 11, 12 and 13 classes did attend professional development on assessment organised jointly by the National Examination and Standard Unit of the Ministry of Education and South Pacific Board for Educational Assessment. He said that junior teachers in his school were rarely given the opportunity to attend any professional development activities, in assessment or otherwise.

The teachers identified their need for curriculum development officers and assessment and examination officers to provide technical support and assistance to upskill teachers on assessment. They particularly asked for support not only when new curriculum materials are implemented in the schools but also on a continuous

basis and suggested that decisions to provide such learning opportunities should be based on a teacher needs analysis. There appeared to be limited professional development programmes taking place in the five high schools and they all remain small in scale, are often one-offs, focused on generic teaching topics and directed and funded by external organisations that often have their own agendas for conducting the professional development workshop. Clearly, the findings have revealed the need for ongoing professional development for science teachers that is embedded within the official school programme. The next section provides a summary of the teachers' professional learning needs in assessment.

6.5 Professional Learning Needs of Teachers

This section presents a summary of the findings relating to the elements of assessment that the teachers seemed to have found most difficult to implement in their classrooms and that the teachers were interested in exploring during the upcoming professional development workshop. It also reports on other contextual factors and influences that have affected the science teachers' school-based assessment practices.

6.5.1 Teachers' reflections of the challenges they face in assessment

The specific assessment areas in which the six teachers indicated they would need professional support are listed in Table 17. The table includes the elements of assessment that teachers found most challenging. While teachers claimed general satisfaction in implementing and managing their assessment activities, they also stated that they found certain elements of assessment quite challenging. These included planning for assessment, the use of a variety of assessment methods to assess students' understanding (for example, authentic and performance assessments), constructing items or questions that ask students to demonstrate a variety of knowledge levels, using test blueprints to construct a unit test and end of term examinations, and expanding the application of summative data compared to what they were currently being used in their school-based assessment practices.

The teachers identified test construction as an area that they felt little confidence about their own capabilities. They said that the formulation of items or questions

that they include and ask students to demonstrate high quality thinking and practical skills, including the use of authentic assessments, was most challenging. This type of assessment enables students to apply knowledge and skills to solve problems. It was also clear from the discussions held with the teachers and samples of assessment tasks sighted that all the teachers emphasise and use tests almost exclusively to assess their students' performance in science.

Some of the teachers felt they were unable to use laboratory or practical activities to assess students due to a lack of basic equipment, large class size and insufficient teaching and learning resources. The teachers' unfamiliarity with alternative assessment practices also signalled a lack of awareness of how these methods could be applied in their own classrooms. Sound assessment guidelines to improve and support the teachers' practices were lacking. This is an important area that should be addressed through professional development activities at both the national and school level.

One of the most important findings from the baseline study was that teachers did not use a test blueprint or table of specifications to help them construct items for the tests and examinations – that is a concern as far as whether the teachers follow stringent quality assurance guidelines in order to develop valid, reliable and fair assessment tasks. This explains why they looked for test items or questions from textbooks and past examination papers instead of constructing the questions themselves based on the work they taught.

Overall, the findings suggested that assessment seemed to be a neglected area of teaching. The teachers admitted that there had been no meaningful reform in assessment at their schools since they joined the teaching force and so they continued to rely on the traditional assessment methods to assess their students. The specific assessment areas in which the six teachers indicated they would need professional support are listed in Table 17. The table includes the elements of assessment that teachers found most challenging. While teachers claimed general satisfaction in implementing and managing their assessment activities, analysis of their interview responses and practices indicated that they found certain elements of assessment quite difficult.

Table 17: Aspects of assessment that the teachers identified as an area of need

Element of assessment teachers find challenging	Comments
Planning for assessments	Much of what teachers described as an assessment plan were found to be forms of their daily lesson plans. Although teachers expressed the importance of an assessment plan during the discussions, it was clear that they did not produce a written assessment plan for the units they would assess in a term or year.
Selecting and adapting assessment methods and tasks	Given the interest amongst teachers in tests, they seemed to pay little attention on exploring the merits of different assessment strategies, like library research, investigative projects and field trips.
Designing item to assess a range of cognitive skills other than knowledge and facts	Teachers appeared to have constructed their test items by paraphrasing texts from the science textbooks and locally produced science instructional materials. Teachers expressed their desire to learn about how to construct good assessment items including multiple choice items so that they could use these in the unit tests and end-of-term examinations.
Using weighting, blueprint, or examination specifications	Teachers did not use weightings scales. Nor did they plan components of assessments which they would use to determine students' grades. Teachers did not use written procedures to construct their tests, nor is there evidence to suggest that they used blueprints to guide them to construct items for their unit tests or examinations.
Developing rubrics and other criteria to judge the quality of students' work	Teachers relied on their professional judgment for most of the time to assess the quality of their students' work thus they appeared to use less marking schemes. They did not use rubrics for performance assessments.
Selecting assessment methods or tasks for large classes	Teachers appeared unprepared to explore other assessment tasks for a large group of students and focused on tests instead. Teachers lacked training on how to design group work of assessment.
Using fixed percentage method to determine achievement grade	Teachers calculate the aggregate percentage score to determine grades although guidelines indicate specific weighting scales for continuous assessment and examinations. Issues relating to lack of uniformity and application of the recommended weighting scales were prevalent.
Choosing alternative uses of summative assessment data/information	Currently, teachers use summative data primarily for reporting grades. Summative data are available in the schools but they appeared to be rarely used to inform teaching, planning and to improve students' achievements in science.

These included planning for assessment, the use of a variety of assessment methods to assess students' understanding (for example, authentic and performance assessments), constructing items or questions that ask students to demonstrate a variety of knowledge levels, using test blueprints to construct a unit test and end of term examinations, and expanding the application of summative data compared to what they were currently being used in their school-based assessment practices.

6.6 Summary

The baseline study was conducted to investigate the six secondary science teachers' existing perceptions and experiences of assessments, so that their professional learning needs in assessment could be identified. Five aspects of their assessment practices were explored: the science teachers' perceptions and knowledge of summative assessment; their planning practices, types of assessments used and what they used data for; the challenges they face in their assessment practices; their professional development needs regarding assessment; and the factors and conditions within schools that seemed to have supported or impeded their overall summative assessment practices. Findings of the baseline study indicated a number of strengths, weaknesses and challenges that the teachers experienced in their assessment practices.

Findings of the baseline study also have highlighted that the science teachers developed their summative assessment practices on the job. Teachers' perceptions of assessment and the strategies they used indicated that they had a fair understanding of how to design their teaching programmes, including unit schemes of work and daily lesson plans. They considered that their teaching plans included assessment as an integral component of their job as teachers. However, the teachers did not develop an assessment plan of the year nine science units at the beginning of the unit or term. Instead they scheduled and developed tests after the completion of each unit. They did not use a table of specification to construct their end-of-term examination; instead they applied their own procedures. Teachers' responses indicated that they have implemented assessment methods,

strategies and procedures and have used them frequently to satisfy the summative purpose of assessment; that is, for ranking, grading, and reporting students' results. They also took their assessment responsibilities seriously but gaps in their knowledge constrained the application of quality assessment.

The baseline study indicated that the assessment task most frequently used by the teachers was a test, while laboratory activities and written assignments were less commonly used for grading and reporting purposes. Teachers developed and used unit tests to assess their students. Examinations were often administered to students at the end of the semester and the questions included were taken exclusively from past external year nine science examination papers. Teachers rarely used summative data or information to inform their future instructional plans. They stated that they did not have the time to analyse student assessment data and the fact that they often taught different grade levels each year made it unrealistic to evaluate and inform their instructional decisions for the following year.

Teachers reported a lack of relevant assessment reference resources that they could use to guide their assessment practices. Locally produced year nine science curriculum materials were used but these do not provide assessment guidelines, nor were examples of assessment tasks that the teachers could follow to construct their own assessment tasks available. Teachers' responses indicated that there was a genuine need for professional development at the school level, embedded in school programmes so that they could learn about new assessment strategies. The evidence gathered from this study indicated that a satisfactory technical culture of assessment did not exist.

The year nine science syllabus and accompanying curriculum materials specify the content area and the expected learning outcomes such as comprehension and application of scientific knowledge and skills and problem-solving. However, samples of tests and examination examined indicated that they placed an enormous emphasis on items on recall of memorised facts and knowledge at the expense of higher order cognitive skills.

The baseline study identified the elements of assessment that the teachers found most challenging. These include: planning for assessment, adapting assessment methods, designing assessment items to assess a range of skills, being able to construct a test blueprint, rubrics, and other criteria to judge the qualities of student work, and knowing how to assess a large class using group work.

At present, professional development opportunities that teachers reported in the five secondary schools are limited and therefore concerted effort is required to provide support teacher up-skill their assessment expertise. A more desirable approach would be to provide an ongoing hands-on professional development programme that is embedded within the school programme, in which the teachers learn about different assessment processes in the context of their classroom assessment practices.

A preliminary analysis of the baseline study data was initially used to inform a small scale professional development intervention study for the six science teachers and this is reported in the next chapter.

CHAPTER SEVEN: FINDINGS - PROFESSIONAL DEVELOPMENT

IMPACTS OF THE PROFESSIONAL DEVELOPMENT INTERVENTION

7.1 Introduction

This chapter presents findings of the professional development initiative designed to extend and refine teacher participants' summative assessment practice. The components of the professional development initiative comprised a four-day training workshop on assessment, school visits, implementation and assessment of what the teachers applied in their post-professional development summative assessment practice. The training workshops offered a professional learning opportunity for the six science teachers in assessment and served as a basis for investigating what they learned and how they learned. The school visits were intended to provide additional professional support to the teachers in those areas of assessment they wanted to implement in their practice. The implementation stage involved the teachers applying what was learned to their summative assessment practices. Finally, the assessment was conducted by the researcher to ascertain the overall patterns of change in the six secondary science teachers' professional learning experiences and practices as a result of the professional development on assessment including identifying the factors that supported or inhibited the teachers from implementing the new assessment ideas and procedures they learned from the workshop.

To fully understand the impact of the teacher professional development on the teacher participants, Section 7.2 reports teachers' views of professional development in assessment. Section 7.3 provides descriptions of the topics covered in the professional development workshop and the rationale for including these. Details of how the content was covered in the professional development workshop, as well as how the workshop program was negotiated with the teachers to tailor the professional development to their learning needs have been discussed in Chapter 5 (see Sections 5.3.1 through to 5.3.3). Section 7.4 provides findings of the teachers' reflections on their professional learning experiences during the

professional development workshop. Section 7.5 discusses findings on what the teachers put into practice as a result of the professional development. Section 7.6 provides the learning strategies teachers applied to understand the new assessment ideas and procedures. Section 7.7 provides a summary of the chapter.

7.2 Teachers' Views of Professional Development

This section presents findings on the teachers' views of professional development in assessment. The findings discussed in this section are related to the research question (2) (a): *What are science teachers' existing perceptions of professional development?* Prior to the commencement of the professional development workshop, teachers were asked about their views of professional development. It was important to understand their views of professional development as it shapes how teachers react to professional development programs or activities and patterns of change in their summative assessment practices. The concept of on-going teacher professional development as part of "continuum of teacher learning" has been evident in the education research literature (Darling-Hammond, et al., 2009; Mizell, 2010; Schwille & Dembélé, 2007). However, in some contexts such as the Solomon Islands, it is only beginning to become part of the policy discourse and so here it is used as an analytical tool used by the researcher to measure the extent that the teachers perceive it as an important tool for learning. The science teachers' views and thoughts about how they perceived professional development in general at the start of the workshop are highlighted next.

7.2.1 Teachers' perceptions about the purpose of professional development

After formal introduction of the professional development workshop goals, the first session on day one commenced with an activity that asked the six science teachers to identify their views and expectations of the professional development initiative. The teachers were put into two groups and asked to discuss what the term professional development meant to them, their expectations of what they wanted to achieve, and what role they would play in the professional development activities. There were several terms that teachers used to explain what

professional development meant to them such as in-service training, staff development programme, seminars, conferences and staff meetings. The discussion revealed a range of responses from the teachers, as illustrated in the following responses.

It is a form of in-service training that is offered to teachers so that they can extend their knowledge about the subjects they teach. (Amelia)

It reminds me of staff development activities that are conducted to help teachers learn about new teaching approaches, revised curriculum, and the subject content they teach. (Ivan)

It refers to seminars, workshops, and meetings that teachers attend to acquire new knowledge, skills and information in their specific areas of teaching. (Jineta)

It involves long-term in-service training for teachers who have been teaching for some years, so that they can broaden their knowledge and acquire new qualifications. (Ishmael)

Teachers' responses indicated that they were familiar with in-service training and workshops as forms of professional development activities that catered for the development of teachers in their specific subject area of teaching. They referred to their previous experiences of professional development. The teachers were aware that practising teachers should be offered professional development opportunities throughout their teaching career. According to Jineta, practising teachers need support through professional development activities to "keep up to date with new knowledge and skills in their subject areas". She also pointed out that the key to successful implementation of new curriculum is the provision of an in-service training programme that would engage practising teachers with curriculum change details.

Another teacher (Ishmael) stated that teachers need to learn more about innovative teaching approaches and subject matter, in order to keep current with their classroom practices because as time passes by "teachers can become stagnant".

The teachers' responses implied that they felt a need to access new knowledge and skills to meet new challenges in their teaching profession. It seemed clear that the teachers were aware of the need to extend their generic assessment skills. However, they were also concerned with upgrading their current qualifications.

Of the six science teachers who participated in this study, four were diploma holders and indicated their plans to pursue further degree level studies. The teachers were also aware of short-term in-service training opportunities that were geared towards equipping them with knowledge and understanding to implement new school curriculum materials and other innovative school projects associated with the education reform programme currently going on in the country. Nonetheless, the teachers seemed unsure about the importance of a more structured and well organised continuing professional development program and the ultimate professional growth that teachers could benefit from, compared to the more teacher familiar one-off session that focused on generic educational topics and lacked follow-up activities by the facilitators. This perception implied that the professional development activities that they had attended or experienced in their respective schools were not well established as part of the school programme. The next section provides findings on the professional learning experiences of the six science teachers.

7.3 Focus and Descriptions of Topics Covered in this Teacher Professional Development

The baseline study had indicated that there were very few professional development programs or activities that focused on assessment taking place in each of the schools. The professional development programs that were reported by the teachers to be occurring in their schools were described to be small in scale, were often one-offs and focused on generic teaching topics and classroom management issues. These professional development programs or activities were reported to be funded and directed by education authorities that run the schools. Thus, most of the teacher participants had never attended any professional development that focused entirely on assessment. It was necessary to build their knowledge on those key areas of assessment that the workshop focused on.

Such training was considered vital in supporting the science teachers' efforts to implement new forms of assessment and to use them to serve summative functions aligned with the Solomon Islands year nine science curriculum and assessment reform.

As discussed in Section 5.3.2, the professional development workshop topics were reduced from eight to four. These are as follows and are described briefly below; (a) designing an assessment plan, (b) designing assessment tasks using a test blueprint, (c) fixed percentage method to determine student achievement grades, and (d) analysing and using summative assessment data to inform teaching and learning.

7.3.1 Designing an assessment plan

Findings from the baseline study indicated that the science teachers in the project were aware of the importance of a teaching and assessment plan. However, they did not produce a written plan of assessment to guide their instructional and assessment activities. Therefore, the goal of this workshop theme was to introduce to teachers an assessment plan that lays out a selection of assessment methods, tasks and instructional activities aligned to the year nine science syllabus outcomes. Teachers were provided a typical assessment plan templates construct their assessment plans.

As a participant observer, I wanted to observe the teachers design an assessment plan. I particularly wanted to listen to their discussions on how they came to and agreed on the elements of the assessment plan they would include in their plans. I wanted to dialogue with the teachers to get their views about what and why they included the types of assessments they identified in their assessment plans. During the workshop I moved around the two groups and observed how the teachers went about developing their assessment plan and asked them questions about why they included specific types of assessment in their assessment plans, and the weighting allocated for each assessment type (see Table 18). As a participant observer, I critiqued their assessment plans and suggested improvements. Findings from the workshop on designing an assessment plan are provided in Section 7.4.1.

7.3.2 Designing a test using a test blueprint

Findings of the baseline study also revealed that the dominant form of assessment used by the teachers to assess their students' learning was a unit test, while assignments, projects and laboratory reports were either least used or never employed by teachers. Examinations were usually administered at the end of the semester or year. It was also discovered that the teacher-designed assessment tasks emphasised measuring recall and recognition of facts. The teachers rarely included test items or questions that focused on higher-level thinking and practical skills. This information suggested that the teachers needed support in designing assessment tasks that could enable students to demonstrate different cognitive levels.

To do this effectively, the professional development included time to learn about test blueprints that include levels based on Bloom's taxonomy and to prepare questions that measure different abilities and skills. It was believed that introducing a test blueprint would guide teachers to place the right emphasis and balance on the questions they included in their tests or other assessment tasks they might decide to use – thus measure both low and high cognitive skills of their students.

As a researcher and participant observer, I wanted to find out how the teachers in each group applied their professional development knowledge and understanding to construct a test blueprint. Further, I wanted to dialogue with the teachers as to why they selected particular topics/outcomes and the particular emphasis they placed on these. Findings and observations from the workshop on designing a test blue print are provided in Section 7.4.2.

7.3.3 Fixed percentage method to determine student achievement grade

Findings of the baseline study revealed that teachers did not place much emphasis on assigning weights to components of assessment (e.g. test, quiz, examination, etc.) or science domains such as conceptual understanding, factual knowledge, inquiry and science processes (Atkin, et al., 2001; Shepardson & Britsche, 2001). Instead, they usually added up each student's scores from the tests, and then

calculated the aggregate score before converting it into a percentage score. This was then compared with their school's grading scale to assign a grade to each student to represent the level of achievement in the subject the student studies. It was decided that a fixed percentage method that combines students' scores from the components of assessment tasks they completed into one summary achievement grade should be covered in the teacher professional development.

Not only was it necessary for me as a researcher and participant observer to find out the teachers' conceptual understanding of the new grading system introduced to them, but also to observe how they were able to apply this to examples of students work to determine their grades. In the dialogue with the teachers I explored what they thought about the fixed method approach for grading students' performance compared with their existing school grading system, and whether they thought they would adopt the new system. For example, I observed how they calculated the composited percentage score using the given formula, and asked the teachers in each group whether they had any problem with calculating a student's weighted composite score before using a grading scale to determine his/her grade (see Table 20 and 21). Findings on what the teachers did during the third professional development workshop are provided in Section 7.4.3.

7.3.4 Analysing summative assessment data to inform teaching and learning

One of the important functions of assessment is that it should be used to inform teachers about the status of their students' learning and to decide what actions to take to support and improve that learning. Assessment information should also be used to report students' achievements. According to the baseline study, teachers found past tests and national science examinations very useful in preparing students for the end of semester examinations and the important national science examination that are held at the end of year nine. The year nine national examination results are used to select students for year 10. In other words, teachers used questions from past examinations formatively to prepare their students for the year nine national science examination. However, there was evidence to suggest that the data or information derived from teacher-designed unit tests and end of semester examinations were used only for determining and

communicating students' grades. There was also little evidence to suggest that the teachers analysed the answers students provided in the assessment tasks they completed to identify their weakness and strengths, nor did the teachers use summative information to plan their future teaching goals or to determine the help they could give to their students to improve their performance in science. Thus, teachers were unable to get a complete picture of what exactly their students were finding difficult and why.

The teacher activity involved teachers in conducting an analysis of students' responses from past year nine science examinations papers. I wanted to observe how they conducted the data analysis and identified students' problems. During the workshop I observed teachers analysing student responses from past year nine examination papers based on a set of questions (see Table 23) and discussed with them the usefulness of the data analysis exercise. From the discussion I noted the teachers' views on how they would use such data in the classroom to inform their teaching plans. Findings on what the teachers did during the professional development are given Section 7.4.4. The next section reports on the teachers' learning experiences.

7.4 The Professional Development Workshops: Evidence of teachers' learning experiences

This section provides evidence of the teachers' learning experiences, development and their reflections on what and how they learned aspects of alternative assessment procedures during each workshop session. These are related to the presentation of assessment ideas and procedures covered in each session of the four-day workshops and the activities that the teachers carried out to reinforce the ideas covered during the presentations. Hence, the research question being addressed here is: What and how did the science teachers learn from the professional development workshops that focused on developing new assessment ideas and procedures? The questions that guided collection of evidence of teachers' learning experiences at the beginning, during and after the professional development workshops are given in Appendix G.

The professional learning experiences of the six science teachers are presented under four main workshop themes in this section: (a) learning by participation to design an assessment plan; (b) learning by participation in developing a test blueprint; (c) learning to use a fixed percentage method to determine students' achievement grades; and (d) learning as a result of participation in diagnosing students' weaknesses and strengths, and using the information generated to inform the teaching-learning process.

7.4.1 Workshop One: Learning by participation to design an assessment plan

The objective of this workshop session was to provide an opportunity for the teachers to work collaboratively in designing an assessment plan. The introduction of the workshop session involved the entire group in discussing the issues teachers would face without a proper assessment plan. The teachers were then divided into two groups to work on the activities that required them to design an assessment plan for a selected year nine science unit. The two groups then identified a framework for planning assessment. They were provided with two templates for planning assessment, proposed by Brookhart and Nitko (2007) and Earl and Katz (2006), to use as a guide in designing their own assessment plans.

The teachers were also guided by the following key questions: (a) Why am I assessing my students? (b) Which student learning objectives will I assess? (c) What assessment tasks should I employ? (d) How can I use the data/information that I gather from the assessment task? (Earl & Katz, 2006, p. 82). These questions supplemented the assessment framework given to the teachers to design their assessment plans. An example of an assessment plan that one group designed is presented in Table 18.

The assessment plan exhibited in Table 18 showed that the teachers had understood the concept of planning and were able to include all the elements that should be in a plan - learning outcomes, type of assessment and weightings for each assessment task. However, there were no indications in the plan under formative assessment of how the teachers would provide or receive feedback from the students, which might reflect that the teachers still hold to an overall

perception of assessment as a teaching task that happens at the end of a course or unit. On the other hand, the assessment tasks the teachers indicated under summative assessment indicate they were able to identify a variety of assessment tasks. Overall, the teachers allocated equal weighting to continuous assessment (50%) and examinations (50%) which is a shift from previous practice. However, tests and examinations were allocated a higher total weighting than the other assessment tasks. This might reflect that the teachers still perceive tests and examinations as the most preferred assessment tools for measuring students' learning.

Table 18: Assessment plan designed by three teachers (Ivan, Amelia and Ishmael), for assessing a year nine unit on electricity and light

Year Nine Science/Unit 2: Electricity and Light	
Topic: Electric circuits and applications	
Student learning objectives	• Set up circuits from diagrams using dry cells, bulbs and meters • Classify materials according to how well they conduct electricity • Explain series and parallel in electric circuits using bulb • Measure voltages and currents in simple circuits • Explain, discuss and present electric circuits using simple diagrams • Explain use of fuses and circuit breakers to prevent overloading
Formative assessment	• Set homework for students to do each week • Set work on circuit diagrams (prepare worksheet with questions) • Give three quizzes (during weeks 2, 3 and 4) †Note: <i>Students' responses from the assignments will be analysed and used to provide extra support to students</i>
Time allocation	18 periods
Summative assessment	<u>Tasks for teacher</u>
	• Prepare worksheet that students will use to draw circuit diagrams independently and assemble the components of the circuit • Prepare a project that involve a mode that uses electrical components (e.g. torch, toy etc.) and a rubric/marking criteria before the start of the projects; give them to the students • Prepare and give a test at the end of the unit • Identify students' weaknesses and strengths by analysing their answers in the test • Provide feedback and support to students that need help
Weighting	• Homework (5%), Quiz (5%), Assignment (10%), test (20%), Project (10%), Examination (50%) – note that these are the overall percentage weighting for determining student grade.

Key findings from teachers' learning experiences of an assessment plan

The teachers expressed their overall appreciation of being able to expand their knowledge about planning for assessment. For example, Ishmael indicated that he could not recall learning about how to design a separate assessment plan during his initial teacher education program, and so the opportunity to design an assessment plan with his group was a useful learning experience for him. Table 18 shows an assessment plan that one group designed that was based on a year nine science unit on electricity.

All teachers seemed to appreciate that the assessment template they adopted showed them a better way to plan their classroom assessment compared to the strategies they had used to construct their tests in previous years.

Another new concept that the teachers learned during the workshop was the percentage weighting for components of the assessments that they chose to use to determine their students' final grades. The teachers said that they had never considered weightings in their planning or in determining students' final semester grades. They recognised that the weighting concept is an important part of the grading process because it ensures that they use a variety of assessments to measure students' performance (in the form of scores) and from these determine grades.

During the group discussions, the teachers shared their thoughts about unpacking of syllabus objectives into specific student learning outcomes. In the past, teachers would use the syllabus objectives as they appeared in the syllabus to prepare their lessons or construct test items. In this activity, teachers re-wrote the learning outcomes for the specific unit they were working on. The teachers could see logic in translating the objectives to specific learning outcomes, though they struggled with them at first. According to the teachers, finding the right verb to describe the outcome that the students were expected to achieve was challenging. However, they said that unpacking the syllabus objectives into manageable student learning outcomes was necessary considering the number of objectives they have to teach or prepare class activities and assessment tasks for. Wilson mentioned that he

often struggled with some syllabus objective statements that used terms such as “know and understand” that do not tell him much about the specific outcomes that students are expected to demonstrate. The activity was of great help to him as he was able to specify syllabus objectives that had seemed vague to him in the past.

Another important concept teachers learned with regard to writing down the purpose of an assessment they chose to use in their assessment plans was to make explicit what they wanted to use the assessment information for. The teachers said that they often took it for granted that tests serve a specific purpose that is to find out if students have acquired knowledge and skills related to subject taught, and so they never bothered to write down the reasons for using it. However, as Amelia noted, she realised that establishing in writing how her group would use the type of assessment they selected reminded her about why she needed to assess her students as well as made her think deeply about what she needed to do with the assessment data.

The teachers also indicated that some of the elements in the assessment planning framework they used were not entirely new to them. However, they were appreciative of the fact that the professional development activity helped them to expand their current understanding of an assessment plan in general, and why it should be an essential part of their instructional planning and assessment. Working as a team to draw up their assessment plan was quite a new experience for all the teachers. Prior to this, they had worked independently in their schools. Wilson commented that a group work approach to planning was very useful and said that “it was a carefully guided activity and we learned a lot from each other”.

In their small groups, the teachers assigned the tasks and so everybody had a task to do before they compiled the information they were asked to put together in their assessment plan. Jineta was very positive about the strategies her group used to complete the activity. She valued what each member of her group contributed towards developing their assessment plan and said that from that experience she had learned a few tips that broadened her outlook of an assessment plan. She described the role each member of her group played in the activity:

Our group decided that each one of us should be allocated a specific task to do in designing the plan. I was in charge of compiling students' learning objectives. Wilson and Steven worked together to identify the types of assessment we considered and the percentage weighting we allocated to each type of assessment we agreed to use to generate students' marks. We then used the planning template and wrote down the information each of us compiled. As we did this, we gave our individual feedback on what each one has contributed and eventually came up with a final draft of our assessment plan. The views and ideas we shared or learned from each other and my exposure to designing an assessment plan have certainly increased my confidence in instructional planning and assessment. (Jineta)

An important finding from this professional development activity was that the teachers liked the idea of working in small groups where they used a common template to design an assessment plan. They worked collaboratively with members of their team to design their assessment plans that they never did in their respective schools. Hence, the practical activity of designing an assessment plan in small groups was an important step towards creating collaborative and social learning contexts. This collaborative process enabled teachers to discuss, share and learn about best or improved assessment practices.

The teachers also acknowledged that an assessment plan they devised assisted them to identify the types and forms of assessment they could use to assess their students' learning. They also recognised that an assessment plan could help teachers allocate instructional time, identify resources for instruction and assessment and consider the types of assessment to assess their students. Jineta summed up nicely the positive impact of the activity on assessment plan. She said that to plan, her group had to reflect on what they had been practising and integrate information about their students, the subject curriculum they teach, the resources available for instruction and other factors. Three of the teachers (Ivan, Ishmael and Wilson) contested that the real test for them would be when they went back to their schools and implemented their assessment plans. For these three teachers, it appeared that the adoption of an instructional and assessment

plan into their classroom practices required a major shift for which they had to prepare well for. All in all, the professional development activity on designing an assessment plan made them feel comfortable about what they ought to teach and assess, as well as gave them a sense of direction, understanding and ownership over the teaching and assessment they planned. Thus, the evidence showed that these teachers recognised that there was value in having an assessment plan; however, a real challenge was to implement the plan.

7.4.2 Workshop Two: Learning by participation in developing a test blueprint

The objective of this workshop was to assist teachers to develop their knowledge and skills in constructing a test blueprint so that they could use it to write questions for an end of unit test or end of semester examination. The workshop began with an overview of objectives of the workshop session and the context and background. This workshop was followed by a presentation on a typical test blueprint, including its importance and purpose in assessment. Samples of test blueprints and year nine examination specifications were used during the presentation to give concrete examples and to elaborate on the concept. The teachers were then put into two groups to design a test blueprint for a unit they selected from the year nine science syllabus (see Table 19).

Table 19 shows the number of items/questions the teachers wanted to include in a unit test, its link to the student learning outcomes in the year nine science syllabus and the levels of knowledge targeted. At the end of the session, a discussion was held to ascertain what the teachers had learned from the activity.

The activity enabled the teachers to explore the elements of a test blueprint and then used the template to help them design a mock test blueprint. The template emphasised and included the following elements:

- (a) the content/topics to be assessed;
- (b) student learning objectives to be assessed;
- (c) types of assessment;
- (d) number of questions and marks allocated to each question, and

(e) the level of learning skills that the questions targeted.

Key findings from teachers' learning experiences of a test blueprint

It was clear from the baseline study that none of the six teachers had used a test blueprint to develop their tests and examinations. This view was formed despite claims made by some of the teachers (Ivan, Ishmael and Amelia) that they had learned about test blueprint during their initial teacher education.

As a result of the professional development activity on a test blueprint, the teachers reported that they learned how to construct it. Commenting on his learning experience, Steven stated that he found the test blueprint useful in determining the possible number of questions that he could construct for an end of unit test. He recalled that when he started teaching the previous year, he did not use any guidelines to decide on the number of items or questions that he should include in a test he designed. Nor were there guidelines, Steven recalled that he could refer to—to help him determine test items that asked students to demonstrate the different level of skills. And so he mainly used test items from the science text books and past test papers he could obtain from the science resource unit. He went on to explain that the questions he included in the unit test then were determined by estimating the time it would take most students to answer the questions.

Steven also stated that the “test blueprint table made visible the connection between the learning objectives (in the syllabus) and the number of questions” he should construct from each objective. Steven, however, pointed out that one of the challenges he still faced even after the activity was writing the actual questions to assess the different levels of learning objectives and skills.

Amelia mentioned that she had learned about how to construct a test blueprint during her initial teacher education and so what she learned from the workshop activity expanded her understanding further. This is what Amelia stated, when she was asked about her views of the blueprint.

It is such a useful table for allocating questions, marks each question is worth and the different knowledge levels that the questions must target – all based on the student learning objectives that teachers are expected to teach in science. (Amelia)

Like Amelia, Jineta reported that the professional development activity on a blueprint brought back memories of some of the things she learned about test blueprints when she was a student teacher and that it was refreshing to revisit those important steps and have them re-emphasised.

Jineta also said that she recognised a test blueprint makes important links between the content, the learning objectives of the science syllabus, and what she actually teaches her students. She admitted that she had previously used test blueprints, but only infrequently in her practice:

I use other procedures, like I just look at the specific student learning objectives from the syllabus, and construct questions, without drawing up a table [blueprint] as we did in the activity. I do follow the procedures I develop myself as I get more experienced in my teaching. (Jineta)

Jineta's comment seemed to imply that as she gained more experience in her teaching, she did not feel the need to follow basic assessment procedures. Jineta indicated that the negative effect of this was that she tended to side-track from sound assessment practices, and was pleased to be reminded and to re-learn how to prepare a test blueprint. Jineta in particular recognised that a test blueprint provides elements of validity for assessment.

Ivan and Wilson indicated that they were confused at times when they calculated the weighting (percent) for each set of objectives, from which they would then determine the actual number of items or questions for the unit test (see Table 18). They stated that it was after several attempts that they understood what they needed to do. They also stated that they struggled with understanding how to allocate the number of items or questions that should focus on the different cognitive skill levels (e.g. knowledge, comprehension and application). However,

with the help of their colleagues and researcher, Ivan and Wilson were able to grasp the concepts and made sense of what was required to prepare a blueprint.

Table 19: A test blueprint for year nine science unit/Unit 3.1 Resources constructed by Steven, Jineta, and Wilson

Unit 3.1 Resources		Content outline				
[†Note: The content outline was extracted from the Solomon Islands year nine science syllabus. Only the student learning objectives that the teachers intended to assess were selected, which indicated that the teachers selected content based on what they valued in the science curriculum.]		Knowledge	Comprehension	Application	Total	Percent
3.1.1 Elements	Name the common elements found in the earth’s crust, oceans and atmosphere	1	0	0	1	5%
	Identify and explain the position of the common earth elements – H, O, Al, Si, Mg, Ca, Na, K, Fe, and C in the periodic table	0	2	0	2	10%
3.1.2 Mineral Resources	Discuss the terms renewable and non-renewable resources as they apply to mineral resources, energy resources and biological resources	0	2	0	2	10%
	Identify common minerals and rocks in Solomon Islands	1	0	0	1	5%
	Describe how minerals and rocks weather	0	1	0	1	5%
3.1.3 Properties of metals	Describe how the use of metals depends on their properties such as malleability, ductility, density, corrosion resistance and conductivity	1	0	2	3	15%
	Explain which metals are more reactive than others with oxygen, water and dilute acids and be able to explain these reactions	0	1	2	3	15%
	Balance chemical equations – simple examples only	0	1	1	2	10%
3.1.4 Energy sources	Explain how the sun’s energy is used in animals and plants	0	1	0	1	5%
	Identify and describe the different sources of energy available in Solomon Islands and how these may be used in the future	1	1	0	2	10%
	Describe renewable sources of energy that could be used in the Solomon Islands	0	1	1	2	10%
Total number of questions		4	10	6	20	100%

The test blueprint in Table 19 illustrated that the teachers have grasped the development of a test blueprint. In terms of content and topic to be assessed, all the four topics in the unit were included in 3.1.1 to 3.1.4 with a reasonable weighting for each topic. Further, the blueprint covered the expected student learning objectives. The test blueprint showed more emphasis in the higher order questions as compared to lower knowledge level questions. This can be taken to show that the teachers were aware of the need to include a variety of questions in a test to enable students to demonstrate a range of skills learned. However, the marks for each question were not indicated. The teachers might not see the need for this because they were expected to develop a marking scheme for a test.

Overall, the teacher participants appreciated and gained personal satisfaction from learning how to construct the test blueprint. They realised that a test blueprint is indeed a useful tool for constructing a test and it would assist them in identifying unit objectives they needed to teach, and the number of questions they need to construct to assess their students' understanding in science. They also realised that a test blueprint is part of sound assessment practice, and said that they were looking forward to applying it to their teaching.

7.4.3 Workshop Three: Learning to use a fixed percentage method approach

The objective of this component of the professional development workshop was to introduce teacher participants to a weighted method that combined students' various scores on the basis of a weighting from a range of items to determine their students' achievement grades at the end of a semester. This method is known as the "fixed-percentage method" approach because the weight percent allocated to each component of assessment is fixed or has been decided in the assessment plan, and the scores students gain are used in the calculation to determine a percentage score (Brookhart & Nitko, 2008). Each calculated composite percentage score of a student can then be translated to the grading scale used by the school to award an achievement grade.

The fixed method approach was introduced to the teachers so that they could adopt an effective grading system that takes into consideration the use of other

types of assessment besides relying on tests and examinations. To calculate a student's composite percentage score, the steps outlined in Table 20 were presented.

Table 20: Steps for calculating a student's composite percentage score

Step 1:	Convert each student's scores on each component entering into the composite score to percentage score
Step 2:	Multiply each component percentage by its corresponding weight.
Step 3:	Add these products together
Step 4:	Divide the sum of the products by the sum of the weights
†Note: The steps are adapted from Brookhart and Nitko (2007).	

The steps described above can be summarised by the formula given:

$$\text{Composite percentage score} = \frac{\sum (\text{weight} \times \text{percentage score})}{\sum (\text{weight})}$$

Where $\sum$ = sum of
Weight = weight percent allocated to a component of assessment

The teacher participants were taught how they could organise their students' achievement records, especially the scores students achieved from the assessments they did, to determine their final grades. The assumption was that if teachers were introduced to a new grading procedure they might recognise the need to adopt a more systematic reporting system. This would also allow them to adopt a more cohesive approach to determining students' grades before the grades were determined and reported to parents, students themselves and other stakeholders who may require such information. Part of this approach involved showing them how to organise and allocate weights against the assessment components teachers might select to determine their students' grades.

Table 21 shows the weights allocated to each component of assessment and their weight percent, as well as the calculated weighted composite percentage score for each student. Note that the weight percent for each component of assessment that

the teacher considered to determine his/her students' grades was decided by the teachers during the planning stage.

Table 21: Examples showing the weighting percentage of components considered for students' grades and composite percentage scores.

Student	Quiz (wt. =10%)	Assignment (wt. =20%)	Project (wt. = 20%)	Exam (wt. =50%)	Weighted composite percentage score
Tere	85	80	70	60	68.5
Tavulani	80	65	80	70	72.0
Talei	70	76	75	65	69.7

Table 22 shows how a student's (Tere) composite percentage score is calculated. It indicates the percentage score that the student attained in each assessment component and the total composite percentage score (of 68.5).

The total weighted composite score for each student was then compared to the grading scale set for the award of letter grades. After the presentation of the workshop theme, the teachers were given an activity so that they could practise calculating the weighted composite percentage score using their students' achievement marks from the previous year. Some of the comments that teachers made regarding this activity are given next.

Table 22: Example showing how Tere's composite percentage score is calculated

Quiz	$85 \times 10\% = 85 \times 0.10 = 8.5$
Assignment	$80 \times 20\% = 80 \times 0.20 = 16.0$
Project	$70 \times 20\% = 70 \times 0.20 = 14.0$
Examination	$60 \times 50\% = 60 \times 0.50 = 30.0$
Total	$8.5 + 16.0 + 14.0 + 30.0 = \mathbf{68.5}$

Key findings from teachers' learning experiences of a fixed method approach

Responses generated from the conversations with the teachers while they were doing the activity and the discussions held at the end of the workshop session

revealed that, overall, they had developed an understanding of the fixed percentage method approach. The teachers generally acknowledged that they needed to consider what proportion or percentage of the different assessment tasks they were supposed to consider and used to assess their students' learning and to determine their students' grades:

I think the steps involved in the approach are straightforward and I strongly agree with the idea of using weighting percentage to determine a student's grades, rather than adding up tests and examinations marks together to find an average and then determine a student's overall grade from the school's grading scale. (Jineta)

Teachers were able to reflect on what they had learned from the activity. Two teachers (Ishmael and Jineta) were generally appreciative of the fixed percentage method because they said that the steps were quite easy to follow and not very different from the steps they used previously, except that in this new approach they had to incorporate the weight percent in the formula. One teacher (Ishmael) captured this when he explained how the activity his group did filled a gap in his knowledge:

I was never aware of the fixed percentage method. I am aware of it now...and the activity has reinforced my understanding hence I feel prepared to use the approach. (Ishmael)

Another teacher, Steven, expressed that as a beginning teacher he was learning about a new way of determining his students' grades. He also recognised and spoke highly of working with the experienced teachers in his group. He said that through their participation in the activity, he and his two colleagues were able to help each other by clarifying the steps to each other so that they could calculate correctly each student's weighted composite percentage score.

Amelia said that the weighting introduced was similar to her school's assessment guidelines. However, she stated that the emphasis and instruction given in the guideline was not clear: it only specified tests and examinations as the only forms of assessment tools to be used to ascertain students' achievement. The activity the

teachers did showed them how they could structure a variety of assessments so that they consider assessing students' conceptual understanding, knowledge, inquiry and science processes. Amelia added that the examples and activity she shared with her two colleagues had extended her understanding about the approach – particularly the steps involving the weight percentage. She said, “I’m glad with myself – for learning more about what I need to do as a teacher and assessor”.

Four out of the six teacher participants (Ishmael, Steven, Wilson and Ivan) expressed that the fixed method approach was totally new to them and that they had struggled with calculating the weighted composite percentage score for each student given in the example. They also expressed that the method would be tedious for teachers especially those who taught large classes. One of the teachers (Amelia) stated that she would not be in a position to adopt the fixed method approach immediately to determine her students' grades because her school already has a grading system and to change this would need the school managements' approval.

Overall, although the fixed method of determining students' achievement grades looked complex at first to the teachers, they felt they were able to grasp the concepts when they used their students' scores as a working example to calculate their students' weighted composite percentage scores. However, the real test for teachers was whether they would be able to apply what they had learned about the fixed percentage approach to determine their students' grades when they returned to their respective schools. From the researcher's evaluation of what the teachers were taught, it was assuring to know (based on the teachers' feedback) that the teachers learned what I hoped they would, although the new approach introduced looked complex to them at first.

7.4.4 Workshop Four: Diagnoses of students' assessment responses

This was the final workshop conducted for the teacher participants and its objective was to help teachers to diagnose misconceptions students hold about the topics they study, including their strengths in an assessment they do. The

workshop also aimed to help teachers use information generated from the students' responses from a test or assessment task to inform their instructional decisions. It was hoped that the teachers would use the assessment information to plan the next steps of teaching to enhance their students' learning. Following the presentations that focused on the theoretical and practical perspective of feedback and the use of assessment data to inform teaching and learning, an activity was organised for the teachers to explore and generate information from a unit test or examination that had students' answers included. The teachers worked in their usual groups to formulate what they could find out about student learning from the evidence in the assessment (e.g. year nine national examination paper that had students' answers). In order for them to use the information to support their teaching and student learning, the teachers had to plan the next action they should take to help students relearn what the assessment had demonstrated they did not fully understand.

A sample of the 2007 year nine national science examination papers with students' answers was obtained from the Solomon Islands National Examination and Standards Unit. These were photocopied and used in this activity. The identities of the students were not revealed. The year nine national science examination paper was made up of two sections: Section A (multiple choice questions), and Section B (structured questions). For the purpose of this activity, only questions from Section B were considered so that the teacher participants could conduct a general item analysis using a set of guidelines and questions that were formulated in consultation with their groups.

Key findings from teachers' learning experiences of a diagnostic function of assessment

The activity using examples of real year nine science examination papers generated a lot of interest and discussion amongst the teachers as usually only selected teachers marked the national examinations that were often held during the month of October each year. The teachers seemed to relate well to the answers students provided in the examination scripts they examined. This was evident in the level of discussion that was going on during the activity about why certain

students might not have answered specific questions, and what they could do to help students in this kind of situation. In their discussions, they even made suggestions on how to teach certain concepts that students found difficult.

Wilson reported that he had examined a student's examination script and identified a set of questions that the student had attempted but found difficult and did not get the questions correct. He shared what he found with his two colleagues in his group and later with the rest of the teachers during group discussion. Wilson examined a question with three parts. This question, on a metal and acid reaction, required the student refer first to a provided periodic table to select a metal that would react with an acid (in this case, HCl). The second part of the question asked the student to identify the products that would form from the reaction. The third part of the question asked the student to write down a balanced chemical equation for the reaction. Wilson reported that while the student was able to identify a metal from the periodic table and the expected product of the reaction, he was unable to write the correct balanced chemical equation for the chemical reaction. From the analysis of the student's answers, Wilson commented as follows:

This student must have found the concepts of chemical reaction difficult and could not balance the chemical equation. I wonder why! (Wilson)

Wilson shared his findings with members of his group. He stated that the problem he identified with the student may be widespread, given that many of his own students also found the concept of balancing chemical equations extremely difficult. The group discussed other related concepts that students would need to know to be able to balance a simple chemical equation, and identified a number of them, including: chemical symbols, counting of atoms in each compound, coefficients, and subscripts, writing formulae of compounds, valences, and labelling the reactants and products of a chemical equation. Jineta, who was in Wilson's group, stated that the activity really made her group think deeply about the answers students wrote in the examination paper:

It really made us feel conscious of the difficulties that some of our students experience in their learning, and what appeared to be an activity that we

felt we should do, but which we do not have the time to look through and to identify the sort of answers that students provide. (Jineta)

By doing the activity, the teacher participants became more conscious of students' learning difficulties as a result of item analysis. They were able to diagnose that each student was struggling with balancing of equations and suggested several solutions that students could be helped with to get the balancing equation correct.

Steven shared what he discovered from a student's script he examined. It was a question that related to the topic on local environmental concerns. The particular item in the examination paper asked the student to describe the sequence of processes that might result from a logging company that was operating near a river where a rural community collected water from for drinking and cooking. Steven said that one of the problems he identified in the student's response was the comprehension level of the student and that he thought it was not up to standard:

The student did not organise the points he was supposed to argue on and even the level of his written English was not up to standard. I could not make much sense of what the student wrote. (Steven)

During the group discussion, the teachers talked about in length how the student seemed to be unable to organise his ideas on paper. The student seemed to find it difficult to learn science using English as a medium of instruction for learning science. Amelia analysed the answers that a student provided in relation to a question on properties of light and discussed her findings with her two colleagues. She said that the question asked students to identify the location where an image of an object would be likely to form. A diagram showing the position of the object and a mirror and a ray of light passing through the object to the mirror and out was provided. The student was required to draw other rays of light to identify the position of the image from the object. According to Amelia, the student whose script she examined drew several lines to show the pathway of rays of light, but somehow positioned the image incorrectly. She shared her findings with her colleagues in her group and they identified some of the misconceptions students

reveal when studying the properties of light. During the discussion that followed, Ivan pointed out that quite often he focused his attention on “ticking” what his students got correct on the test so that he could compile their scores and use them to decide grades. Ivan stated that he rarely analysed his students’ answers to the questions that they got incorrect. It appeared that Ivan did not have the time to analyse every students’ responses from the test he gave, or he did not realise the importance of it. So when he compared his practice to what he and his group did or achieved during the activity, he was overwhelmed with the richness of information he and his group were able to extract from the students’ scripts. He considered how teachers might be able to assist students if only they took time to identify their learning difficulties through the responses students provide in their assessment tasks. Ivan said:

Through this activity, I was able to analyse the answers a student provided and identify the concepts the student understood well or not. When I identified the questions that the student was struggling with, I thought about what I could do to assist my students to answer the questions correctly.
(Ivan)

All the teachers appreciated the fact the activity helped them to consider carefully the answers the student provided in the examination script they analysed and gave each one of them some insight into the type of questions that students find difficult as well as questions they find easy.

Overall, the activity showcased to teachers the importance of diagnosing students’ responses in the assessments with the intent to inform their instructional decisions. The message that was put across to the teachers through this activity was that it was important to give ticks (✓) and crosses (×) to identify which questions students got correct or wrong. However, equally important was the need for teachers to find out students’ weaknesses and strengths through the answers they provided in the tests they took. Teachers found value in assessing not their own but authentic examination papers that meant there was less anxiety about the students’ answers. Table 23 summarises the teachers’ views of how the information generated from examination scripts could be used.

Table 23: Teachers' general views of how data/information generated from examination scripts could be used.

a)	How well do the items/or questions link with the specific student learning objectives in the syllabus? • There is a link between the student learning objectives and the items or questions included in the examination paper • A few items/questions were more specific to a particular context (e.g. rural or urban) that could disadvantage students
b)	Which items/questions do the students answer easily or find difficult to answer? Teachers reported that they identified the items/questions that students' found easy or difficult. • Students' performance varied considerably. Students found some questions easy and difficult. ▪ The topics on electricity and balancing of equations seemed difficult for most students. ▪ Four of the teachers felt the abstract nature of the tasks for both electricity and balancing of chemical equations was problematic for students. For example, it is more concrete for students to find an element in the periodic table than to write a chemical balance. The teachers stated that students learn more about electricity by doing the experiments than by completing worksheets.
c)	Which learning level (knowledge, comprehension, and application) does each item/question assess? Teachers expressed different opinions regarding whether the questions exhibited a variety of learning levels. • Three teachers thought that the year nine examination paper was balanced, meaning that the questions focused on the key year nine syllabus and student learning outcomes and measured different levels of learning. That is, there was a balance in the distribution of items/questions including knowledge, comprehension and application skills. Three other teachers felt that there were far too many questions/items that focused on knowledge and comprehension and fewer items/questions on application.
d)	Discuss in your group, how you should use the data generated from the examination script you examined. Here are other ways teachers suggested they would use the data/or information from the tests or examinations: • Use student data/information to identify and design extra exercises for students, especially on those topics identified as difficult. • Look for teaching materials or consult other teachers (if they were willing to share their ideas) to assist them with strategies to teach the difficult topics. • Use summative data/information to improve quality of test or examination items for use in the future. • Suggest to the school principal or head of science department ways in which the department or school could use students' achievement data compiled in previous years to inform teaching and subject programmes to improve students' achievement.

All in all, the workshops that focused on the four specific areas of assessment outlined above provided teachers with the opportunity to learn through hands-on activities that increased their knowledge and skills in those areas of assessment. Most importantly, the professional development offered the teacher participants time to learn new ideas about summative assessment with their colleagues from other schools. Their professional learning experiences indicated that the teachers had the opportunity to update their assessment knowledge and to rethink ways to improve their summative assessments. For example, the discussions with teachers at the end of the workshop indicated that their views of what they learned could be put into practice. This is discussed in the next session.

7.4.4 Teachers' views of putting into practice what was learned

Discussions were held around what teachers had learned so as to make them think aloud with newly gained assessment knowledge. Teachers' views about what they thought they had learned and would take away from the workshops was organised into four strategies (see Table 24). They identified assessment ideas and procedures that they could; (a) apply immediately after the workshop, (b) apply before and after they have given the first unit test, (c) apply during the reporting period, and (d) share with their colleagues and principals to gain their opinions about the possibility of adapting some of the assessment procedures in their respective schools.

As shown in table 24, teachers indicated aspects of assessment ideas and procedures they would apply to their classroom practice when they returned to their schools. Their immediate action was to construct an assessment plan because they said that they were convinced that planning is an integral component of the teaching and learning process. Two out of the six teachers suggested that they would first share some of the ideas about assessment with their colleagues and make an appointment with their principals to report on the outcomes of the workshop. It was pleasing to note that the teacher participants were already thinking ahead about implementation of the assessment plans and strategies before they returned to their respective schools.

Table 24: Initial indications of how teachers reported implementation of plans assessment procedures within their classrooms

Action	Assessment Ideas and Procedures
Immediately	• Design assessment plan • Reduce learning objectives to specific learning outcomes • Inform students about learning outcomes • Discuss outcome of workshop with colleagues and principal
Before/after first unit test	• Construct a test blueprint • Prepare marking scheme/criteria • Conduct item analysis to find out students' weaknesses and strengths • Provide timely feedback to students
During reporting period	• Determine student grade using the fixed percentage method • Report students' achievements
Share with colleagues and principal	• Students' composite percentage scores • Assessment plan • Suggest how student achievement data in the school could be used to inform teaching and learning.

In summary, the findings strongly indicated that the teacher participants had gained knowledge on the assessment topics covered during the professional development workshops. Hence, it was comforting to note that the teachers had shown signs they had learned what I had hoped they would learn about summative assessment from the workshops. For example, the teachers indicated that the sessions on planning for assessment and test blueprint reinforced what they already knew about these and they were pleased to have been taught again these topics as it gave them the opportunity to learn them in more detail that had expanded their understanding about these aspects of assessment. However, a few of the teachers indicated that they would need to review their overall teaching programme and prioritise what they needed to include in their overall teaching plan, which also included assessment.

There was overall satisfaction amongst the teachers that they were introduced to instructional planning and assessment and had learned them during their initial teacher education. However, as they progressed in their teaching career, they somehow felt that they could deliver lessons without a lesson plan or an assessment plan. So they appreciated the importance of planning for assessment as

well as to practice it with their colleagues during the professional development workshop.

In regards to the professional development sessions on a fixed percentage approach, there were indications that more than half of the teachers (Ivan, Ishmael, Steven, Wilson and Amelia) found it to be too complex. For these teachers (it was claimed), this was the first time they had been introduced to the fixed percentage approach. Nevertheless and as reported earlier (see Section 7.4.3), all teachers generally appreciated the fact that they had been introduced to the fixed percentage approach and that they regarded this as an alternative tool for determining grades. They said it was much fairer compared to the method they used in their schools. However, they indicated that it would take them time to fully understand and apply it in their assessment practices. Based on the sentiments expressed, I had concern that the teachers may not be comfortable with applying the fixed percentage method to determine their students' final grades when they returned to their respective schools.

Finally, there was evidence to suggest that the teachers had learned the techniques to diagnose misconceptions students held including their weaknesses and strengths about the topics they studied using a unit test or examination. The teachers expressed that the knowledge and experience gained during the workshop would enable them to identify the difficulties students face in answering the questions correctly. The challenge for teachers as expressed by Jineta and Ishmael was whether or not they would have the time to analyse their students' responses from each unit test or end of year examinations considering the large student number in their classes. The teachers had earlier indicated teaching large classes that ranged from 40 to 50 students (see Chapter 5/Section 5.5.1). It was expected that the teacher participants would be able to apply assessment knowledge gained, and use assessment information to inform their instructional decisions based on what they learned from the workshops. The next section describes aspects of assessment procedures teachers implemented in their classrooms.

7.5 Connecting Professional Development Learning Experiences to Classroom

This section presents findings relating to the evaluation of the implementation of the teacher professional development to their classroom practices. It focuses on the extent that the teachers applied new assessment ideas and procedures they learned from the professional development workshop to their teaching, and how these experiences changed their summative assessment practices. The findings discussed in this section are related to the research question (2) (b): *What new assessment strategies did the teachers implement when they went back to class?*

The findings are presented in two parts. The first part (section 7.5.1) focuses on findings from follow-up school visits that took place three weeks after the four-day workshop was conducted, during the first week of April 2008. The teachers were visited at their respective schools to find out how they were progressing with their assessment plans and so additional support could be provided where necessary. The second part (section 7.5.2) reports on factors that influenced their decisions to adopt aspects of the new assessment procedures.

7.5.1 School visits: Meeting with individual teachers

The first school visit to the teachers was organised in April 2008, three weeks after the professional development workshop was conducted. The aim of the school visit was to provide on-site support to the teachers after the professional development workshop, to encourage them in the changes they wanted to build into their classroom practices and to see what summative assessment strategies were being used. It was important to meet and talk to individual teachers in order to find out what aspects of the new assessment procedures they were thinking of applying or had begun implementing in the classroom. One-on-one discussions followed on the issues individual teachers came up with and suggestions were made to provide direction. Data on the school visits were gathered through the one-on-one discussion with individual teachers and the examination of assessment-related documents the teachers had developed and used.

Results of the school visits indicated that there was noticeable variation in the way teachers had been thinking about what they needed to do or what they did soon after they returned to their schools after participating in the professional development workshop. Most teachers had initiated early changes, each at his/her own pace. Some teachers had consolidated the assessment plans that they began devising at the professional development workshop, while others were still coming to grips with how they could apply what they had learned to their classes.

Early change in teachers' summative assessment practices

The teachers stated that on return to their respective schools after the professional development, they thought about and strategised how they would implement some of the new assessment ideas in their classrooms. However, they realised that making changes to their existing practice was not a straightforward process, as Ishmael found out:

I knew what I wanted to do when I resumed class after the workshop, but deciding where to start was not easy. I'm so used to my usual classroom routines that I struggled with the changes I should adopt. However, I started by re-examining my teaching plan in order to incorporate a unit assessment plan. (Ishmael)

Ishmael was not alone in experiencing some degree of uncertainty regarding where to start. The rest of the teachers expressed similar experiences. One of the first tasks that the teachers reported doing when they returned to their classes was to consolidate and finalise their assessment plans that they had begun during the workshop.

Of the six teachers, four teachers (Amelia, Jineta, Ivan, and Wilson) stated that they prepared both a year plan and an assessment plan for the unit they were teaching, and two teachers (Steven and Ishmael) produced a unit assessment plan. These two teachers said that they wanted to focus on a unit assessment plan because it was their immediate priority. Four of the teachers described in some detail the process they went through in developing both their yearly planner and

separate unit assessment plans after the professional development workshop. This was confirmed by Ivan:

The first thing I did after the workshop was to review my overall teaching programme. I then developed my year plan before I prepared an assessment plan for the unit that I started teaching before I attended the workshop. I had to write up a proper assessment plan as I did not have such a plan when I began teaching the unit at the beginning of the term. (Ivan)

Ivan also mentioned that one of his main concerns at the time he was reviewing his teaching programme was how best to fit the unit assessment plan into his existing teaching programme. At one point Ivan thought he had too many plans to deal with. However, he said that he sorted out this issue by recognising that each plan he developed had a specific purpose and therefore he adopted an integrated teaching and assessment plan.

Ivan also mentioned that he had shared some of the assessment ideas he learned from the professional development workshop with his colleagues during a staff meeting at his school and indicated to them that he would organise a workshop so that he could share what he had learned with his colleagues.

Another teacher (Amelia) stated that the assessment plan gave her a sense of direction; she felt more focused on what to do as she was able to prioritise the tasks and activities that she needed to do before she started teaching a unit as well as before she developed the assessment tasks she wanted to use. Amelia also stated that she had briefed the head of science department in her school about the outcome of the professional development workshop, and had also made a short presentation to give some ideas about the workshop she attended to her colleagues during a science department meeting. Steven prepared a hand-written unit scheme of work with assessment statements that was laid out on a double page lined book - see Figure 3.

Figure 3: Steven's unit scheme of work showing his teaching and assessment activities

Units/weeks	Time/hr	Objectives	Activity	Assessment	Results	Comments
Week 1	1hr	Teacher student the basic structure of the Solar system and its place in the universe	Ask the student to make their own model of the Solar system	Students to make the role play of the model of the Solar system's model as part of their presentation.	Very good	The activity is properly done.
3.1.1	1hr	Explain the Earth's composition				
	1hr	Explain the position of the common elements in the Earth's crust that can be found in the periodic table.				
	1hr	Explain the reactivity of metals.				
	1hr	Explain the groups and period and how the structures relate the periodic table.				
	1hr	Know the relative importance of the elements to human/living organism				
Friday week 1						
Week 2	1hr	Recap on the week one's				

by
for
14/5/2009

Head of science department's signature indicating approval of Steven's unit scheme of work.

Surprise Quiz

70% of the student had done it well.

A very positive reaction.

The unit scheme of work Steven developed provided details of the unit objectives and instructional and assessment activities. He also wrote down in his unit scheme of work the overall percentage weighting for the components of assessment he had decided to use to determine his students' semester one grades. He stated that he prepared his unit scheme of work a week in advance, in accordance with his school's staff monitoring system that required all staff to prepare their unit schemes to be checked and signed by the head of the science department. However, Steven did not develop a detailed assessment plan, which was what he was expected to do.

The scheme of work was very generic and at best provided just an overview of the science learning outcomes that he planned to teach and needed to be able to make a judgement about. The assessment activities lacked detailed information of assessment tasks. Steven needed to draw up a proper assessment plan and to follow it to guide his assessment practices. Perhaps with more practice and ongoing support, Steven is likely to create and implement an effectively assessment plan. This analysis of Steven's plan demonstrates that one of the keys in professional development is that teachers will not necessarily be able to

implement in the first iteration of new practice. Jineta also adopted an assessment plan framework she learned from the professional development. An important addition to her assessment plan was prior knowledge of the topics she was going to teach through diagnostic testing (see Figure 4). She also indicated specific assessment tasks (e.g. quiz, homework and a unit test) that she wanted to use formatively so that she could identify what students understand.

Figure 4: Jineta's unit assessment plan

Unit/Topic	Time allocation	Student learning outcomes
3.1.1 Origins of elements	Week 1	Name the components of the solar system and state their correct order from the sun Describe the structure of the universe' Correctly identify and label the structure of the earth Describe the composition of the earth's interior regions
	Week 2	Explain the occurrence of elements in relation to their reactivity List the first 20 elements and explain their position in the periodic table State the relative importance of the elements to humans and other living organisms
3.1.2 Mineral resources	Week 3	Define the terms renewable and non-renewable resources Classify resources (mineral, energy and biological resources) as renewable or non-renewable Name common minerals and rocks of the Solomon Islands Explain how rocks and minerals weather
3.1.3 Properties of metals	Week 4	Explain the properties and uses of metals (e.g. malleability, ductility, density, corrosion resistance and conductivity) Compare metals reactivity with oxygen, water and dilute acids and explain their reactions Balance chemical equations – simple examples only Explain corrosion such as the rusting of iron Develop opinion about the process and value of recycling metals
Forms of Assessment		
<i>Diagnostic assessment</i>		Conduct diagnostic tests: *T3.1.1 Quiz 1, T3.1.2 Quiz 2, T3.1.3 Quiz 3
<i>Formative assessment</i>		Quiz, class activities, homework, assignment, topic test
<i>Summative assessment</i>		Research project – solar system, Unit test
Weightings		Summative assessments: Project/assignments 20%, Unit test 30%, End of semester exam 50%
Notes		Inform students of assessment dates Prepare/finalise assessment tasks in advance Analyse student answers
*T3.1.1 – T3.1.3 refer to topic objectives		

Here Jineta demonstrated she had grasped the essentials of an assessment plan, which were that it detail the learning outcomes she would teach to as well as the purposes and forms of assessment she would use to assess her students. Jineta explained what she thought of her assessment plan and what she had experienced so far when she began implementing the plan. She said:

I rarely used a written assessment plan in the past years but I am beginning to experience its advantages. For example, now I am more organised in terms of setting my teaching targets regarding what I want my students to learn and how I should assess them to find out what they know. I have

developed specific learning outcomes from the syllabus, and these are the focus of my teaching and which I will base my assessment on to find out if my students have attained the outcomes at the end of the unit. (Jineta)

Jineta also reported that the changes she incorporated into her assessment plan were both challenging and exciting. It was challenging she said because she had to compromise her beliefs about her usual planning practices that did not include a written unit assessment plan. It was exciting because she was keen to explore how the assessment plan would improve the way she organised her assessment activities and help her to stay on track while she performed her other teaching roles and extracurricular responsibilities.

Steven and Jineta were teaching two separate streams of year nine science classes at the same school. At the time of the school visit, Steven mentioned that he and Jineta were working together and passing on their experiences to the principal. Both had had a briefing with their principal and informed him about the outcomes of the professional development workshop. They also discussed how they organised their assessment activities as a result of what they learned from the workshop.

It was noted that the two teachers' professional development experiences were slowly making an impact on how they organised their assessment activities, as they realised the need to work together and to build a strong collegial relationship between them and their colleagues and the school principal. It can be seen from these results that time and mentoring are required to help teachers make changes over time.

General queries from teachers

Apart from the general discussions held with the teachers on how far they implemented their assessment plans and strategies, teachers also sought further advice and assistance on some of the assessment ideas covered during the workshop. For example, two teachers (Amelia and Ivan) sought further help on how to construct a test blueprint, and another two teachers (Ishmael and Wilson)

sought clarification on the fixed method approach for calculating student grade. Ivan, who had made an attempt in practising designing a test blueprint, showed the partially completed test blueprint. He said that at the workshop a group effort had constructed a test blueprint, and so he wanted to practise by doing it by himself. He particularly wanted assurance on whether the number of test items or questions he had indicated covered a balance of the learning levels specified by the unit objectives. Ivan certainly required assistance to find the right balance and distribute items so they covered each learning level (knowledge, comprehension and application) adequately. Ivan pointed out that the unit he was teaching consisted mainly of learning objective statements that demanded students to demonstrate “knowledge and understanding” and this was one of the reasons he said he wanted to construct questions on these levels of learning. We came to an agreement that most of the student objectives for the unit he was teaching and for which he had constructed a test blueprint emphasised recall of facts, and I suggested that he needed to include a number of questions that would allow students to demonstrate higher order cognitive skills.

Ishmael and Wilson wanted further clarification on the fixed method approach for calculating student grades. They wanted to know how to factor the weighting percent in the formula to calculate an individual student’s composite percentage score. Wilson in particular mentioned that he and his colleague (a teacher who was not part of this study) at the school had practised using his students’ raw scores from the past year in order to familiarise themselves with the method.

The teachers were generally appreciative of the on-site assistance they received from the researcher. They said that they had a chance to clarify some of the doubts they had about what they learned from the professional development workshop. It deepened their understanding about aspects of the assessment procedures they were not too sure about.

Visiting the six teachers in their schools three weeks after the professional develop workshop confirmed that most of the teachers had finalised their assessment plans and started to implement them. Overall, the teachers had devised

a year plan and a unit assessment plan. Each of these plans had a specific purpose; the year plan provided a work schedule for the year nine grade and divided the number of units into the number of teaching months allocated. The assessment plan provided an assessment framework for a unit that was aligned with the year nine plan and specific learning outcomes for that unit. However, it became clear that most of the teachers were unable to apply the fixed percentage method simply because it was complicated and that their respective schools have their own grading system. The teachers did not ask any questions on diagnoses of student learning – an activity that they might be able to do once they had given a test to their students. The next section presents findings on how the teachers applied their newly acquired knowledge to their teaching.

7.5.2 Post professional development summative assessment practices

This section presents findings from the second and final visit made to the teachers in August/September 2008. The visit took place four months after the first school visit was made. The aim of the visit was to find out the extent to which the teachers had applied what was learned from the professional development workshop. Data for this segment of the study was obtained through semi-structured interviews, samples of assessment the teachers used and student achievement records. Three themes that related to the data of the teachers' post-professional development summative assessment practice emerged. These are: (a) impact of assessment plan on teachers' assessment practices; (b) assessment procedures and strategies teachers' adopted; and (c) teachers' post professional development perceptions of summative assessment. The context that the teachers implemented regarding the new summative assessments strategies introduced to them is discussed next to highlight the factors that constrained and supported the professional development intervention.

Impact of assessment plan on teachers' assessment practices

Teachers reported that they had gained knowledge and skills to plan an assessment and had implemented their plans at the time of the second visit. A variety of ways in which the assessment plan helped them in their teaching are presented in Table 25). Excerpts from the teachers' reflections on how the

assessment plans had affected their post professional development summative assessment practices are presented as indicators of teacher development in assessment.

Clarified the purpose for assessing students

The teachers recalled that prior to the professional development workshop they had rarely stated in writing the purpose for assessing their students and so it was a new experience for them, as three teachers' comments reflected.

Table 25: Teachers' views of how the assessment plan impacted on the their post professional development instructional and assessment practices

• Clarified their purpose for assessing their students;
• Provided a sense of direction of what they needed to do to assess and report their students' achievement;
• Identified specific student learning outcomes pertaining to the units they taught and assessed;
• Notified students about intended learning outcomes;
• Increased their confidence in carrying out and managing their assessment activities compared to in the previous year;
• Increased focus on assessment-related activities.

One teacher (Ishmael) said that he had not thought much about the bigger purpose for assessing his students prior to professional development because he saw it as part of a classroom routine that he usually did at the end of a unit. However, Ishmael stated that when he designed his assessment plan and the strategies he chose to use to assess his students it helped him to set clear goals for his students regarding how he should measure their progress and achievement, plan lesson and communicate results.

Similarly, Amelia stated that she had always been aware of the important function of tests and examinations in the education system, but having a proper plan of what to assess and how to assess what students might have learned as outlined in her assessment plan made a lot of difference in the way she usually thought about the purpose of assessment. Jineta said that she found the assessment plan useful

because it complemented her teaching programme by making clear what she was supposed to teach, or what units she needed to assess and the assessment tools and techniques she would need to use to assess her students.

Assessment plan provided a sense of direction

Some teachers indicated that the assessment plan they designed and implemented provided direction and guidance on the type (e.g. test or assignment), format (multiple choice or short answer questions etc.) and purpose (formative or summative) of each assessment task they used. As one teacher (Steven) mentioned, “The assessment plan helped me to develop the strategies I would need to use to develop, administer, mark and report data related to what my students’ have learned”.

Another teacher (Amelia) remarked that she felt much better prepared when it came to developing assessment tasks because she had thought about and listed the strategies she would need to follow, compared to when she did not have such a plan. Another teacher (Ishmael) pointed out that he had never designed an assessment plan previously and so the shift from no plan to having one had enabled him to select an assessment from a variety of formats to assess his students. Teachers also mentioned how useful they found the student learning outcomes they derived from the teaching objectives (from the syllabus), when they incorporated them into their assessment plans, though some teachers found this quite challenging.

Identified unit learning objectives/outcomes

Some teachers reported that they had gained knowledge and experience in writing specific learning outcomes from the key teaching objectives outlined in the year nine science syllabuses. Their comments showed that they had come to understand and realise the importance of making learning more student-centred. This was important because the learning outcomes enabled them to identify relevant skills they expected students to learn. By developing specific learning outcomes for a unit using teaching objectives from the syllabus, teachers were able to determine what their students needed to learn, understand and

demonstrate. When teachers translated or rephrased the teaching objectives, using their own words, it gave them a better understanding of the intended goals of the syllabus. This is evident in the key learning outcomes they identified for a unit in their assessment plans. They reported that this had enabled them to focus their teaching on those learning outcomes as well as emphasising them when they developed questions for the assessment tasks they set for their students. Teachers stated that translating the teaching objectives from the syllabus into intended student learning outcomes helped them to decide the kind of activities they needed to prepare to achieve the outcomes of the units they taught. As Jineta commented:

My daily lessons focused on the learning outcomes I developed. I focused on these learning outcomes to prepare questions that I included in the homework and assignments that I set for my students. When I was ready to give a test to my students, I knew which learning outcomes I would consider and constructed questions from these. (Jineta)

A few of the teachers mentioned that they did not intend to use all the teaching objectives and translate them into specific learning outcomes as most are already specific enough. However, they stated that they had to rephrase the teaching objectives that had verbs such as “know” and “understand” and redefine them in terms of more specific measureable outcomes. The teachers noted that the year nine science syllabus used terms such as “know” and “understand” to describe the teaching objectives. They felt that it was necessary to replace such terms with more measureable outcomes in order to design both instructional and assessment activities that are student-centred and to achieve the learning targets. While the teachers expressed an overall satisfaction in their ability to develop clear learning targets for their students, they also emphasised that developing learning outcomes in ways that promote important cognitive attributes and selecting appropriate methods to assess specific learning outcomes was challenging.

Informing students about intended learning outcomes

It seemed clear that teachers were aware that one of the fundamental aspects of teaching and assessment is to establish a clear understanding of the learning goals for their students. This understanding was evident in the reflections of the teachers

when they talked about the importance of communicating learning targets to students. Two teachers (Wilson and Ivan) in particular mentioned that they paid attention to informing their students about the intended learning outcomes of the topics they taught in each lesson as a direct consequence of the assessment plan. The two teachers mentioned that the list of the intended learning outcomes they prepared for each unit had an impact on the way they began their lessons. Not only did the intended learning outcomes remind them that these were their targets of their teaching, they also helped them to inform their students in each lesson.

Both teachers recalled that the approach they adopted at the beginning of the lesson prior to the professional development was different from how they introduced their lesson after attending the professional development workshop. Prior to this professional development, they would normally mention the topics they were going to teach to their students, and then deliver their lessons through class activities. Wilson stated that he now made sure that he began his lessons by introducing the specific learning outcomes of the topic he was teaching to his students. Similarly, Ivan argued that students are likely to perform better in science if the expected outcome is clearly communicated to them. Ivan said that he now wrote down the learning outcomes on the board or read them aloud when he began each lesson to reinforce the learning targets for his students. Both teachers reiterated the point that it was important to inform students what they should learn because in order for them to do well in science they needed to know what they have to learn or do to achieve high grades.

Increased teacher confidence in carrying out assessment

One of the impacts of the assessment plan on teachers was that it increased their level of satisfaction regarding how they carried out, organised, and managed their assessment activities and responsibilities. For example, the teachers said that they felt better prepared because they had identified in their plans what to assess and which tools and techniques they should use to do so. Satisfaction over an assessment plan also contributed to how the teachers prioritised their instructional and assessment activities. Amelia and Jineta stated that they managed their instructional and assessment activities reasonably well because they planned what

they set out to achieve compared to the past year when they did not have an assessment plan.

Increased focus on assessment-related activities

One of the positive effects of the assessment plan on the teachers' post professional development summative assessment practices was that it generally increased their focus and awareness of the need to plan for assessment. In her reflection on her experience of assessment during the post professional development assessment period, Amelia said that the assessment plan generally increased her awareness not only of the purpose of assessment, but of how best she could capture students' learning that occurred and used the data in ways beneficial to both her students and to her teaching. She tried to capture evidence of her students' learning not only through formal tests that she graded, but through other work that she set for her students such as homework and extended assignments. The other teachers seemed to increase their focus on assessment-related activities for other reasons. For example, Steven mentioned the need to prepare his students for national examinations. Hence, his reason for deepening his focus on assessment-related activities tended to be more to do with preparing students for the examinations. "I am more conscious of assessments because the students I teach need to be prepared well before they sit the examinations" (Steven).

There were only few to moderate changes in the way teachers responded to or implemented their assessment plans and the impact this had on their practices. Nevertheless, the changes that some of the teachers described indicated beneficial effects of planning for the assessment process which the teachers themselves applied when they went back to class after the professional development workshop.

7.5.3 Assessment procedures adopted during post-professional development period

Analysis of the teachers' interview responses and documents used (e.g. assessment/lesson plans achievement records) showed that they prepared and

reviewed their plans as they progressed, and then implemented them. Teachers indicated that they had expanded their knowledge about planning, constructing and administering assessments. Half of the teachers who participated in the study adopted new assessment strategies and techniques in addition to the usual end of unit tests and semester one examinations they administered to their students to determine end of semester one grades in the year nine science course (see Table 26).

Table 26: A comparison of types of assessment the six teachers used to assess their students during pre-professional development and post-professional development period

Name of teacher	Types of assessments adopted during pre-professional development period (2007)	Types of assessment adopted during post-professional development period (2008)
	Unit test	Unit tests
	Quiz	Quiz
Steven	Laboratory	Seminar/presentation
	Practical	Practical
	End of year examination	End of term examination
	Topic test	Topic test
Ivan	Unit test	Unit test
	End of year examination	Written Assignment
	Attendance	End of term examination
	Unit test	Unit tests
	Written Assignment	Written Assignment
Amelia	Laboratory/practical	Laboratory reports
	End of year examination	End of term examination
	Unit test	Unit test
Ishmael	Examination	Written assignment
	End of year examination	End of term examination
	Unit test	Unit test
Jineta	Assignment	Written Assignment
	End of term examination	End of term examination
Wilson	Topic test	Topic test
	Unit test	Unit test
	End of year examination	End of term examination
	Attendance	

One teacher (Steven) reported that he had organised a project for his students that they did in small groups followed by a presentation, as part of summative assessment. Two teachers (Amelia and Ishmael) administered extended written assessments. Ishmael mentioned that, unlike in the past, when he had used only unit tests and end of term examinations to determine his students' final term

grades, he had decided to use written assessments, including an essay. The written assignment required students to research in their school library and to write a three-page report on an environment topic related to the unit they were studying. Ishmael stated that he had prepared marking criteria and he went through these with his students before they started the assignment. Asked why he decided to vary the assessment formats he used, Ishmael said he wanted to explore how effective the assessment tool was in demonstrating students' writing and communication skills and their ability to organise information.

Examination of student achievement records kept by the teachers indicated that Amelia and Steven had used the highest number of laboratory or practical investigations for grading purposes. In the first semester, Amelia had assigned ten practical investigations while Steven had organised five. The rest of the teachers (Jineta, Ivan, and Wilson) did not use any new type of assessment that implied that they were satisfied with the types of assessments (mainly quiz, unit/topic tests and end of semester examination) they had used in the previous year and maintained them in the post professional development period.

Another notable feature of the teachers' post-professional development summative assessment practice was that three of the teachers adopted the weighting of the assessment components to determine their students' final grades. This was evident from the students' achievement records that the teachers kept. However, three teachers reported that they did not apply the weighting percent in the formula (fixed percentage method) to calculate individual students' weighted composite percentage scores. Instead they resorted to the old approach of calculating individual student aggregate scores before converting them into percentage scores. They did not apply the new approach because the school would need to endorse it before they could adopt it in their practice.

Table 27 and 28 show the major assessment procedures and strategies that the teachers applied in the classrooms before and after receiving professional development.

Table 27: Indications of assessment procedures teacher applied during pre-professional development period

Pre-professional development summative assessment practices	Teachers					
	Steven	Ivan	Amelia	Ishmael	Jineta	Wilson
Designed a written assessment plan	No	No	No	No	No	No
Constructed test blueprints to write questions	No	No	No	No	No	No
Calculated aggregated score to determine student grade	Yes	Yes	Yes	Yes	Yes	Yes
Use fixed percentage method to determine student grade	No	No	No	No	No	No
Prepared an answer sheet to mark tests and examinations	Sometime	Sometime	Sometime	Sometime	Sometime	Sometime
Prepared answers and marking scheme	No	No	No	No	No	No
Used assessment as a diagnostic tool (i.e. students answers) to identify students' strengths and weaknesses	No	No	No	No	No	No

Table 28: Indication of assessment procedures applied during post-professional development period

Post-professional development summative assessment practices	Teachers					
	Steven	Ivan	Amelia	Ishmael	Jineta	Wilson
Constructed assessment plan	Yes	Yes	Yes	Yes	Yes	Yes
Constructed test blueprints to write questions	Yes	Yes	Yes	Yes	Yes	Yes
Calculated aggregated score to determine student grade	Yes	Yes	Yes	Yes	Yes	Yes
Use fixed percentage method to determine student grade	No	No	No	No	No	No
Prepared answer sheet to mark tests and examinations	Yes	Yes	Yes	Yes	Yes	Yes
Prepared answers and marking scheme	Yes	Yes	Yes	Yes	Yes	Yes
Used assessment as a diagnostic tool (i.e. students answers) to identify students' strengths and weaknesses	No	No	Yes	No	Yes	No

†Note: Teachers were asked to indicate whether they applied the constructs in their practice and to show samples of their work during the interview.

According to the overall evidence presented, teachers indicated that their assessment practice had undergone some modification after receiving professional development. For example, Table 28 shows that all the teachers designed a unit assessment plan, constructed a test blueprint to write questions for their tests and used model answers to mark their students' work. However, not every teacher adopted the rest of the assessment procedures. None of the teachers made an attempt to apply the fixed method to calculate their students' composite score before assigning grades but instead resorted to the traditional approach of calculating averages to determine grades. All teachers commented that, unlike in the previous year, they now prepared their answer sheets with a marking scheme that provided detailed criteria to evaluate students' answers and allocated the possible marks awarded for each correct answer.

Teacher reports and exemplars showed that the teachers adopted a variety of the assessment procedures after the professional development workshop. This showed that they valued what they learned and believed that they are useful in improving their assessment practices. For example, the six teachers constructed assessment plans for the unit they were teaching during the time this study was conducted. However, the specificity of assessment plans varied - Steven's scheme of work (Figure 3) and Jineta's assessment plan (Figure 4).

Three teachers (Jineta, Steven and Amelia) indicated that they diagnosed at least their students' responses from one of the tests they administered to identify their students' weaknesses and strengths and to identify the questions that their students found easy or difficult. The teachers reported that although they knew that item analysis was a time-consuming activity, they conducted the analysis while marking their students' unit test scripts. Of the three teachers who reported diagnosing their students' responses, only one teacher (Jineta) provided evidence of an item analysis she carried out on her students' performance (see Figure 5).

Figure 5 is an extract of item analysis Jineta conducted to find out her students' strengths and weaknesses. This analysis was beneficial and useful for two reasons. First, it allowed her to gauge the difficulty level of each question in the test and topic in the unit. For example, only 30 per cent of the students got Question 13

correct indicating that a majority of the students needed more support to understand magnetism.

Second, she was able to identify what aspects they might be finding difficult and then to develop a plan of action to further support student learning. The depth of analysis demonstrated in the example below was variable but nevertheless indicated she was able to make some use of the ideas about summative assessment that had been developed in the professional development.

Figure 5: Extract of item analysis Jineta conducted to find out her students' strengths and weaknesses in the topic she assessed.

Form 3 science: Unit 3.2 Electricity and light
Student Performance Analysis [item analysis]

Questions	Performance (% of students who answered correctly)	Analysis	Plan of action – what needs to be done to help students and inform teaching
MC [1-10]			
Short Answer questions [11-16]	49%	Satisfactory performance Lack ability to explain 'repel and attract'	Provide remedial session –give more exercise on static electricity
Q12	65	Good response how students carelessly did not fully answer the question and failed to give answers	Inform students on the importance of instruction in an assessment
Q13	30%	Poor performance especially for question 13, (a), (b) and (c). Magnetism is a mystery to all students. Students responded well to Q13 (c) and (d)	Provide remedial session to all students on the relationship between electricity and magnetism
Q14	51%	Majority of students were able to draw a circuit for the series circuit. However when it comes to measuring the voltage they lacked knowledge on how to connect the voltmeter	Students need to know how to the use the ammeter and voltmeter correctly. Organise a lab to show students how to take measurements using the instruments
Q15	47%	Some students did not attempt this question. Students who attempted this question correctly identified the components of the ray diagram but failed to complete the reflected ray. It seemed that the students failed to read the instructions and completed the refracted ray	Advise students to read instruction carefully More exercise to be given on refraction and reflection
Q16	49%	Students who attempted the question answered the question correctly. A good number of students did not attempt this question.	Students need additional exercises on spectrum

Jineta carried out a thorough item analysis of her students' answers from one unit tests, to identify their strengths, weaknesses and misconceptions. The following excerpt illustrates Jineta's reflections on her experiences in the analysis of her students' answers:

I was very keen to find out the kind of answers my students would provide from the tests I designed. So that was what motivated me to analyse my students' answers. It was a tedious exercise having to go through more than 50 scripts. I discovered the questions my students found easy or difficult. As I read each student's test script, I got an insight into what my students learned and understood and what they found difficult. I took note of the questions that the students struggled with as well as decided the measures to help them relearn the concepts they did not quite understand. I did provide extra activities for my class and retaught some of the concepts that they did not quite understand. (Jineta)

Jineta also felt she still had enough time to use summative data/information formatively, as she explained:

The unit test which I analysed is the last one I have to prepare before my students sit for the year nine national examinations so I have time to provide feedback to my students. (Jineta)

Jineta was interviewed at the beginning of September (2008) a month away from the year nine examination. She had planned to spend the whole of September revising some of the topics as well as administering mock examinations so that students had lots of practice on the questions that were likely to be asked. All the teachers had indicated in their plans that they would leave September for revision, so they could help their students do more practice using questions from past examinations.

As part of the post-professional development intervention, the teachers were asked to construct a test or other assessment tasks to assess their students' performance. Figure 6 shows an example of the first page 1 of a test constructed by one of the teachers. The test sample indicates that the teacher had been able to construct questions that required students to recall factual knowledge and provide explanations. They used a test blueprint to construct items or questions they included in their tests. Previously, they would look for test items or questions from past tests or examination papers and textbooks.

Figure 6: A sample of a teacher's test - Post PD summative assessment practice

FORM THREE UNIT 3.4 TEST

Time: 40 minutes

INSTRUCTIONS

1. Write your name clearly on your paper.
2. Answer all questions in the sheet of paper provided.
3. All questions are compulsory.
4. Write clearly and neatly.

Questions

1. The table below shows the diameter of the planets in the solar system

Planet	Diameter (km)
Venus	12.10
Mercury	4.90
Mars	6.80
Jupiter	142.80
Earth	12.75
Saturn	120.0
Uranus	51.0
Pluto	2.30
Neptune	49.0

- a) List four (4) planets correctly arranged to their diameter sizes from the smallest to the biggest.
Least: _____, _____, _____, _____
2. Draw the diagram of Earth's different cross sections (regions) and correctly label them.
3. The Earth's layer(s) said to be molten would be?
4. List two(2) different methods of catching fish that would ensure fish as a renewable resource.
5. Where in the atomic structure are neutrons located?

													I	
A	B								C	D	E	F	G	H
Q	P								O	N	M	L	K	J
R	S	T	U	V	W	X	Y	Z						

6. Using your knowledge about groups and periods of the periodic table above, identify the followings;
 - a) Two (2) elements in the same group.
 - b) Two (2) elements in the same period.
 - c) Collective name for group seven (7) elements.
 - d) Collective name for group eight (8) elements.
7. Silicon is the second most common element in the earth's crust. List two (2) commercial uses of silicon.
8. Briefly explain the two types of resources with an example for each.
9. Name the three (3) types of rocks commonly found in Solomon Islands.
10. Define a material and list two important conditions for mineral formation.
11. State two different types of metamorphism.

1

This test example does not however demonstrate a substantial shift in teacher practice, which is consistent with the teacher reports they found it difficult to

write questions to measure the breadth and depth of students' abilities. They attributed this to lack of assessment resources and reference materials in their schools and explained that, as a result, they used past year nine test and examination papers to source question for their tests.

7.5.4 Teachers' post-professional development perceptions of summative assessment

Analysis of the interview data indicated that the teachers no longer confined their perspectives of summative assessment to ranking, grading and reporting as initially discovered, but were becoming more aware that summative assessment information could be utilised for other purposes. Table 29 shows a list of teacher post professional development views about the roles and functions of summative assessment. These include a formative function for student learning and teacher effectiveness, for making judgements about student ongoing achievement in addition to summative and reporting functions.

Table 29: Views of teachers about summative assessment at the end of the professional development intervention

According to the teachers, summative assessment:
• Enables teachers to identify the concepts that students learn easily and those that students struggle with;
• Helps teachers to set new goals for students and ways to improve or maintain their standards of work;
• Information has the potential to inform teacher to adapt teaching, redevelop new teaching, learning, and assessment activities
• Is a measure of how well students master knowledge, skills and understanding of science they learn at school;
• Helps teachers to realise the standards the students have achieved in relation to national curriculum standards;
• Enables teachers to report their students' achievement to their parents and the school;
• Information can contribute to evaluation of teacher effectiveness.

The teachers' views about summative assessment shifted as they learned more about it. They acknowledged that the use of summative assessment should not be confined to comparing students' abilities, reporting, selection, qualification, and accountability purposes only, but its usage extended to instructional decision processes that would enhance planning of future teaching, learning, and

assessment. Overall, there were variations among teachers in what they were thinking or planning to implement or actually implemented. This is an indication that the teachers were not all at the same state of learning and chose those aspects of assessment that they felt they had confidence to implement in their practices.

The next section will present findings on how the teachers learned during the professional development workshop.

7.6 Effectiveness of the Professional Development: How the teachers learned

The aim of this teacher professional development was to enhance the teacher participants' knowledge on those four specific areas of assessment outlined in the preceding sections, as these are considered to be central to effective summative assessment of students. First, an important characteristic of this professional development was that it was hands-on, activity-driven. Tasks were included in order to help teachers learn by doing. Second, support was given to the teachers through visits made by the researcher to their respective schools so that they could be assisted further with any doubts they had about what they had learned and wanted to put into practice. The teachers' responses indicated that they learned through active participation, interaction and collaboration; where they reflected on their existing practices as they learned new ideas, as well as shared ideas with members of their groups and the researcher. The following provides accounts of how the teachers learned, that is, their thoughts and feelings about the learning strategies they used.

Teachers learned through active participation

Each workshop session focused on a specific assessment topic with hands-on activities that were aimed at enhancing their knowledge. Hence, the professional development workshop provided an opportunity for the teachers to get involved in the activities and to learn by doing. This was not an ordinary sit-and-watch teacher professional development. Teachers learned through hands-on-activities that also allowed them to practice what they learned with members of their groups during the workshop to help them understand and to implement what they learned

at the workshop in the classroom. When asked how well each of them got involved in the activities, Jineta stressed that each activity (for example, planning for assessment) was designed in such a way that they had to participate fully by doing the specific tasks. Similarly, Steve commented that the activities that he described as “relevant and no different to the sort of activities he does in his classroom assessment, motivated him to actively participate and was able to learn meaningful aspects of assessment.

According to Amelia, while appreciating the presentations on each aspect of assessment covered at the beginning of each work session, said that the activities reinforced the new assessment concepts they came across. And so in their small groups she got more involved in doing what the activities wanted them to do and so it became more meaningful and made sense of what they were learning about.

There was general agreement amongst the teacher participants that the content covered (presentation, selection of activities etc.) was relevant. Jineta expressed her opinion about how the strategies used and the general cooperation of members of her team made the workshop a success:

This workshop lived up to my expectations. I was able to follow what was presented and made links with what was covered in each session. I am of the view that the workshop provided about the right balances between theory, practical activities, and discussions. (Jineta)

Ishmael expressed similar sentiments. He said, “the professional development was customised in that the content covered was related to the assessment procedures and strategies similar to the ones that the teachers employed in their respective schools to assess their students’ learning. He said that not only were the new assessment ideas and procedures relevant, but the professional development opportunity was offered at a time when he felt he most needed support to up-skill and improve his assessment practices.

The teachers’ responses also indicated that through interaction and collaboration with their colleagues during the workshop helped them to learn. The next section describes some of the experiences of the teachers.

Teachers learned through interaction and collaboration

The teachers in this study indicated that they found working in small groups more fruitful than working on their own. Engaging in group work and discussions was said to facilitate their learning process. The activities required the teachers to work in groups of three. Through group effort or teamwork, the teachers discussed what they had to do, delegated the tasks to each member and when each of them had completed the task, they were able to critique on each other's work and made a few alterations before they finalised their finished product (for example, a plan of assessment for a unit). Through tailor-made and task-related activities, the teachers' assessment skills were strengthened and self-confidence built. Team members gained understanding of the functioning of each assessment procedure (e.g. constructing an assessment plan, a blueprint, calculating students' grades using a fixed percentage method and diagnosing students' strengths and weaknesses through the responses they gave on the test) through learning-by-practice. Although not always an easy process, the teachers were able to reconstruct meaning and understanding of summative assessment and the role it plays in the education system.

The group interactions (between teachers) gave them an opportunity to make sense of new ideas and skill sets. Collaborative learning allowed more knowledgeable teachers (e.g. Jineta) to clarify points related to the assessment activity they did and or assist more inexperienced teachers (e.g. Steven) to solve or do the activities. Collaborative learning on organised groups helped individual teachers to learn and practice new skills.

Sharing ideas and peer learning

The teachers were open-minded and shared what each knew about summative assessment when they did the activities related to specific assessment themes in groups. For example, the teachers worked together in groups of three to design an assessment plan, construct a test blueprint as well as calculated student composite percentage scores and diagnose students' misconceptions from a sample of past exam papers. In the planning process, those who had more experience in drawing up teaching plans shared their expertise with members in the groups who had less experience. Some of the teachers brought with them samples of tests and showed

them to their colleagues. The teachers shared their expertise with each other through collaborative activities (Hord & Sommers, 2008). This is one way that teachers' professional learning has been enhanced in this professional development intervention. Through guided participation the more experienced and knowledgeable teachers in each group helped the inexperienced peers to solve problems they were tasked to do. For example, the teachers who appeared to be knowledgeable took the lead in preparing a test blueprint or calculated students' scores to determine final grades using the fixed percentage approach.

Reflections

The tailor-made assessment activities that the teachers were engaged in tended to influence them to reflect on their assessment practices and assessment outcomes. For example, Ivan stated that the activities they did were similar to the work they did in their classroom practices that made them think about or look back at their past practices and compare them with the new assessment strategies. This way, the teachers were able to make sense of the topics they were learning about during the professional development workshops.

The teachers' reflections on their learning experiences during the workshop enabled them to make connections between what they already knew and practice with new assessment knowledge. During the professional development, the teachers used the activities to reflect back on what they did and to think about what they might do differently when they got back to their classrooms. For example, referring to the session on blueprint, Wilson said that the professional development impacted hugely on his confidence. Wilson explained that he was glad that he learned about a test blueprint.

I am glad that I have learned how to construct a blueprint. I can now use it to determine the items I should include in a unit test. (Wilson)

Another teacher believed that his knowledge of summative assessment had improved because of the professional development.

I feel more confident in planning for an assessment as well as in diagnosing my students' weaknesses and strengths by analysing their responses in the tests they do. Similar professional development should be organised for my

colleagues whom I believe need to up-skill their assessment knowledge.
(Ishmael)

All in the all, this professional development approach enabled the teachers to make sense of an assessment artefact they were familiar with, while it expanded the efficacy of this tool for them to use with their students. It became clear that relating professional development activities back to their existing summative assessment practices was important for the success of the workshop. The learning experiences of the teachers in the professional development intervention demonstrated the importance of active participation, interaction and collaboration, reflection and sharing of ideas and experiences to develop their summative assessment practices.

The findings of this study showed that there were variations in terms of the outcomes of the professional development intervention. These variations were expected due to a number of factors. One of the key factors that might have influenced the outcome of the teacher professional development intervention described in this study was the time limitation. This study was a small research project and was conducted over a short period of time. Therefore, it is likely the teachers might have not fully grasped the concepts introduced to them due to limited time.

The second factor that might have contributed to the variations in the professional development outcomes in this study was that the teachers were involved in the study at different points in their teaching career. Some teachers were more experienced, while others were relatively inexperienced with less number of years of teaching experience.

The third factor is concerned with the school setting and culture. Some schools encouraged change within the school, while others resisted change. Further, teachers are likely to implement new assessment procedures if these are incorporated into the school assessment policy and are practiced by all teachers. For example, one of the teachers in this study was enthusiastic about the fixed method approach for grading students' achievements. However, she could not

apply it in her school because the school had an existing assessment policy based on a different grading system. There were also internal influences that could have affected the teachers' teaching practices. These include the teachers' beliefs and values about assessment and teaching as a whole. The next section provides a summary of the findings of the professional development intervention.

7.7 Summary

This chapter presented the key findings of the professional development intervention study that was conducted not only to strengthen the six secondary science teachers' summative assessment practices, but also to explore how they applied in their classrooms the new assessment procedures they learned at the professional development workshop. It also reported on the factors within the schools that supported or impeded transfer of knowledge and skills classroom practice.

The teachers who participated in this study commented during the professional development sessions and interviews that the support they received facilitated their professional development. The professional development workshop stimulated a lot of discussion, deep thinking, reflections of and sharing of ideas and teaching and assessment practices. Teachers said that they became more reflective about their own practices and what had worked and what had not. They thought deeply about assessment, its purpose and the impact it had on their teaching, curriculum, and students. They collaborated in small groups to complete the specific tasks associated with the themes of the professional development. During the learning process, the teachers thought deeply about what they were learning, linked the new ideas to their usual practices, reflected on their past experiences and shared ideas and experiences. They chose aspects of what they learned and implemented them in their classroom practices.

The teachers indicated that they filled their knowledge gaps in assessment, in that they learned about how to: design an assessment plan, develop a test blueprint, calculate a fixed composite percentage method and use it to determine their students' grades, and how to diagnose student strengths and weaknesses from an

assessment task. Of the four key assessment topics or themes introduced, all the teachers designed and implemented an assessment plan and a test blueprint to construct test items.

The findings also indicated that the teachers used at least one unit test they had designed originally to assess their students' achievement and to diagnose their weaknesses and strengths in the unit they were assessed on. However, only one teacher was able to provide evidence of the item analysis conducted that she used to inform her instructional decisions. None of the six teachers were able to apply the fixed percentage method to determine their students' grades. At least two teachers attempted to use the method but abandoned it when they got confused along the way. The rest of the teachers continued to use the traditional mode of calculating averages of students' marks, and converting them into percentage score before the school grade guidelines were used to assign grades.

Overall, the change experienced by teachers indicated that the professional development had a positive impact on teachers' personal and professional development in assessment. The teachers indicated that they had both filled the knowledge gaps and increased their awareness of the need to self-evaluate and reflect on their practices, and thought of ways they might accommodate new ideas into their practice. The teachers made small to moderate changes to their assessment practices and were appreciative of the outcomes.

The next chapter will discuss the results of the baseline study and the impact of the professional development intervention on the six science teachers. A discussion will also be provided on the significance of the findings in answering the research questions; and the chapter will include conclusions and implications for policy and practice and for future research.

CHAPTER EIGHT: DISCUSSION OF FINDINGS, CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

8.1 Introduction

This chapter provides a summary of the key findings of the study and discusses how these findings compare with research in the literature review. The findings are discussed in relation to the research questions. Implications of the findings for assessment in science are discussed and recommendations made for further research.

The literature review has shown that assessment is an integral component of the teaching-learning and educational decision-making processes—particularly in regard to improving students’ achievement levels. Assessments can provide rich information about students’ learning progress and academic achievements in science and are used by teachers and education decision-makers to serve various purposes. However, past research on educational assessment has revealed that many teachers overemphasise traditional assessment methods and restrict their use to obtaining data for grading, certification and reporting purposes (Brookhart, 1993; Harlen, 2004a, 2008; McMillan, 2001; Mertler, 1998). In science education, professional organisations such as the National Research Council (National Research Council, 1999, 2007) and the American Association for the Advancement of Science (1998) as well as educational researchers (Atkin, et al., 2001; Atkin, et al., 2005; Black & Wiliam, 1998a; McTighe & O’Connor, 2005; Shepard, 2000, 2005b) have appealed to teachers to employ a broader, more inclusive range of assessment methods that reflect the complexity and interconnectedness of the science they teach (Buck & Trauth-Nare, 2009), and in order to allow students to demonstrate the variety of learning skills they might have learned. This more inclusive range necessitates teachers having sound assessment knowledge and skills to implement an effective assessment program in the classroom. Current research in teacher education in the Solomon Islands reveals that when teachers reflect on their teaching practice, the area where they are least confident is that of assessment (P. Rodie, 2011). To this end, a better

understanding of teachers' assessment practices, especially profiling their assessment literacy levels, would be an essential starting point for addressing professional development needs of teachers aimed at enhancing their competencies and effectiveness in assessment.

This study was conducted in response to a lack of research on assessment practices in the science classrooms in the Solomon Islands schools and the need to gain a better understanding of teachers' summative assessment practices in an environment where the national examination system plays an influential role in the selection of students to progress to the next grade level. Hence, the Solomon Islands education system is often described as 'examination-orientated education system' (Kerapuke, 1991; Mellor, et al., 2001; Pongi, 2004a). In light of the curriculum and assessment reform currently being undertaken by the Solomon Islands Ministry of Education and the professional development support teachers require to implement the revised curriculum and assessment frameworks successfully, it was necessary to establish a baseline on teachers' summative assessment practices as well as to explore a professional development model that could be adopted to enhance teachers' assessment knowledge and skills. Thus, this study marked the beginning of investigations into science teachers' assessment practices and their professional learning experiences in the Solomon Islands school context.

Specifically, the aim of the study was to develop an in-depth understanding of the six secondary science teachers' existing summative assessment practices and professional learning experiences during and after a small-scale professional development intervention was conducted, and to use that understanding to contribute towards generating rich insights to guide improvements in the assessment of junior secondary science in the Solomon Islands. To gain insights into the teachers' summative assessment practices and professional learning experience, an interpretive research methodology was adopted. Data were generated through one-to-one semi-structured interviews with individual teachers, focus group discussions and documentary analysis. The data collection was guided by two sets of research questions (see Chapter 4/section 4.2).

The discussion in this chapter is divided into five main sections. Section 8.2 describes the context of this study; Section 8.3 provides a summary of the key findings of the baseline and professional development study; Section 8.4 discusses the key findings of the study; Section 8.5 provides a conclusion and discusses limitations of the study, the implication of the findings on teacher development and training, curriculum and assessment and education policy reviews and reforms and recommendations for further research.

8.2 Context of this Study

This study involved six secondary science teachers who were teaching year nine science in five secondary schools in 2008. The teaching experiences of the teachers ranged from one to seven years. All were trained and qualified science teachers except one teacher who had no teaching qualification. To study the patterns of teachers' existing summative assessments, four key assumptions were considered. First, the science teachers in this study learned the principles and methods of assessment at different levels during their initial teacher education and these and other factors have influenced their assessment practices in their science classrooms. Second, the science teachers in this study gained confidence in their assessment practices as they progressed in their teaching career over time, based on their teaching experiences and professional support from knowledgeable colleagues. Third, the science teachers' existing assessment practices were also influenced by their own beliefs about teaching and school policies and regulations. The final assumption is that the teachers could have gained new assessment knowledge and understanding through their participation in professional development programmes. Again what was learned and applied to their practice could be different from one teacher to another. These assumptions were initially developed by Saxe, Franke, Gearhart, Howard and Crockett (1997) to study mathematics teachers' assessment practices and professional learning experiences in the United States of America.

This study is also based on the premise that differences in socio-cultural contexts between countries imply that science teachers in different contexts experience varying degrees of preparation and professional development support in

assessment. Internationally, research has revealed that teachers developed most of their ideas about teaching from past experiences and actual practice, primarily from their own experiences and through observing other colleagues (Kagan, 1992). There is agreement amongst educational researchers that assessment should be perceived as a social activity as it is not only done with the students and for the students (Bell & Cowie, 2001) but also because the results have social, cultural and economic implications (Aikenhead, 1997; Gipps, 2002). Thus, teacher decisions on the pedagogical approaches they choose to employ in their teaching and assessment are influenced by teacher knowledge, school context, and professional experiences (Lambeth, 2007; McMillan, 2003; Shepardson, 2001b). The next section summarises the key findings of the study.

8.3 Summary of Key Findings

Four key findings stemmed from the first part of the study that focused on teachers' existing views of summative assessment and their self-reported practices. These were as follows:

- Teachers perceived the assessment process as largely summative;
- The dominant method of assessment used by teachers was a test;
- Internal and external factors influenced teachers' existing summative assessment decisions such as heavy teaching loads, their involvement in extracurricular activities and pressures from the national examination;
- Teachers expressed gaps in their assessment knowledge and practices such as how to plan an assessment program, design a good test or assessment task using a test blueprint and use of assessment information to inform their teaching.

Three key findings stemmed from the second component of the study that focused on professional development:

- Teachers gained new knowledge and clarity on the areas of assessment covered by the professional development intervention (e.g. designed an assessment plan, they learned how to use a test blueprint to design a unit test, and analysed and used summative test data to inform their teaching);
- Teachers applied new assessment knowledge and strategies that they were more comfortable with into their assessment practices;

- Implementation of new assessment ideas and strategies was constrained by a lack of, or out-dated, school assessment policies.

The key findings of the study are discussed in Section 8.4.1 to 8.4.6.

8.4 Discussion of Key Findings

Discussion on the key findings of this study are organised according to the above summary. It involves a brief description of the finding, reflections and interpretations of the finding, and how each of the findings are linked with findings of similar studies conducted in contexts that are different to that of Solomon Islands.

8.4.1 Teachers perceived the assessment process as largely summative

The finding that the teachers in this study perceived the assessment process as largely summative raises concerns about how teachers viewed assessment and their assessment practices. Teachers need to establish positive views and understanding of assessment and to be informed that assessments serve various purposes in the education system in order to be effective in their assessment practices. However, the finding is a reflection of what the teachers viewed as necessary aspects of their teaching and assessment practices and what they perceived to be appropriate feedback and indicates their responses to what is acceptable learning. There was relatively little weight placed on diagnostic and formative assessment. The teachers seemed unprepared to implement diagnostic and formative assessment strategies effectively, probably because they considered these to be additional workloads in their teaching (Black & Wiliam, 1998a). It could also be due to gaps in their knowledge which meant they had only limited or no strategies to implement formative assessment effectively into the classroom.

The viewing of assessment as largely summative seemed to be also due to the perceived importance of high-stakes national examinations in the education system. As the national examination system has been identified as a key factor that influences teachers' assessment decisions and thus, their summative assessment practices, details of how this affects teachers is discussed in Section

8.4.3. The findings of this study have similarities to past studies conducted in Pacific Islands countries (Pongi, 2004a) and internationally (Hipkins & Neill, 2003; Jackson, 2009) that is, teachers viewed assessment to be more or less synonymous with examinations. The presence of national examinations in primary and secondary schools in the Pacific Island countries have been reported to have caused many teachers to view teacher-made unit tests and end-of-term or year examinations as the only forms of assessment that can be employed to assess students learning progress and academic achievements (Pongi, 2004a). In New Zealand, Hipkins and Neil (2003) found secondary teachers that participated in the National Education Certificate (NCEA) Level 1 perceived formative assessment to mean practice tests used to prepare students for the NCEA assessments. This supports the observations of Hume and Coll (2009) that the NCEA qualifications which is considered as high stakes by teachers and schools and that “assessment for qualification is driving the senior school and classroom programmes in New Zealand” (p.286). Another study conducted in a district school in Georgia, USA to investigate teachers’ existing assessment practices in classrooms and the forces that influenced their assessment decisions, found that teachers were aware of the need to mimic state standardised tests throughout the year and format their assessments similar to the state standardised tests (Jackson, 2009). Teachers provide more time and testing opportunities to their students in preparation of high stakes tests because they believe by coaching students with practice tests – they would become more familiar with the type of questions that would be included in the examinations and thus increase their chances to pass the examinations.

Educational researchers have established for many years that the beliefs teachers possess about teaching tend to shape the nature of their teaching and assessment practices, which ultimately affect students’ behaviour and learning (Byrnes, 2008; Clark & Peterson, 1986; Gallagher, 1991a; Pajares, 1992) and called for implementation of educational reforms to help address teachers’ negative beliefs about teaching. Black and Wiliam (1998b) argue that if teachers’ assessment beliefs contradict current views of effective assessment practices, those beliefs could hinder efforts to restructure assessment practices. The belief the science teachers in this study held about all assessments as largely summative had indeed

influenced their assessment practices in the classrooms and could be an obstacle to students' learning. The evidence suggests that the teachers used tests all through the year to assess their students. This is a significant finding because if teachers always use tests that require students to provide facts and factual information, then the breadth desired outcomes and standards that students should achieve are not realised. Also, teachers might not be able to use assessments to diagnose problems that students encounter in their learning. Nor will they be able to prepare next steps of teaching to help students learn those concepts that they struggle with. This suggests the need to re-introduce to teachers the use of multiple sources of assessment rather than rely heavily on summative tests and examinations as a way to change their existing views about assessment. Therefore, there is a need to address how best to help teachers develop desirable views, beliefs and understandings of assessments, and the variety of purposes assessment can have in the Solomon Islands school system.

Teachers in this study needed to understand that assessments can be used to serve a variety of purposes (not only summative alone) and the interpretations of their outcomes have direct and lasting impacts on teachers and students and the classroom assessment activities (Buck & Trauth-Nare, 2009). For this reason, international educational assessment experts are appealing to policy makers to support teachers develop desirable teacher beliefs and understanding that will have a positive impact of their teaching practices through initial teacher education and professional development programmes (Byrnes, 2008; Gallagher, 1991a; Rath & Amy, 2003; Stiggins, 2004). Also educational reformists call for the use of multiple sources of assessment information to inform instructional planning and decisions on teaching and learning instead of limiting assessment practices to summative tests and examinations (Linn & Millar, 2005). As discussed in Chapter 2, the Solomon Islands Ministry of Education has responded (through the current education reform) to this assessment reform movement and has drafted and begun implementing a new assessment policy framework for the school wide assessment system. The thrust of the new assessment policy is to reduce the reliance on the national examination system and move to a system that integrates school-based assessment with the examination system, and also to promote the use of multiple sources of assessment information to determine students' learning progress and

achievements, as well as to use the assessment information to support teaching and learning.

A practical approach for educational policy-makers in the Solomon Islands would be to support teachers through initial teacher education and professional development programmes so that they can acquire not only a better understanding and desired views of assessment that could enable them to support changes in practice, but also to harness the potential of summative assessments and to reduce its negative impact on students' motivation for learning (Harlen, 2005; Kennedy, et al., 2007). A good starting point to change the misconceptions and undesirable views teachers currently hold about assessment that might have negative impact on their teaching and assessment practices is through informal and formal professional development interventions. Assessment experts can be engaged in the professional development to challenge teachers' negative views, and misconceptions about assessment and to promote desirable teacher beliefs and perceptions that would enable them to realise that assessments can be used to serve different purposes. Such an approach to professional development should demonstrate to teachers, strategies that would enable them to construct quality assessments, to diagnose, support, and summarise students' learning progress and achievements of students in science.

Moreover, researchers have argued that it is essential to include specific policies to guide reform curriculum and assessment. This action is to ensure that schools and teachers understand what they are expected to implement and should also consider teachers' existing beliefs and to put in strategies to challenge them to help teachers develop beliefs that could have a positive impact on their teaching and learning. Lessons learned from the studies of Cheung (2002), Tunstall (2001) and Yung (2001, 2002) are relevant to the Solomon Islands situation. These researchers studied different educational reforms that focused on improving teachers' assessment practices. They all found that relevant policies that were put in place in the reform addressed teacher's beliefs and therefore helped them to participate meaningfully in professional development and adopted the reform programme in their classroom practices. This study has provided insights into the views and science teachers held about summative assessment and which appeared

to have influenced them in their assessment of their students. However, it was not in the scope of this study to explore how teachers' assessment beliefs impacted on their assessment-related decision-making process.

The key argument in respect to the finding discussed in this section is that teachers needed to rethink and adopt a more comprehensive view of assessment that emphasises the integral role and to use multiple forms of assessment in the teaching and learning process. Teachers would then believe that all "assessments should become a part of the ongoing learning process" (Shepard, 2001, p. 1066) rather than being viewed as an isolated activity from instruction (Brookhart & Nitko, 2007; Stiggins, 1998). In order to help students learn better and to succeed in gaining educational outcomes, Shepard (2001) suggests a fundamental shift in classroom assessment practices, from a traditional belief system attached to assessment, which is measurement-driven, to one that involves changing the content and form of assessments to align with the learning goals and integrating assessment information into the teaching and learning process. In light of recent reformed views on the role of classroom assessment in teaching and learning, it is not only imperative to develop a framework for understanding science teachers' summative assessment practices, but also to foster ways in which teachers can reconceptualise their summative assessment practices and to adopt effective strategies that enhance teaching and learning (Harrison, 2007).

In summary, the findings suggest that teachers considered the assessment process to be largely summative. This view is thought to be strongly influenced by the examination system that has been employed in the Solomon Islands school system to determine students' progression to the next level of education. The need for teachers to change their assessment beliefs that could have negative impacts on their teaching and students' learning is recognised. However, research has shown that it is often difficult to change the beliefs teachers hold. Nevertheless, to support change amongst teachers' views and beliefs, it is suggested that current and future Solomon Islands Ministry of Education reform programmes to focus on creating a balanced assessment system that not only integrates the examination system at exit points of the education system with school-based assessment, but also to promote the multiple sources of assessment information in the classroom.

The next section discusses the predominant assessments teachers use in year nine science classroom to assess their students' learning progress and achievements in science as discussed next.

8.4.2 The dominant method of assessment used by teachers is a test

The findings show that the six secondary science teachers in this study always used a unit test and end-of-term/or year examination to gather information about students' learning progress and achievements in science compared to alternative assessments. The teachers seemed aware of alternative assessments (e.g. performance assessments) but they stated that they never used them because of lack of knowledge and experience to construct and use them effectively. It appears that the teachers were not prepared well in the area of alternative assessments and preferred to use tests instead. This result has important implications for teacher education and professional development.

The findings were not surprising given the influence of national examinations. However, the quality of the teacher-designed tests was below accepted standards of assessment practices. The quality of teacher-designed summative tests was considered inadequate in terms of their ability to measure the range of learning outcomes prescribed in the year nine science syllabus. Teacher-designed summative tests concentrated on reproduction of facts and factual information about the science topics. The finding is of concern and shows that teachers need professional support to construct quality test items or assessment tasks that would enable students to demonstrate a variety of skills.

It is also of concern because the year nine science curriculum emphasises the importance of teaching higher order cognitive skills such as analysis, synthesis, evaluation and problem solving and yet teachers tended to use unit tests that stress basic skills rather than also requiring sophisticated levels of thought. The direct impact of narrowly focused tests on teachers that emphasise recall type assessments is that it could lead them to narrowing of the curriculum and emphasis on rote memorisation of facts with little opportunity to practice focused on higher order thinking skills (Dietel, Herman, & Knuth, 1991). It can be argued that such practice is ineffective and potentially detrimental to students' learning.

The teachers in this study used a fairly narrow range of assessment tools. These findings can be compared with the results of several international studies that explored teachers' assessment practices in a number of countries and contexts. They showed that most secondary teachers relied heavily on achievement tests that focused on traditional techniques such as short answer questions and multiple-choice items. Alternative assessment tools were used much less often (Brookhart, 1993; Brooks, 2001; McMillan & Lawson, 2001; Mertler, 1998; Pongi, 2004a, 2012; Stiggins, 1991; Suah & Ong, 2012).

However, in countries that have enacted curriculum and assessment reforms effectively (Bol, Ross, Nunnery, & Alberg, 2002; Carless, 2005; Harrison & Harlen, 2006; Hill, 2011; Hodgson & Pyle, 2010; Torrance & Pryor, 2001), teachers learned how to employ alternative assessments such as diagnostic, formative and performance assessments, to assess their students' learning progress and overall achievements. For example, studies in the USA that compared primary and secondary school teachers' assessment practices indicated that primary teachers frequently employed performance assessment and formative assessments in the form of questions and observations (Bol, et al., 2002; Mertler, 1998).

Secondary school teachers used traditional methods of assessment such as tests and examinations in the form of multiple choice items and short answer questions and essay and problem solving type items (Bol, et al., 2002; Mertler, 1998; Zhang & Burry-Stock, 2003). Other studies have reported teachers using a variety of assessment tools such as standardised tests, textbook tests and quizzes and commercially developed tests and quizzes, portfolios and projects (Atkin, et al., 2001; Atkin, et al., 2005; McMillan & Nash, 2000; McTighe & O'Connor, 2005).

Achievement tests are often employed not because they assess simple skills that are valued but because teachers claim tests are easier to grade (National Research Council, 2001). It is this concern of how test content affects what is taught in class – the notion of 'teaching to the test' that should be discouraged and therefore efforts should be made to help teachers meet the demands of the emerging assessment agenda which is to closely align assessments with the curriculum

content and pedagogy (Daugherty, Black, Ecclestone, James, & Newton, 2007; Hackling, 2004).

The findings in this research suggest that the way forward to address the assessment issues in the Solomon Islands education system—is to promote the use of a variety of differentiated tasks and strategies, both formal and informal and to discourage the overemphasis of tests. By doing this, teachers would be able to gather sufficient evidence, which can allow them to make sound judgements about individual students' learning (Earl, 2003). This means that teachers in the Solomon Islands need to become knowledgeable and skilful in developing a variety of assessment tasks that actually assess changes in students' conceptual understanding of important ideas of science (Bell, 2005). Changes would enable students to demonstrate competence to use scientific tools and processes, and apply science understanding to solve new problems, explain new phenomena and think critically and make informed decisions in the learning process (Atkin, et al., 2001).

The research literature points to a new educational assessment agenda worldwide. The agenda exhorts teachers to construct assessment tasks that would involve students not only to apply their reasoning and critical thinking skills. Furthermore, teachers are urged to require students to demonstrate mastery of important learning skills to produce better learning outcomes (Brookhart & Nitko, 2007; Harlen, 2007; Zimmerman, 2006). To bring about these changes, teachers would need to apply effective science teaching approaches that focus on teaching in depth important scientific knowledge, skills, and assessing a variety of learning and teaching, rather than the superficial coverage and teaching of many topics that seems to be the case with the current year nine syllabus in the Solomon Islands.

There was evidence from an examination of test papers to suggest that the science teachers in the present study focused heavily on the memorisation of the facts and vocabulary of science. Gallagher (1991a) found that teachers who did this put less emphasis on getting students to understand the knowledge and its application to the real world and students' experiences. Most importantly, it is desirable for science teachers to promote teaching and assessment of high order cognitive skills

and their application to the real world. The existing approaches to teaching of science should be shifted away from an emphasis on what is taught to an emphasis on what is learned or how the knowledge is learned by students (Gallagher, 1991a). This approach to learning and its alignment with pedagogy and curriculum content would require teachers to investigate and understand more about how students learn new knowledge. Teachers would need opportunities to use alternative teaching strategies and assessment tasks which could meet the learning needs of students and to verify whether students are indeed learning. Systematic, ongoing professional development would be needed.

It has been found that all types of assessments influence teaching, learning and classroom activities (Buck & Trauth-Nare, 2009). This view implies that new ways of using summative assessments should be explored and promoted. In the literature review, ideas about how teacher-designed assessments or internal summative assessments can be used to serve two different purposes are proposed as a way of rehabilitating summative assessment (Harlen, 2005; Kennedy, et al., 2007). First, Harlen (2005) and others illustrate ways that teacher-designed summative tests can be used in formative ways, not necessarily as the teachers currently do to prepare students using past test or examination papers. Rather, they should be used to diagnose students' weaknesses and teachers should use the information obtained to plan and implement the next steps of teaching to improve students' learning. Second, teachers should use a variety of assessments that measure a variety of science process skills to inform the student and parents about the learning progress a student has made so far. Although this sounds a potential approach for rehabilitating summative assessment, teachers are not trained in carrying out this approach of assessment effectively (Hayward & Spencer, 2010; Hayward, Spencer, & Simpson, 2005).

In summary, the findings show that the dominant assessment employed by the science teachers in this study to determine their students' learning progress and achievements in science is a test. Suggestions to redress the overuse of tests in science classrooms are discussed which include the need to collect multiple types of assessment information and to help teachers reconceptualise how best to develop teacher-designed summative assessments, and how the information drawn

from them could be rethought and considered to inform decisions beyond grading and placement purposes such as to inform instructional needs, curriculum and understanding of science content and acquisition of scientific process skills. The global shift in assessment is to move away from an emphasis on grading, to one of diagnosis to direct teaching. Teachers in the Solomon Islands will need to stay current with these assessment developments. In the next section, the key factors that influenced teachers' assessment practices in the classrooms are discussed.

8.4.3 Internal and external factors influenced teachers' existing summative assessment decisions

Internal influential factors

The main internal factors that seem to have influenced teachers' summative assessment decisions and the influences emerging from the baseline study were: beliefs and values of teaching, learning and assessment; knowledge and experiences of conducting assessment, and institutional constraints such as teaching load and extracurricular duties and the responsibilities teachers had to perform.

Teachers' summative assessment decision-making processes appeared to be one of the key internal factors that influenced the teachers' roles and responsibilities in assessment. The teachers recognised that it was their responsibility to assess students' learning and the decisions they made in this regard affect what science content gets assessed, how students should be assessed and how often students get assessed. It also influenced the emphasis teachers placed on certain learning outcomes and content which were based on what they valued and considered most important and students ought to learn them.

There was evidence to suggest that the teachers' assessment decision process was influenced to a large extent by their own beliefs of teaching, learning and assessment. For example, one of the teachers stated that his assessment practice was associated with theories of assessment he learned from his initial teacher education programme. Teachers' assessment decisions were influenced by their views of educational process and the role they needed to play to assist students under their care achieve the expected educational outcomes. The findings

provided insights into the teachers' perceptions of teaching, learning and assessment and hence its impact on their summative assessment practices. Teachers' self-beliefs can have both positive and negative impacts on their decision-making process and thus assessment practice. With regard to their current beliefs, teachers have been influenced to regard the assessment process as largely summative thus restricting their practices to tests to determine students' learning.

An issue that can affect teachers' assessment decisions is the knowledge and experience teachers have in conducting assessments in the classroom. It seems reasonable to say that the teachers' current summative assessment practice and their level of confidence are directly linked to their knowledge and experience in assessment. There is therefore a limit to what the teachers can do to become more effective in their assessment practices. Hence, there is a need to provide professional support to the teachers so that they can enhance their ability and continue to play a significant and trustworthy part in all summative assessments of their students.

A key factor identified by teachers to have influenced or affected their teacher decision-making processes are institutional constraints such as teaching load and the extracurricular duties they are obliged to perform as teachers. As teachers are responsible for assessing their students' learning, the pressure to respond to their duties could exert pressure on time for lesson planning, test preparation, scoring and grading to ascertain the achievement levels of students. Teachers can feel that they are under undue pressure as they respond to their teaching, administrative and assessment roles and thus responsibilities and can affect their performance. This multiplicity of duties can impede teachers from having quality time for preparing their teaching and assessment activities. Because of their heavy teaching loads and the instructional constraints and pressures that teachers build within themselves, teachers' assessment decision-making can favour tests to determine students' learning. Lack of relevant assessment resources that teachers can refer to as references and guides to constructing tests or assessment tasks could also increase the undue pressure and time demands teachers face.

External influential factor

The key external factor that affected teachers' assessment decisions in the classroom was the high stakes national examination taken by students at exit points of the education system (year 9, 11, 12 and 13). These placed a lot of undue pressures and expectations on the teachers to pass students so that they could progress to the next grade in the education system. The presence of the Solomon Islands national examination system and its implications for teaching and learning is an important factor that could influence teachers' existing views and beliefs of assessments in general and the purposes of assessment in the school system. The fact that teachers in this study mimic the national examinations in their assessment practices and format the unit tests and end-of-term/or year examinations according to the national examination papers format is clear evidence of the influence of the examination system. Understandably, teachers give importance to the national examinations and feel it is their responsibility to prepare their students for them.

Clearly, the teachers in this study perceived summative assessments (teacher-designed and externally designed) as a way of responding to the accountability measures of the education system as more parents and authorities want to know about students' performance and achievements and what teachers are doing to help students achieve expected educational outcomes. Parents and other stakeholders tend to measure teachers' performance according to the number of students who pass national examinations. It is also their belief that tests assess students' learning fairly and accurately as indicated by one of the teachers, "I use a test because I believe it is the most effective assessment tool that I know for assessing what my students' learned after teaching a science unit" (Steven).

The importance of national examinations in the Solomon Islands education system is stipulated in the Education Act 1978 (MEHRD, 1996) and accompanying policies and regulations governing the high-stakes examination system (MEHRD, 2012c). These policy documents emphasise the sole purpose of examinations as that of measuring a student's academic learning progress and achievement and the data derived to be used for grading and selection of students to the next level in the formal education system, as well as certification that a student has met the requirements. Given the centrality of the national examination system in

determining students' future, it is understandable why teachers perceive summative assessments as more important than diagnostic and formative assessment. This is quite disturbing though as it indicates that the teachers seldom or never sought multiple sources of assessment information or used assessment information to inform their instructional decisions.

Previous studies on teachers' assessment practices in the classrooms revealed that among the internal factors that influenced teachers' classroom decisions were: subject areas (Zhang & Burry-Stock, 2003), school level (Bol, Stephenson, & O'Connell, 1998; Mertler, 1998), years of teaching experience (Bol, et al., 1998; Mertler, 1998), self-beliefs about teaching and assessment, preference, views of educational processes and concern about the development of students (Jackson, 2009). Teachers' decisions to use tests instead of projects, for example, could be based on their self-beliefs that a test is more convenient to construct and assess students' achievement levels than other assessment tasks and that it was a more accountable measure. Teachers' reasoning for selecting summative assessment tests could also be influenced by their perceptions of students' abilities and the curriculum they teach (Tomanek, Talamaquer, & Novodvorsky, 2008). It was evident that learning outcomes in science that were valued by the teachers got assessed while other learning outcomes that might be central in terms of science understanding were neglected.

McMillan (2003) found secondary teachers' assessment decisions were "highly individualised and idiosyncratic process, one that did not seem to be founded on common assessment principles" (p.38). McMillan (2003) also found that teachers' assessment decisions were influenced to a large extent by school context and professional experiences rather than their initial teacher education experiences. Moreover, McMillan and Nash (2000) found that secondary teachers' internal beliefs and values and the realities of the classroom and other external factors imposed on them were key influential factors that contribute to the decisions teachers make in the classrooms.

Heavy teaching loads and extracurricular duties were experienced by the six science teachers and exerted work pressures. However, the issues could also be

traced to a lack of training of these science teachers on the aspects of assessment. The teachers had no choice but to teach many science classes or all science classes, with a relatively high class size (e.g. 40-50). For example, heavy teaching loads and the involvement of teachers in extracurricular duties such as sports and supervision of students as part of their daily rosters meant limited time for teachers to prepare for their lessons and assessment tasks. Muralidhar (1993a) documented that in the Pacific Island countries, science teachers often experienced heavy teaching loads. They were found to work typically under severe institutional constraints, with pressures from high teaching loads, examination expectations, and the need for syllabus coverage, all of which got in the way of imaginative teaching.

In summary, the finding that teachers' assessment practice in the classrooms is influenced by both internal and external factors is supported by the present study. Teachers' assessment decision-making process was a key internal factor whilst high stakes examination was the key external factors that influenced teachers' summative assessment practices. Teachers' assessment decision-making process plays an important role in terms of the methods of assessment employed, what aspects of the subject content get assessed and why these and not others should be tested. It is suggested that a reduction of the influential factors can be redressed not only by teacher education institutions who prepare teachers but also professional development to advance teacher assessment competencies. The next section discusses limitations of teachers' assessment knowledge and skills.

8.4.4 Teachers expressed gaps in their assessment knowledge and practices

When the six science teachers were asked to reflect on their assessment practices in the classroom, overall, they indicated positive self-beliefs about and relatively high levels of confidence in their assessment skills and competencies. For example, this is how Wilson responded when asked how confident he was in carrying out his assessment responsibilities: "I am confident in assessing my students". Yet when probed further, he seemed unprepared and lacked deep understanding of the assessment processes. Their shallow understanding of various assessment methods and their lack of assessment knowledge and competencies was evidenced in the quality of tests they prepared and administered

to their students. Key areas of professional support needed by teachers were identified such as in constructing tests/and alternative assessments, grading, and analysis and interpretation of students' results.

Gaps in teachers' assessment knowledge and skills could be attributed to their initial teacher education programme and or to a lack of continued professional support in the area of assessment. Whatever the case, there was evidence to suggest that lack of assessment practice grounded in the application of a variety of assessment tasks could have serious consequences on students' learning. For instance, in view of the substandard quality of test items designed and used by the teachers, it was difficult to tell whether students taught by the teachers in this study demonstrated better conceptual understanding of the sciences. Also there was no evidence that the teachers had used performance assessments and so it was difficult to determine whether students have gained a variety of science process skills. Teachers who are insufficiently prepared to take on their assessment roles and responsibilities cannot fully realise effective summative assessment in their classrooms to provide a snapshot of their students' learning progress and achievements.

With regards to teacher preparation, the findings support the necessity of relevant assessment courses being offered by teacher education institutions in order for teachers to develop the necessary assessment skills and thus implement an effective assessment program (Popham, 2009; Stiggins, 1998, 1999b). It is proposed that the teacher education institutions in the Solomon Islands need to consider reviewing the educational assessment courses offered with the view to refocus teacher training and certification programmes on assessment competencies. More emphasis need to be placed on developing pre-service teachers' assessment competencies so that they are better able to select and implement a variety of appropriate assessments to support student learning (Siegel & Wissehr, 2011). Currently, accountability measures are being imposed on Solomon Islands schools and teachers by educational authorities including the Ministry of Education. It is argued that if teachers possess inadequate knowledge they may not be likely to assess and explain students' performance sufficiently (Popham, 2009). Hence, teachers need to be highly competent in the area of

assessment and accountability and should be the target for teacher pre-service and professional development programmes.

The findings of this study are consistent with a substantial number of studies conducted in Canada (Hargreaves, Earl, & Schmidt, 2002; McDonald, 2002; McMillan, 2001), USA (Cizek, Fitzgerald, Shawn, & Rachor, 1995; Mabry, 2003; Mertler, 1998), England and Scotland (Assessment Systems for the Future, 2005; Black & Wiliam, 1998b; Hayward, et al., 2005; Lingard, Mills, & Hayes, 2006) as well as in the Pacific Islands countries (Pongi, 2004a, 2012; P. Rodie, 2011; Sade, 2009). These studies revealed that many teachers were concerned about their lack of preparation in the area of assessment and were regarded as insufficiently skilled. A more recent study that is relevant to the findings of this study was conducted in the Solomon Islands to determine the professional learning experiences of beginning secondary teachers during the first two years of their teaching. P. Rodie (2011) found that the teachers expressed lack of confidence in planning and preparation of assessment tasks, students' reports and interpretation of assessment data.

The literature review has indicated the need for educational policy-makers to further support the need for teachers build their assessment skills and competencies in assessment (Black, et al., 2010, 2011; Harlen, 2007; Pongi, 2012; Popham, 2009). This is due to limitation in both preservice and in-service teacher training and lack of support from continuous teacher professional development in assessment (Black, et al., 2011; Mertler, 2003, 2005; Wissehr & Siegel, 2011) to equip teachers with effective assessment knowledge and skills. In-service training programmes that cater for continuing teacher professional development needs in assessment in particular should identify and address the actual needs of teachers. When this is the case, teachers can gain the competencies for and be effective in assessing their students' performances, including the need for teacher networks within and across schools. If no attempt is made to support teachers' upskilling of their teaching and assessment practices then there is no guarantee that teachers would have and be able to use effective assessments effectively. It is argued that teachers' inadequate knowledge in classroom assessments can "cripple the quality of education" (Popham, 2009, p. 4).

In summary, the findings indicated that the six science teachers had limitations in their assessment knowledge and skills. They do not have the support to explore summative assessment processes deeply in terms of varying the types of assessment tasks and processes used and how to effectively use the information obtained from assessment tasks. It is suggested that both initial teacher education programme and professional development need to focus more on assessment to improve the strategies and procedures used in teacher-designed assessments in science. The sections following this section discuss the findings of the professional development intervention.

8.4.5 Teachers gained new knowledge and clarity on the areas of assessment covered by the professional development

This section discusses the findings of the professional development intervention. The intervention comprised of workshops and school visits that aimed to provide additional support to the teachers. Findings indicate that not only did the professional development enhance the science teachers' views and understanding of summative assessment but it also clarified and or reinforced their knowledge and understanding of the different forms of assessment that could be used in summative ways, and the processes and principles of assessment in general. Overall, the professional development intervention made teachers more aware of the different forms and processes of assessment that could be used for summative purposes in the classroom and it also opened new ways of thinking and using assessment information to inform and improve teaching and learning in science.

It appears that the Solomon Islands Ministry of Education has not in the past decade embraced or emphasised teacher professional development programmes to upskill teachers in their assessment practices apart from in-service for teachers on the revised curriculum. However, a school-based teacher professional development initiative has recently been proposed to ensure there is support for teachers in applying the new student learning assessment framework, lesson planning, and the use of appropriate pedagogies, in line with the revised teaching standards and the curriculum reform programme (MEHRD, 2012b). This study provides insights into how the intervention might be modelled in order to build teachers' understanding of the summative assessment process, the context of the

science classroom through hands-on assessment activities that allowed the teachers to collaborate, reflect and share their experiences as they were introduced to new summative assessment procedures to enhance its impact.

The teachers in this study learned by doing, that is, the teachers actually developed an assessment plan for the unit they were going to teach next, had practice on using a test blueprint and constructed a unit test. They also calculated students' scores using a fixed percentage method to determine their grades as well as analysed students' answers from the previous year nine national science examination to determine the problems students had. Through their active participation in the professional development, the teachers became more reflective of their assessment practices. By engaging in the activities and with their peers, the teachers were able to share ideas and experiences of their assessment practices. They discussed openly and became more reflective in their assessment practices as a result of the professional development intervention. The level of discussion and the completing of activities with their colleagues appeared to have been non-existence in their respective schools but needs to be encouraged at the school level to sustain professional growth of teachers.

This study suggests that continuous professional development programmes that specifically focus on assessment as well as pedagogy that will enhance the professional growth of teachers need to be established as part of every school improvement programme in the Solomon Islands. This is important because it is widely recognised that teacher quality is the very centre of learning. Research shows that the knowledge, skills or competencies a teacher possesses are key to how successful students will become in achieving learning outcomes (Darling-Hammond, 2000; Goe, et al., 2008). Students must also be made aware that they are responsible for their own learning— this is also part of teachers being assessment literate. Teachers need to be assessment literate in order to understand fully how to design assessment tools that measure students' learning accurately. They need to possess good content knowledge and to be able to align assessment with learning outcomes that are valued most in order to use assessment to its full effect (Earl & Katz, 2000; Stiggins, 1991, 1995, 1999a). The professional development intervention aimed to equip the teachers with specific components of

assessment such as planning for assessment and designing a unit test using a test blueprint, grading and analysing students' learning difficulties. The six science teachers expressed satisfaction in gaining new knowledge as well as clarity on those assessment concepts and procedures covered through the professional development intervention.

The findings of the present study is similar to the findings of a study conducted by Black and his colleagues (2010, 2011). They explored the ways in which teachers of English and mathematics, working with students aged of 12 to 16 years, in three secondary schools in England, could improve their summative assessment. The study showed that the teachers enhanced their competence of summative assessment in ways that had a positive impact on their teaching and learning. The teachers gained competence in designing assessment tasks (e.g. portfolio) and applied these in their classrooms. Also they gained confidence in marking and aggregation, and standardisation and moderation. However, Black et al. (2010) cautioned that whilst they appreciated the positive impact the project had on teachers' assessment beliefs and practices improved assessment competence and skills requires sustained commitment over many years. They proposed that interventions that aim to improve teachers' summative assessment practices and competencies should begin by identifying their existing practices. This should be followed by engaging teachers targeted in reflection on their individual and shared assessment literacy, before proceeding to work together in groups to examine and reconsider their underlying beliefs and assumptions regarding summative assessment (Black et al., 2010). This study reinforced what other researchers have found, that is, subject-based (Soulsby & Swain, 2003) and collaborative professional development with colleagues (EPPI, 2003) had a positive effect on the teachers in terms of the change they need to implement to improve their assessment practices in the classroom.

In summary, the findings show that the teachers not only gained new assessment knowledge and skills based on the four areas covered in the professional development but also clarified what had been learned previously as student teachers or practicing teachers. Findings also indicate that professional development can usefully involve a community of teachers who share, reflect and

collaborate together to achieve common goals linked to change their classroom practice. Important lessons have been learned from the literature review and the findings of the present study in regard to teacher professional development reinforces the need for sustained efforts to support teachers in their job. This study reinforces what other researchers have found—that ongoing professional development is an essential component of teacher development. It also embraces the notion that teachers aim for continuous improvement in their professional skills and knowledge after their initial teacher education and throughout their teaching careers (Gray, 2005).

8.4.6 Implementation of new assessment ideas and strategies was constrained by a lack of, or out-dated, school assessment policies

While there was clear evidence that the four areas of assessment the professional developed focused on seemed to address the teachers' knowledge gaps in assessment, this study also found that it was challenging for the teachers to change their practices without the involvement of all teachers in their respective schools. There could be several factors that might have inhibited the successful implementation of all suggested assessment ideas and procedures introduced to the teachers during professional development workshops. The key issues however that seem to have impeded teachers from implementing new assessment ideas into their practice were related to the uneasiness of individual teachers to implement their reformed assessment ideas and procedures while the rest of their teacher colleagues continued to practice traditional methods of assessment. The decision to limit the implementation of new assessment ideas and procedures was partly attributed to old (national and school) assessment policies and a lack of initiative at the school level to start an assessment reform. It was also attributed to what is termed here as a 'clash of new and old beliefs' about assessment, as well as decisions that individual teachers made as they responded to high teaching loads, limited availability of assessment resources and other factors such as the influence of the examination system. On the whole, the teachers chose to implement specific assessment ideas and procedures covered during the professional development workshops that were in parallel with their individual and school assessment practices.

The findings that the teachers implemented some assessment ideas or procedures learned from the professional development workshops and not others are consistent with research carried out elsewhere. There is general agreement in the studies conducted that teachers can readily accept some assessment innovations (Pannizon & Pegg, 2008) while being reluctant to shift or unable to shift some of their existing assessment practices within the timeframe of the reform programme (Morris, et al., 2000). For example, Morris, et al. (2000) encountered a number of challenges to assessment practice reform by teachers in Hong Kong. Similar findings have been reported of UK teachers, who were hesitant to adopt mandatory changes, which required them to shift their assessment practices from the use of traditional summative assessment to formative assessment methods (Torrance & Coultas, 2004; Tunstall, 2001). Pongi (2004a) has reported that attempts to change assessment practices amongst teachers in the Pacific Island countries have been hampered by the general reluctance of teachers and education authorities to try alternative methods due to the influence of high stakes examinations, “out-dated policies, and non-conducive environments in which the assessments operate” (Pongi, 2004a, p. 1).

However, working with secondary teachers in the Solomon Islands to determine the impact of a technology education professional development programme for traditional technical education secondary teachers to assist with the implementation of technology education, Sade (2009) found that the teachers he worked with enhanced their understanding of their assessment practices. He noted an improvement in the teachers’ assessment practices both in formative interactions in their classrooms and in the criteria that the teachers developed for the summative assessment tasks to measure students’ performance compared to before the intervention.

Other research has indicated that the ease of implementing new assessment procedures and strategies including developing and scoring assessments, weighs heavily on which assessments teachers are willing to use and how they are willing to use the data generated from these assessments (Jackson, 2009). This was also the case in this study. Finally, educational researchers have stressed that changes in practice at the school level can be achieved through school-wide improvement

programmes instead of focusing on individual teacher learning to change their practices (D. C. Reynolds, Teddlie, & Stringfield, 2000).

In summary, the findings of this study indicate that carefully planned professional development interventions that take into account teachers' understanding of assessment and the context of science teaching and that incorporate teacher-teacher collaboration, individual and collective, reflection, and also provide ongoing support are likely to be successful in changing teachers' assessment practices. The teachers in this study made attempts to implement selected assessment ideas that were introduced to them into their practice when they were convinced they would work and add value.

Out-dated school assessment policies and a reluctance by teachers to take action as individuals seemed to be the main issues that the teachers grappled with in changing their assessment practices. These factors can be seen to have affected full implementation of the ideas and procedures suggested to enhance teachers' summative assessment practices.

Finally, the results of this study suggested that in-service training support for summative assessment is highly critical. This is particularly important for several reasons. Teachers need ongoing professional support in their areas of speciality to be effective. This study has shown that the teachers were not appropriately in-serviced in the area of assessment. There was a general lack of in-service training opportunities for teachers on assessment in schools. Hence, they lacked new knowledge about summative assessment processes and practices.

Research and new developments in assessment provide new or reformed assessment strategies which can be beneficial to teachers. Teachers need to be introduced to new ideas about assessment and learn about what it means to be an effective science teacher. The findings from this research also revealed that support for assessment change at both national and in school levels is generally of low priority despite teachers' concern of their limitations on current assessment practices. This issue necessitates the establishment of ongoing professional development to enhance teachers' capacities on assessment in schools. This

should include the development of exemplars and assessment tools to assist teachers incorporate information gathered during and after the teaching process into their practice (OECD, 2005a).

Fundamental principles about the process teachers go through when asked to change their practice need to be understood. Researchers have pointed out that meaningful change takes time—it takes time for teachers to “become convinced of the need to change and of the value of changing, and to feel sufficiently safe to change” (C. Smith, Hofer, Gillespie, Solomon, & Rowe, 2006, p. 8, cited in Poskitt & Taylor, 2008). Smith et al. (2006, p. 23) state that change is not easy because “individual teacher change sometimes leads to new challenges unless teachers and administrators work together to discuss consistency of goals and curriculum across the programme”. To assist teachers make the necessary changes, there needs to be mechanisms in place to monitor the effects of professional development on teachers’ practices and students learning outcomes (Poskitt & Taylor, 2008). According to the literature review teachers’ “... enthusiasm and willingness to commit themselves naturally increased when they realise personal results from a change initiative; this in turn reinforces their investment and leads to further learning” (Senge et al., 1999, p. 47, cited in Poskitt & Taylor, 2008, p. 8). It is also pointed out that “continuing improvement in schools should involve an ongoing cycle of inquiring in the professional development programme” that teachers are engaged in to ascertain “what is working or not working” and to take the necessary steps to achieve the goals (Poskitt & Taylor, 2008, p. 8) This study had produced similar impacts on teachers as previous international studies.

The next section discusses the conclusions drawn and the limitations and implications of the study.

8.5 Conclusion and Implications

An emergent purpose of this study was to determine six Solomon Islands secondary science teachers’ summative assessment practices by exploring their views and understanding of summative assessment, the types of assessment

employed and their use of assessment information as well as their professional learning experiences. The data collected regarding their existing summative assessment practices and professional learning experiences support what was delineated in selected educational assessment literature reviewed.

A summary of the key findings of the study are presented and discussed in Section 8.4. All in all, an investigation of the teachers' summative assessment practices and samples of tests examined revealed that teachers' existing summative assessment practices was based on their existing knowledge and beliefs about teaching, learning and assessment. The findings indicated that the teachers engaged in this study were performing their assessment roles and responsibilities to their own satisfaction and to that of their schools. However, analysis of the teachers' interview and focus group data and an examination of the tests they had developed and used indicated that the teachers needed additional support in developing effective summative assessment processes. It was disconcerting to note that teachers perceived all assessment processes as largely summative and that they used tests predominately. This was due mainly to the use of national examinations in the education system, as well as limitations in teachers' expertise in assessment and lack of professional development. The study provided professional development workshops that covered specific areas of assessment to address the misconceptions the teachers held about assessment and to clarify and/or reinforce key summative assessment procedures. Follow-up activities were necessary and used to assist the teachers to apply their new assessment knowledge and skills as not everything they learned during the professional development workshops addressed the assessment issues the teachers encountered in their classrooms.

It is argued that summative assessments need not be narrowly restricted to tests and examinations, rather alternative assessment methods should be promoted as these methods are capable of assessing the variety of student abilities align with current subject content conceptions and associated pedagogy. Kennedy et al. (2007- see also Harlen, 2008) suggested the promotion of teacher-designed summative assessments. This study recognised that teacher-designed summative assessments can and should be used as "feedback to help students move from

where they are to where they need to be and they can be designed in ways that reflect the principles of assessment for learning” (Kennedy, et al., 2007, p. 8). It also supports the notion that teacher-designed summative assessments should be used formatively to support teacher effectiveness that could lead to improvement in students’ performance and achievement in science because of the immediate availability of feedback as opposed to national examinations that can take time to receive feedback (Black & Black, 1998a; Harlen, 2005; Atkin et al. 2001).

In order to rehabilitate summative assessment, evidence in this study supports the preposition that Stiggins (2002) offered that it is the teachers’ “mindset” that needs to change for them to adopt new ways of using summative assessments. Teachers’ summative assessment have the potential to positively influence students and teachers (Harlen, 2005, 2007, 2008; Kennedy et al. 2007; McMillan, 2003) without the negative effects associated with external tests and examinations. They can be used to yield more comprehensive pictures of students’ learning progress and achievements (Harlen, 2005, 2007, 2008; Martínez, Stecher, & Borko, 2009). However, it is not an easy task to tell or even show teachers that and how they ought to change their practices by selecting and or developing most effective assessments – teachers need to be convinced that alternative assessment methods can provide far more convincing results than traditional methods, as was the case in this study. Before the implications of the study are discussed, the limitations of the study are briefly discussed.

8.5.1 Limitations of study

The findings of this study have some limitations that are related to the study setting, participants, the research method employed, and personal and contextual factors that are inherent in the research setting. First, making recommendations based on the findings of this study to inform changes in the assessment programmes in the education system in the Solomon Islands requires robust understanding of the issues faced by teachers from a relatively large population sample. Therefore, the results of this study should not be used to generalise the assessment situation in the Solomon Islands though they could possibly illuminate the general issues in assessment. This study engaged only six secondary science teachers to obtain information about their summative assessment practices, and

professional learning experiences. To strengthen the findings from this study, it could be replicated and use a larger sample of science teachers teaching the same grade level (year nine) and to use both quantitative and qualitative research methods. However, the findings of this study point towards quality in-depth understanding of assessment procedures being vital to teachers' summative assessment practices.

The second limitation is concerned with the amount of time given to conduct professional development and the follow-up activities that the researcher needed to do to assist teachers implement what they learned from the professional development workshops. Research has indicated that professional development is a key mechanism for improving teachers' teaching and students' achievement (Ingvarson, Meiers, & Beavis, 2005). However, not all professional development interventions are successfully implemented and one of the conditions for success advocated by experts is a sustained period of time for teachers to implement change to improve teaching and learning. Teacher change is a slow process and teachers require time to assimilate changes into their practices and to become confident in their use (Phillips, Desimone, & Smith, 2011; C. Smith, et al., 2006).

The third limitation is concerned with the evaluation of the professional development workshops. The researcher designed, conducted and evaluated the professional development intervention. There may be suggestions that the professional development intervention could have been evaluated by an independent person. However, this was not possible due to limitations in time to conduct the study and evaluation, finance to hire an evaluator and the availability of the evaluator. Hence, the researcher conducted the evaluation using some guidelines that he developed. The need for a valid and reliable evaluation strategy or guideline is recognised because these would limit bias. According to Guskey (2000), good evaluations of professional development do not have to be costly, nor do they demand sophisticated technical skills. Rather, Guskey advises that what is needed is the ability of the researcher to ask good questions and have a basic understanding about how to find valid answers. Based on the researcher's perspectives, the evaluation conducted on the professional development intervention to enhance the six year nine science teachers' summative assessment

practices were fair and provided useful and sufficiently reliable information that was used to make thoughtful and responsible decisions about the professional development process and effects.

Despite the limitations, the teachers' lived experiences, before, during and, after the implementation phase of the professional development intervention were observed and recorded. Mechanisms such as member checking were put in place to ensure that misinterpretation of information was avoided. Hence, the findings of this study entail the best interpretation of the teachers' experiences based on shared ideas between the participants and the researcher. Not only that but the present study lends supportive evidence to the commonly and widely agreed characteristics of effective professional development that aim to enhance teacher quality and improved student achievement.

This exploratory study suggests implications for teacher development, curriculum, assessment and policy reviews. It also proposes implications for future research, particularly in the socio-political climate of mandated and high stakes examinations, and more detailed examination of assessment procedures as used by teachers. These are discussed next.

8.5.2 Implications of teacher development

This study exposed teacher graduates who seemingly felt over-confident in conducting assessments in the science classroom. However, when probed further on their assessment literacy levels and what and how they applied their expertise into their practices, they appeared uncomfortable in explaining deep or meaningful understanding of the assessment process—an indication that they felt under-competent when it comes to assessing students' learning progress and achievements and in using assessment information to promote improved student learning. This study has indicated that mandatory national testing or examination requirements can potentially influence teachers' assessment practices in the classroom and could affect teacher flexibility and teaching effectiveness due to time factor and efforts to meet the requirements (Moss, 2013). It is prudent therefore for teachers to reduce their reliance on tests and move towards using a variety of assessments to capture student learning progress and achievement. The

findings of this study could therefore inform the design of initial teacher education preparation programmes. The intent should be to review existing assessment courses with the aim to identify gaps and to incorporate aspects of assessment that teacher graduates found insufficiently prepared (e.g. construction of assessment tasks and the need to assess a range of student abilities associated with a course). The findings indicated that teachers lacked knowledge of alternative assessments and therefore this additional content should be included in the teacher education curriculum.

Research has indicated that teachers do not learn everything they should know about teaching in their initial teacher education programme, to prepare themselves for their professional career. Rather, most teachers learn through their teaching experiences and from knowledgeable colleagues as they progress in their professional career (Loughran, 2007; Loughran & Ingvarson, 1993). The present study provided supportive evidence to this issue and recommends that in-service professional development activities be increased at both national and school level to help teachers gain confidence in planning, preparation of assessment tasks, scoring, grading and interpretations of results and writing students' reports.

In the case of teacher educators, mechanisms should be put in place so that they do not only focus on assisting student teachers gain assessment skills and competencies through their initial teacher education programs but most importantly, follow the graduates at the schools they are posted at. By doing this, teacher educators can learn about the extent to which the courses and training offered in their initial teacher education programme impact on teachers' actual assessment practices. Appropriate in-service training programmes can then be organised for beginning or experienced teachers to support them in the identified areas of teaching and assessment.

Several studies have consistently revealed the importance of effective professional development for teacher learning for improved instructional practices (Phillips, et al., 2011; Yates, 2007). In this regard, the importance of continuing professional development support cannot be overemphasised for teacher graduates particularly during the early years of their professional career and thereafter. The findings of

the present study indicated a lack of appropriate teacher professional development opportunities at a school level that focused on assessment and targets specifically science teachers as well as other teachers of other subjects. Therefore, it is essential that educational policy-decision makers, school leaders and education authorities consider the importance of continuing professional development and make them available to improve teacher quality and student learning. The professional development support and training offered to teachers should consider assessment areas such as demonstrations of the construction and use of a variety of assessments, analysis and interpretation of assessment information including analyses of students' responses to identify their weaknesses and exploration of ways to inform instructional decisions that can potentially improve teaching effectiveness that lead to improved student performance and achievements.

8.5.3 Implications on curriculum, assessment and policy reviews

This study provided evidence that suggested that the teachers' assessment decisions which were associated with their beliefs about teaching, learning and assessment, views about the educational process and role in supporting their students to achieve educational outcomes influenced what got assessed, the assessment methods teachers chose to assess their students with and frequency of testing in the science classrooms. Because of the presence of and influence of the high stakes national examination regime in the Solomon Islands education system, teachers appeared to be teaching to the test. The consequences of these are that teachers can narrow their teaching and focus on those content areas and learning outcomes that they believed would be tested and included in the examinations. Such an unbalanced treatment of the curriculum can cause serious impediments to students' learning – that is, students can be deprived from learning the rest of the curriculum content areas and learning outcomes.

The literature reviewed warned of dangers and risks such narrow focus of the curricula can cause in particular with mandatory standardised testing and examination regimes which act as a means for accountability and transparency in education (Chudowsky & Pellegrino, 2003). It is therefore proposed that teacher education and professional development programmes that aimed to enhance teachers' assessment capabilities should demonstrate the importance of the

alignment that need to be established between the science curriculum on offer, teaching, and assessment tasks designed to measure students' learning progress and achievements.

The findings indicated limitations in the establishment of an explicit assessment framework that is closely aligned with the science curriculum framework in the schools. A new national assessment policy framework has been drafted under the current education reform in the Solomon Islands, however, its successful implementation is yet to be realised. The positive change anticipated in the teachers' assessment practices will depend very much on how well the teachers articulate or interpret and implement the new curriculum and assessment frameworks. Efforts towards familiarising teachers with the new policy frameworks to guide their implementation by teachers are central. Therefore it is recommended both teacher education training institutions and professional development programmes designed to support the professional growth of teachers should ensure that teachers are knowledgeable about the new curriculum and assessment frameworks.

The findings indicated that teachers do not always conform to common assessment guidelines because of lack of such resources and limitation of assessment policies within schools. It is therefore recommended that schools review their existing assessment policies and regulations or develop a new policy to guide teachers in their assessment practices. Assessment policies if enforced in individual schools could ensure uniformity in the assessment approaches used across subjects and grade levels. A clear assessment policy and assessment framework based on the principles of assessment and best practice if enforced in schools could allow teachers to avoid misinterpretation of student assessment data and overemphasis of tests to measure students' learning.

8.5.4 Recommendations for further research

While this study provided some insights into the six secondary science teachers' existing assessment practices and their professional learning experiences, there are other areas related to science teaching and assessment that need to be explored in more depth. Therefore, future research could focus on further investigation on the

findings of the present study. An important gap noted in the findings of the present study was that although teachers expressed their views and beliefs about summative assessment, it was not possible to establish the relationships between the views and beliefs teachers hold and their actual assessment practice. For example, what beliefs or views held by teachers influence their decisions to assess only certain learning outcomes/or content areas of the science syllabus?

Research should also explore how teachers could employ alternative assessments effectively to serve a summative purpose and to explore different ways of using the assessment information obtained. McTighe (2005) suggested seven assessment and grading practices that can be employed not only to measure and report learning but also promote it. The practices promote both summative and formative processes and strategies that effectively consider the use of a variety of assessments (e.g. performance assessment) that could be used to measure understanding of science and science process skills. The research question that could be used to guide investigation would be: do teachers appreciate switching to performance assessments for example, as an alternative to summative tests?

Additionally, a related area of assessment that might be considered for further investigation could be to undertake a longitudinal study that explores how science teachers could use responses that students' write in the teacher-designed summative tests or assessment tasks to diagnose students' learning difficulties and to use the data obtained to inform their future instructional and assessment plans and practices. The study could involve teachers who teach the same cohort of students from year seven through to year nine. This could be done over a period of three years in order to monitor and to determine how the students performed in science in each of the grade levels.

There has been no study carried out previously in the Solomon Islands education system to ascertain the impact high stakes tests and examinations have on teaching and learning. This could be a research area that might be considered for further investigation. Finally, and as mentioned at the beginning of this chapter, this research marked the beginning of investigations into science teachers' assessment practices and their professional learning experiences in the Solomon

Islands school system. In this regard, the study has provided the setting for further research on classroom summative assessment – an area that is increasingly debated intensively by teachers, parents, politicians, and policy-decision makers.

8.5.5 Concluding summary

Prior to this study, there has been no study conducted in the Solomon Islands that explored secondary science teachers' summative assessment practices. In fact no research studies have been conducted on summative assessment in the classroom in the Solomon Islands. Therefore, this study provides a useful perspective on classroom summative assessment, all the more so because it is from a Solomon Islands education system context. It provides a starting point for further research that could be undertaken to generate information that would inform policy and practice so that actions could be taken at a national and school level to improve teachers' summative assessment practices in an environment where national examinations play an important role in deciding students' future.

This study has explored six science teachers' existing summative assessment practices and supported them through a small-scale professional development intervention in order to enhance their assessment knowledge and skills. Findings of the study have shown that the teachers' views and knowledge about summative assessment appeared to have been influenced by a range of factors including their initial teacher education experiences, the other teachers they interacted with at their school, availability of teaching and assessment resources, heavy teaching loads and pressures from the national examinations. These factors had shaped the way in which the teachers taught science and assessed their students. Several studies have indicated similar factors as having an impact on teachers' classroom assessment practices either in a positive or negative way.

The six science teachers who participated in this study took their summative assessment responsibilities seriously and had a reasonably good understanding of the purpose of summative assessment in their context. However, only few of the teachers' comments suggested that they had robust understanding of summative assessment processes and procedures. Teachers perceived the assessment process as largely summative which explains why diagnostic and formative assessments

were not the preferred types of assessment that the teachers engaged in, when it came to assessing their students.

Achievement tests were the type of assessment teachers preferred and used frequently throughout the year. Because of their focus on tests and limited assessment knowledge, the teachers seemed to lack deeper understanding about the processes of assessment. Hence, the teachers did not appear to be aware that alternative assessment could also be used to measure, summarise and report students' achievements. Most importantly the teachers have limited experience in using assessment information to inform and plan future classroom instruction, curriculum and evaluation of their own teaching in support of students' learning. The findings of this study reinforce the call made by international assessment experts to provide professional development opportunities for teachers in their specific contexts.

This study provided evidence that changing teachers' assessment practices cannot be achieved over-night. It therefore reinforces the need for ongoing professional support and guidance to be offered to teachers. By providing professional support teachers need would enable them to adopt change including the need to understand the relationship between assessment and teaching, and learning and curriculum outcomes.

The literature review informed the researcher that teachers must also be prepared to shift their teaching and assessment practices in response to educational reform and changes in society that demand new knowledge and skills (Earl & Cousins, 1995; Earl & Katz, 2000, 2006; Segers, et al., 2003). This is important because young people that teachers teach need to be taught well enough to attain knowledge and skills to be able to meet the challenges they encounter in their own settings and teachers need to use effective teaching strategies to make a positive impact on young people.

The study has shown that teachers can gain new skills in assessment as well as make small to moderate changes to their existing summative assessment practices. This is possible if teachers are provided with professional development

opportunities that build on their existing knowledge of assessment, and the context of the science classroom. In order for professional development to be successful, effective strategies should be employed such as teacher-teacher collaboration, teacher reflection, and ongoing support for teachers to implement new assessment strategies in their classrooms. Finally, this study has contributed original new knowledge in the field of assessment in science education in the educational context of the Solomon Islands.

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APPENDICES

Appendix A: Authorisation letter to conduct research

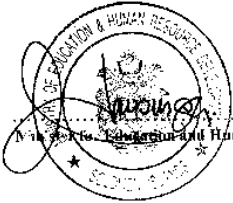
FORM – R.B

THE RESEARCH ACT 1982 (No. 9 of 1982)

RESEARCH PERMIT

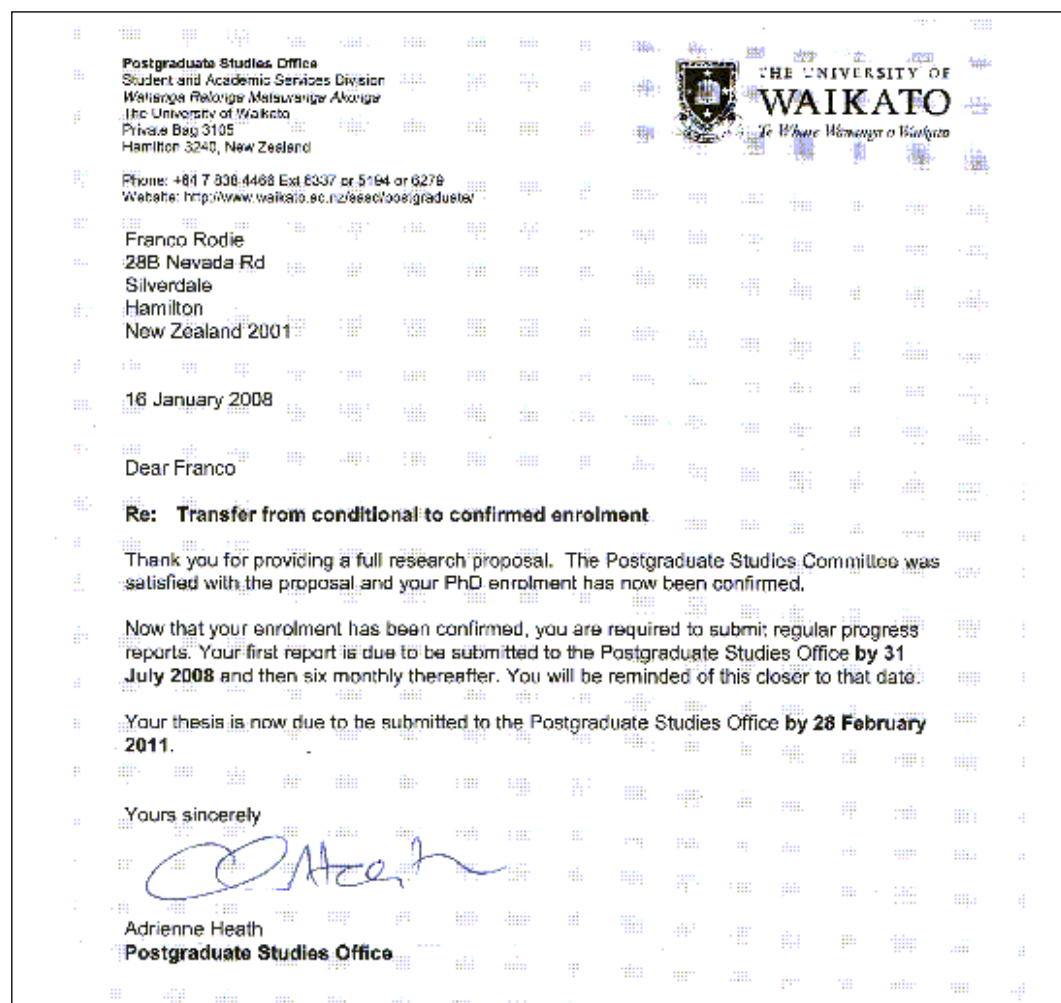
Permission is hereby given to:

1. Name: *Franco Rodi*
2. Country: *Solomon Islands*
3. To undertake research in (subjects): *The investigation of Solomon Islands Year 9 Science Teachers' Summative Assessment Practices.*
4. Ward(s):
5. Province(s): *Honiara*
6. Conditions:
 - a. To undertake research only in the subject areas specified in 3 above.
 - b. To undertake research only in the ward(s) and Province(s) specified in 4 and 5 above.
 - c. To observe with respect at all times local customs and the way of life of people in the area in which the research work is carried out.
 - d. You must not, at any time, take part in any political or missionary activities or local disputes.
 - e. You must leave 4 copies of your final research report in English with the Solomon Islands Government Ministry responsible for research at your own expense.
 - f. A research fee of *SBD300.00* and deposit sum of *SBD200.00* must be paid in full or the Research Permit will be cancelled. (See sec. 3 Subject. 7 of the Research Act).
 - g. This permit is valid until *31/12/08* provided all conditions are adhered to.
 - h. No live species of plants and animals may be taken out of the country without approval from relevant authorities.
 - i. A failure to observe the above conditions will result in automatic cancellation of this permit and the forfeit of your deposit.

Signed: 
Minister for Education and Human Resource Development

Date: *22 January 2008*

Appendix B: Approval of ethics application



Appendix C: Invitation letter to participants

Centre for Science and Technology
Education Research
The University of Waikato
Private Bag 3105
Hamilton, New Zealand



29 January 2008

Dear Year Nine Science Teacher,

Re: Letter of Invitation to Participate in Research to Examine Year nine Science Teachers' Summative Assessment Practices

I am pleased to inform you that your school principal has suggested that you might wish to take part in a research that I will be conducting over a period of two years at your school. I would like to invite you to participate in this research study. The title of my research topic is '*An Investigation of Solomon Islands Year nine Science Teachers' Classroom Summative Assessment Practices*'. This research is being undertaken as a requirement towards my doctoral studies, which I am currently pursuing at the Centre for Science and Technology Education Research, University of Waikato, New Zealand.

The aim of my study is to work with Year nine science teachers to enhance their summative assessment practices through a professional development programme. In order to achieve the aim of the study, I would like to work with six Year nine science teachers, including yourself, if you agree to participate, in the following research activities, during the course of the research.

1. Interviews. I would like to interview you three times formally over a two year period. The first interview, which is scheduled for the first week of February 2008, seeks to obtain your current views about your summative assessment practices. The second interview will be held in September 2008 after a PROFESSIONAL DEVELOPMENT workshop has been conducted. The third and final interview session will be held in September 2009. Each interview will last for 60 minutes.

2. Professional development workshops. I would like to invite you to attend a professional development workshop on classroom assessment practices (see professional development workshop timetable attached for detail). The professional development workshops will be conducted in from 3 to 6 March 2008. Briefly, the professional development workshops will allow you to learn about alternative assessment ideas and procedures. There will be hands-on activities and you will have the opportunity to work collaboratively with your colleagues/and researcher in planning instruction and assessment; help you identify various ways in which you can assess your students' learning or make judgments on your students' learning in science, as well as to help you identify areas of assessment you might wish to learn more about to enhance your practice.

3. Implementation stage. I would like to offer you my support to plan, design and implement summative assessment strategies during the course of the research. The

teachers will implement new summative assessment ideas in their classrooms between March and September 2008.

4. Classroom observations. I would like to observe your Year nine students perform a summative assessment task. The purpose of this classroom observation is not to evaluate your teaching, but rather to observe how well students perform the summative assessment task. I would like to conduct two classroom observations during the course of the study and will discuss this aspect in some detail with you when I visit your school in February 2008.

The data generated from the study will be used for my doctoral thesis and any academic papers and presentations relating to my study. I can assure you that all information obtained from you and your students will be kept confidential and used only for the purposes of this study.

Please read through the research information sheet provided and fill in the Consent Form attached, to indicate whether you would like to participate in this study or not. I will collect the consent form from you, at your school, as soon as you have completed it. I would like to assure you that the information generated from you and your students will be kept confidential and used only for the purpose of this study. You will also be allowed to review any raw material collected and may add or delete them if you wish to do so.

Thank you for your cooperation and I look forward to your response.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Rodie', with a stylized flourish underneath.

Franco Rodie
(PhD Candidate)

Appendix D: Participant's consent form

This consent form is administered to fulfil the requirements of the University of Waikato Human Research Ethics Regulations as well as the ethical research guidelines contained in the Solomon Islands Research Act 1984, to ensure that anonymity of persons and institutions involved in the research.

Read the following statements before you sign this form (if you agree to join the research).

My participation in the research is voluntary and I have the right to withdraw at any time.

None of the quotes from interviews and observations or any written comments will be used unless I give my prior permission.

My anonymity will be preserved.

All information pertaining to me will be destroyed three years after the completion of the research.

The information about me obtained during the research will only be used for the purpose of writing the thesis, published papers, conferences presentation and talking.

My signed consent will be completed before the interviews, questions and classroom observations commence.

I have read and understood the above research information and guidelines and agree to participate in this research.

Name _____

School _____

Signed _____

Date _____

Appendix E: Baseline study interview schedule

Each interview session commenced with a general discussion about non-research related issues before I outlined the approach and format of the interview. Note that other leading questions were also asked to follow up, clarify teacher's responses and to expand on ideas that may have surfaced in the teachers responses.

1. What form of assessment do you use mostly to assess your students? Can you explain why you choose that/those types of assessment?
2. When you think of assessment, what comes to mind?
3. What does the term summative assessment mean to you?
4. What do you use summative assessment for?
5. How do you see summative assessment fitting in with your overall approach to teaching?
6. Do you plan for assessment? If 'yes', how important is it for you to plan your teaching and assessment together? If 'no', explain why?
7. What details do you include in your assessment plan? (If 'yes')
8. Do you design a test/exam yourself or do you use a test that others have prepared?
9. How do you decide the questions/or items that you include in an assessment?
10. In your view, what levels of knowledge do the assessments (tests, exams etc.), you design measure?
11. Can you tell me the structure of the test or exam you construct for your students?
12. Which of the assessment tasks you mentioned, do you use to determine your students' grades? What other factors do you consider to determine your students' grades?
13. What do you do with the data/or information that you gather from tests and exams that your students completed? Are there other ways in which you have used your students' results?
14. How do you determine the final grades that you award to your students?
15. What kind of feedback do you provide to your students?
16. How confident are you in designing a summative assessment or any other types of assessment you use?
17. Do you have a teacher professional development programme in your school? If yes, what professional development activities have you been involved in during the past 24 months? Why do you think professional development important?
18. What specific areas in assessment would you like to learn more about? Why?
19. Who do you think should be responsible for organising professional development? Why?
20. What role do you expect the principal and heads of departments in your school to play to improve assessment practices in your school?
21. What are some of the things happening in your school that might be helping you to assess your students effectively in your school/classroom?
22. What are some of the barriers that you can think of which might be limiting you from assessing your students effectively in your school/classroom?

Appendix F: Interview schedule/evaluation of professional development

Each interview session commenced with a general discussion about non-research related issues before I outlined the approach and format of the interview. Note that other leading questions were also asked to follow up, clarify teacher's responses and to expand on ideas that may have surfaced in the teachers responses.

- 1 Since we last talked in March this year, what major changes have you implemented in your teaching/assessment?
- 2 Can you tell me the changes that you made to your classroom assessment practice:
 - (a) immediately after the professional development
 - (b) some time after the professional development workshop were conducted?
- 3 In what ways did the assessment plan help you to assess your students?
- 4 Which types of assessment did you use to assess and grade your students during the classroom trial?
- 5 What did you use the summative data or information for?
 - (a) How else were you using the summative data/information?
 - (b) Was there anyone else who used the summative data/information? If yes, for what purpose?
6. Can you identify the things that made you confident in conducting classroom summative assessment during the implementation stage?
7. To what extent do you view professional development such as the one you have been through helped you to enhance your professional learning experience and expertise in assessment?
8. Has your beliefs and practice about summative assessment changed as result of the professional development? Explain.
9. What are some of the factors that supported you to implement some of the assessment ideas and procedures into your classroom practice?
10. What are some of the barriers that prevented you from implementing what you learned from the professional development workshops? What can you suggest to address the issues you experienced?
11. Is there anything else you would like to say with regards to your classroom summative assessment trial? Please feel free to comment.

Appendix G: A matrix for analysing assessment tasks

Participant:

Category	Comments
1. Classroom Assessment Plan	
a) Did the teacher devise his/her classroom assessment plan? b) Does the assessment plan give details about the i) different types of assessment that the teacher intended to use? ii) weighting for each assessment task? iii) expected learning outcomes? iv) what and how the assessment information would be used?	
2. Student Achievement Record Book	
a) Identify the assessment components that the teacher used to assess students b) Which components does the teacher consider to determine students' grades? c) Does the teacher consider weighting in his/her assessment? How much weight does the teacher give to each component? d) How does the teacher justify the weighting to the student and to you as a researcher? e) What other information about students' achievement are provided in the record book?	
3. Link between task and Year nine science outcomes	
a) Does the assessment task match the specific learning objectives/outcomes that the teacher taught and intended to assess? b) Does the assessment task include questions that assess a variety of skills such as knowledge, comprehension, application, analysis, synthesis, and evaluation? c) Are the assessment tasks of an appropriate level of difficult for the targeted students? d) Do the assessment tasks relate to students' every day experiences? e) Do the assessment tasks engage students to perform the tasks outside of the classroom?	
4. Test blueprint	
a) Did the teacher use a test blueprint to construct a test? b) What learning/knowledge areas does the blue print include? c) Does the blueprint indicate the number of questions?	
5. Scoring	
a) Did the teacher use a marking scheme or criteria? b) Was the criteria used for marking appropriate to the objectives?	
6. Feedback	
a) Did the teacher find out from students where they encountered difficulties and why those difficulties arose? b) How was the summative assessment information (students' responses both correct and incorrect) used? c) What other ways did the teacher use the SA information? d) Identify the feedback mechanism the teacher used to inform the students' performance?	

7. Grading system	
a) How did the teacher determine his/her students' grades?	
b) What grading scale does the teacher use?	
c) How consistently does the teacher use the grading scale?	
8. Item Analysis (level of learning assessed)	
a) Is it a practice item that require students to reproduce factual information or known knowledge? (Level 1)	
b) Is it a comprehension item that requires students' explanation? (Level 2)	
c) Is it an application item that require student to apply known knowledge? (Level 3)	
d) Is it a synthesis item which asks students to demonstrate their skill in bringing together and integrating diverse areas of knowledge? (Level 4) (L. Cohen, et al., 2007, p. 424).	

Appendix H: Professional development workshop questions

The following questions were used as a guide to elicit information about teachers' views about professional development, what they learned, and how they learned at the beginning, during, and at the end of the 4-day workshop.

1. Questions asked at the beginning of professional development	Comments
a) What assessment issues do you experience in your school?	
b) What is professional development? Why do you think it is important?	
c) What do you expect to achieve from this professional development workshop?	
d) How do you see your role in this professional development workshop?	
2. Questions asked during the professional development workshop sessions	
a) What have you learned from the assessment activity?	
b) What are some of the strategies that your group used to complete the assessment activity?	
c) In what ways did each strategy you used help you to learn about the new assessment procedures?	
3. Questions asked at the end of the professional development workshops	
a) What have you learned professional development workshops?	
b) How well do you think you have learned the new assessment ideas from the professional development workshop organised?	
c) Can you suggest ways to improve the professional development?	
d) Which assessment ideas and procedures you learned are you more likely to apply to your classroom?	
e)	

.....||.....