



MONASH University

Thai primary teachers' thinking about formative assessment

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Abstract

This thesis is a qualitative study that aims to understand Thai primary teachers' thinking about formative assessment. The study design sought to obtain information about how Thai primary teachers understand the place and value of formative assessment in their science teaching and learning. In addition, this study addressed a range of factors influencing their decision to implement formative assessment practices and the use of formative assessment to assess student learning in particular ways that manifested teachers' science teaching and learning practices.

This research was conducted in two phases. In Phase One, a pilot study where the researcher invited approximately 500 public primary teachers from all regions of Thailand to complete a questionnaire, consisting of approximately 30 closed questions. The findings from the questionnaire formed the basis for selecting interview participants and developing interview questions for Phase Two, the main study of this research. The main study identified thirteen questionnaire respondents. Qualitative data gathered from a semi-structured interview provided further insight into the participants thinking about formative assessment. All interviews conducted in Thai underwent transcription and translation into English. The study used thematic analysis methods developed by Braun and Clarke (2006) as a foundational method for qualitative analysis.

Key themes from analysis of the interviews captured that Thai primary teachers provide deep insights into the complex nature of understanding of the place and value of formative assessment. It is best to describe as a continuum moving from simple to more complex. This study found that teachers' content knowledge and their learning experiences connected with formative assessment as part of their initial teacher education programs have an impact on decisions to implement formative assessment practices. Additionally, the analysis revealed the

significance of challenging aspects of Thai cultural values to the implementation of formative assessment practice in a Thai primary classroom context. These included the traditional Thai rigour of controlled-based teaching methods, the components of Thai culture characterised by a hierarchical structure for interaction which shapes the school context and the role of the Thai teachers and students. For Thai teachers, these fundamentals made implementing a formative assessment approach more challenging. Embedded assessment practices driven by Thai cultural aspects and teachers' perspectives about teaching and learning took many forms in the teachers' classrooms.

This study will contribute significant knowledge about Thai primary teachers thinking and experiences of formative assessment in the science classroom. In order to achieve the proposed pedagogical reform and succeed in the implementation of formative assessment in educational reform, it will require the relevant stakeholders to take action and work collaboratively. The study urges Thai policymakers to revisit assessment policy. The teacher educators have to effectively provide the knowledge and fundamental philosophy of formative assessment establishing connections to science teaching in a real classroom context for pre-service teachers. These approaches are urgently required to provide appropriate support and resources that meet Thai teachers' current needs in relation to their ongoing professional development. This study suggests that schools should provide a place in a supportive atmosphere in order to help teachers with embedding ideas of formative assessment in science education effectively.

Declaration

This thesis is an original work of my research and contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Signature:

Sanikan Saneewong

Date: February 2020

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Table of Contents

Copyright Notice	i
Abstract	ii
Declaration	iv
Acknowledgements.....	v
Table of Contents	vii
List of Figures and Tables	xiv
List of Abbreviations.....	xv
Chapter 1: Introduction.....	1
1.1 Background and Rationale of the Study	1
1.2 Context of the Study.....	3
1.2.1 Thailand’s education system.....	4
1.2.2 Education reform in Thailand.	8
1.2.3 Science education in Thailand.	10
1.2.4 Teacher education in Thailand.....	13
1.3 Significance of the Research	14
1.4 Research Aim and Research Questions.....	16
1.5 Organisation of the Thesis.....	16
1.6 Summary	19
Chapter 2: Literature Review	21
2.1 Introduction	21
2.2 Teacher Thinking	21
2.2.1 Defining teacher thinking.....	22
2.2.2 Factors affecting teacher thinking and practice.	24
2.2.2.1 Teacher content knowledge.	25

2.2.2.2	Teacher beliefs of teaching and learning.	25
2.2.2.3	Contextual factors.	27
2.2.3	Potential contribution to student learning.	27
2.3	Assessment and Formative Assessment	29
2.3.1	Definition and type of assessment.	30
2.3.2	Formative assessment.	32
2.3.2.1	Formative assessment strategies.	34
2.3.3	Factors affecting teachers' formative assessment practice.	36
2.3.3.1	Teacher knowledge.	37
2.3.3.2	Teacher attitude.	38
2.3.3.3	Internal school support.	39
2.3.4	Formative assessment in contexts.	40
2.3.4.1	The formative assessment movement in Asian countries.	41
2.3.4.2	Formative assessment in Asian classrooms.	42
2.3.4.3	Formative assessment in science education.	45
2.4	Teachers' Thinking about Formative Assessment	46
2.5	Summary	48
Chapter 3: Assessment in the Thai Cultural Context		49
3.1	Introduction	49
3.2	Thai Culture.....	50
3.2.1	Collectivism.	51
3.2.2	Hierarchies.	55
3.3	Assessment in Thai Education	58
3.3.1	Initial teacher education.	59
3.3.2	Basic education core curriculum.....	61
3.3.3	Guidelines for measuring and assessing learning.	65

3.4	Researcher as Insider and Outsider	66
3.5	Summary	69
Chapter 4: Methodology	70	
4.1	Introduction	70
4.2	Research Approach.....	70
4.2.1	Qualitative research approach.....	70
4.2.2	Constructivism.....	72
4.3	Research Design	73
4.3.1	Research phases.....	73
4.3.2	Research participants recruitment.....	74
4.3.2.1	Target population.....	74
4.3.2.2	Preliminary selection of research participants.....	75
4.3.3	Pilot Study.....	75
4.3.3.1	Participants.....	75
4.3.3.2	Data collection method: Online-based questionnaire.....	76
4.3.3.3	Testing the questionnaire.....	77
4.3.3.4	Data collection procedure.....	78
4.3.3.5	Data analysis.....	79
4.3.3.6	Limitation of pilot study.....	81
4.3.4	Main Study.....	81
4.3.4.1	Participants.....	81
4.3.4.2	Data collection method: Semi-structured interview.....	86
4.3.4.3	Data collection procedure.....	88
4.3.4.4	Data analysis: Thematic analysis.....	91
4.3.4.5	Limitation of main study.....	94
4.4	Quality Criteria and Ethical Considerations.....	95

4.5	Summary	98
Chapter 5: Thai Primary Teachers' Thinking about the Place and Value of Formative Assessment in Science		
		99
5.1	Introduction	99
5.2	A Continuum Construct of Understanding.....	99
5.3	Frequency of Use—A One-Time Event (simple) to an Ongoing Part of Teaching Practice (more complex)	100
5.4	Reasons for Valuing Formative Assessment.....	105
5.4.1	Formative assessment—Information about a level of achievement that can become an incentive for student learning.	106
5.4.2	Formative assessment—Information about student learning needs which can support student learning.	108
5.5	Recognising the Potential of Formative Assessment to Inform Teaching Practice ..	111
5.6	Summary	116
Chapter 6: Potential Factors Influencing Thai Primary Teachers' Thinking about Formative Assessment in Science.....		
		118
6.1	Introduction	118
6.2	Teacher-Related Factors.....	118
6.2.1	Teacher knowledge about formative assessment.	119
6.2.2	Science content knowledge.....	120
6.2.3	Understandings about the role of the teacher.....	122
6.3	Student-Related Factors	126
6.3.1	Student learning behaviour.	126
6.3.2	Family support.	128
6.4	School-Related Factors.....	131
6.4.1	Limited time.....	132
6.4.2	Class size.....	135
6.4.3	Pressure from the school leadership.....	136

6.5	Summary	139
Chapter 7: Formative Assessment Practices as described by Thai Primary Teachers		141
7.1	Introduction	141
7.2	Eliciting Evidence of Student Learning	141
7.2.1	Questioning.	142
7.2.2	Observation.	148
7.2.3	Self- and peer-assessment.	151
7.2.4	Testing.....	154
7.3	Providing Feedback to Students	156
7.3.1	Written and non-verbal feedback.	157
7.3.2	Verbal feedback.	158
7.4	Making Adjustments to Subsequent Instruction	160
7.5	Summary	163
Chapter 8: Discussion		165
8.1	Introduction	165
8.2	Research Question 1: What do Thai Primary Teachers' Think about the Place and Value of Formative Assessment to Support Science Teaching and Learning?.....	166
8.2.1	Making sense of teacher thinking about formative assessment.	166
8.2.1.1	Teachers frequency of use of formative assessment.....	167
8.2.1.2	Teachers' understanding the value of formative assessment.....	168
8.3	Research Question 2: Why do Thai Primary Teachers Hold these Ideas about Formative Assessment?.....	170
8.3.1	Making sense of factors influencing teacher thinking about formative assessment.	170
8.3.1.1	Teacher knowledge.	170
8.3.1.2	Thai culture aspects.	173
8.3.1.3	School context.	179

8.4	Research Question 3: What Practices do Thai Primary Teachers Describe when asked about Formative Assessment and What do these Reveal about Science Teaching and Learning in Thai Primary Classrooms?.....	180
8.4.1	Making sense of Thai primary teacher implementation of formative assessment.	180
8.4.1.1	Formative assessment practices are strongly driven by Thai cultural factors... ..	181
8.4.1.2	Making room for formative assessment by building a sense of trust.	183
8.5	Implications and Recommendations for Stakeholders	185
8.5.1	Policy-makers.....	186
8.5.2	Teacher educators.	187
8.5.3	Professional developers.....	188
8.5.4	School leadership teams.....	189
8.6	Summary	191
Chapter 9:	Conclusion	194
9.1	Introduction	194
9.2	Overview of the Research	194
9.3	A Summary of the Key Findings.....	196
9.4	Limitations of this Study	199
9.5	Recommendations for Future Research	200
9.6	Personal Implications	202
9.7	Concluding Remarks	203
References	206
Appendices	234
	Appendix 1: Permission letter from the Secretary-General of the Office of the Basic Education Commission (OBEC), Ministry of Education (MOE), Thailand	234
	Appendix 2: Ethics Approval from the Monash University Human Research Ethics Committee	235

Appendix 3: Explanatory Statement	236
Appendix 4: Questionnaire.....	239
Appendix 5: Semi-Structured Interview Questions	244

List of Figures and Tables

<i>Figure 1.1.</i> Thai education system	7
<i>Figure 2.1.</i> A conceptual model of the processes influencing and influenced by teachers' thinking	29
<i>Figure 4.1.</i> The process of collecting data	74
<i>Figure 4.2.</i> A pilot study data collection procedure.....	79
<i>Table 4.1</i> A summary of pilot study Participants by Region of Thailand	76
<i>Table 4.2</i> Summary of Data Collection of main study	89

List of Abbreviations

IPST - the Institute for the Promotion of teaching Science and Technology

ITE - Initial teacher education

LAOs - Local Administration Organisations

MOE - Ministry of Education

MOI - Ministry Of Interior

MUHREC - Monash University Human Research Ethic Committee

OBEC - Office of the Basic Education Commission

OEC - Office of the Education Council

OECD/UNESCO - Organisation for Economic Co-operation and Development/United
Nations Educational, Scientific and Cultural Organisation

OHEC - Office of Higher Education Commission

ONEC - Office of the National Education Commission of Thailand

ONET - Ordinary National Educational Test

OPEC - Office of the Private Education Commission

OPS - Office of the Permanent Secretary

OVEC - Office of the Vocational Education Commission

PD - Professional development

Chapter 1: Introduction

This study explores Thai primary teachers' thinking and understanding about the nature of formative assessment, the factors influencing their thinking and decision making about the implementation of formative assessment, as well as teachers' individual formative assessment practices and what these reveal about nature of science teaching and the learning in Thai classroom. This chapter presents an introduction to this research, organised into five sections. It begins with the background of this study, providing an overview of the rationale for the research and the statement of the problem. The second section provides information outlining the context of the research, including a brief description of the Thai education system, the current state of Thai educational reform, science education, and pre-service teacher education in Thailand. A discussion then follows about the significance and purpose of the study and the research questions. The last section of this chapter presents the structure of this thesis.

1.1 Background and Rationale of the Study

This research arises partly from my experience as an academic educator in Thailand and partly from a reflection of the work I have undertaken with Thai primary teachers in public schools. Since 2011, I have been working as an academic educator for the Compulsory Science Division in the Institute for the Promotion of teaching Science and Technology (IPST). My work has aimed to develop the capacity of Thai public primary school teachers to enhance science teaching. In this role, I have observed that many primary teachers in Thai public schools appear to lack interest in developing and improving their science teaching. These observations may be related to a number of issues. One may be that these teachers know they have job security due to their ongoing employment conditions within the Thai public system. Therefore, there may be little incentive for them to change their practice.

Another reason may be that Thai teaching has traditionally focused on finding ways to ensure students achieve high scores on end of year tests and also on the *Ordinary National Educational Test (ONET)*¹. Therefore, many of these teachers presently adopt, teaching approaches traditionally seen as highly valued that focus on the transfer of knowledge, over approaches designed to enable students to construct their own knowledge. While working in the role of researcher, I have also observed that primary teachers often appear to lack content knowledge in some branches of science.

I worked with my colleagues at IPST to address these areas by developing teacher Professional Development (PD) programs to assist public primary teachers to more effectively attend to students' learning goals and needs, especially in science education. These PD programs provided opportunities for teachers to build their content knowledge and pedagogical content knowledge and encouraged teachers to reflect on their teaching practice. Teachers who attended these PD programs had opportunities to experience a range of teaching strategies and explore a range of formative assessment techniques designed to elicit student understanding.

Following these workshops, professional instructors interviewed public primary teachers to learn more about the impact of these programs. The data indicated that while teachers gained more confidence in teaching science and their content knowledge, and an apparent increase in pedagogical content knowledge and skills of teaching occurred, teachers did not develop or adopt formative assessment as part of their teaching practice. Responses indicated the teachers believed formative assessment was challenging to use in a real

¹ Ordinary National Educational Test (ONET) is a national standardised test administered to grade 6, 9, and 12 students. The objectives of ONET are to test the knowledge and thinking ability, to assess the academic proficiency, to provide information to the schools to improve their teaching and learning activities, and to evaluate the quality of education at the national level.

classroom situation and was time-consuming when working with a large number of students. Many teachers believed the program content was not a comfortable fit with all school contexts. In terms of formative assessment techniques, many teachers were often reluctant to apply these approaches in their classroom. They gave a reason that they lacked knowledge about how to assess student thinking and learning, while others did not recognise or value the benefits of formative assessment.

These PD opportunities appeared to enable teachers to gain more content knowledge in science, but teachers were still reluctant to implement formative assessment in their classroom. So this leads me to wonder if there was specific information about formative assessment that Thai primary teachers needed that existing PD opportunities were not providing or if the information could be aligned more closely with the thinking and experiences of Thai primary teachers. To identify this information, perhaps it is important to understand more about how Thai primary teachers' think about their existing assessment practices, in particular why they think the approaches they use matter. Since teachers who have different knowledge, beliefs, and experiences in teaching and learning may interpret the same classroom instruction in different ways. Additionally, we know little about Thai teachers' thinking about assessment, in particular, formative assessment. Therefore, this research aims to learn more about Thai teachers' thinking about formative assessment, and understand what informs their thinking about the place and value of formative assessment in their teaching, and how they implement this approach in their own ways.

1.2 Context of the Study

This section provides background knowledge of the Thai context, where the study was situated. In order to facilitate an understanding of the Thai education system, I explain key educational policies and developments such as the National Education Act of 1999, science education, and teacher education in Thailand.

1.2.1 Thailand's education system. As stipulated in the 1999 National Education Act, the Ministry of Education (MOE) is the primary agency responsible for promoting and supervising the provision of education at all levels including basic and higher education and of all types include formal, non-formal and informal education (Ministry of Education [MOE], 2017).

Five major agencies operate the education administration and management system at the central level (MOE, 2017):

1. The Office of the Permanent Secretary (OPS) is responsible for coordinating operational and budgetary affairs within the Ministry, setting out the priorities, guidelines and work plans of the Ministry, and supervising the provision of non-formal, informal and private education;
2. The Office of the Education Council (OEC) is responsible for formulating national education policies, plans and standards, mobilising educational resources, reviewing educational provision, conducting research and developing educational laws;
3. The Office of the Basic Education Commission (OBEC) oversees the provision of general education from pre-primary to upper secondary levels to ensure that all school-aged children have access to basic education;
4. The Office of the Vocational Education Commission (OVEC) administers the provision of technical and vocational education, from upper secondary level to post-secondary education, integrating the labour market demands of the country into the framework; and
5. The Office of the Higher Education Commission (OHEC) regulates higher education standards and quality, provided by public and private tertiary educational institutions.

At present, there are four government-supervised agencies and three public organisations established to supervise specific tasks mandated by the Ministry (MOE, 2017). IPST is one of the four government agencies under the direction of the MOE, which take responsibility to conduct research on curriculum development, evaluation and pedagogical materials related to these subjects and offer training to teachers and students. IPST is involved in setting the learning standards and provides content information for the core subjects of science, mathematics and technology for basic education. For the science strand, IPST also provides learning units, basic science course descriptions and lesson plans which consist of concept maps, content for levels and grades, along with expected learning outcomes for successive periods from Grade 1 to Grade 12. All this information comprises the core of basic education curriculum as stipulated in the National Education Act of 1999 (Institute for the Promotion of Teaching Science and Technology [IPST], 2005).

Thailand's education system includes public, private, municipal and demonstration schools. The majority of schools in Thailand fall under the public school system, i.e., over 30,000 schools across the country. The number of municipal schools² is around 20,000 schools, while there are about 4,000 private schools. Demonstration schools³ are the minority of schools, i.e., less than 70 schools. Teaching and learning in each type of school are promoted by different agencies. The IPST has the mandate from the MOE which is responsible for the promotion of teaching and learning in mathematics, science and technology for teachers in public schools, while Local Administration Organisations (LAOs),

² Municipal schools offer primary and secondary education according to local needs. These schools are operated by Local Administration Organisations (LAOs). The Ministry of the Interior (MOI) oversees and finances LAOs while the MOE helps organize and provides guidance to local authorities.

³ Demonstration schools offer primary and secondary education. These schools are operated in alignment with the faculty of education in public and private university and are used for the training of pre-service teachers, education research and development.

Ministry of Interior (Ministry of Interior [MOI], 2008) directs teachers in municipal schools.

OPEC supports teaching and learning in private schools, and demonstration schools operated in association with a university. This information is outlined in Figure 1.1.

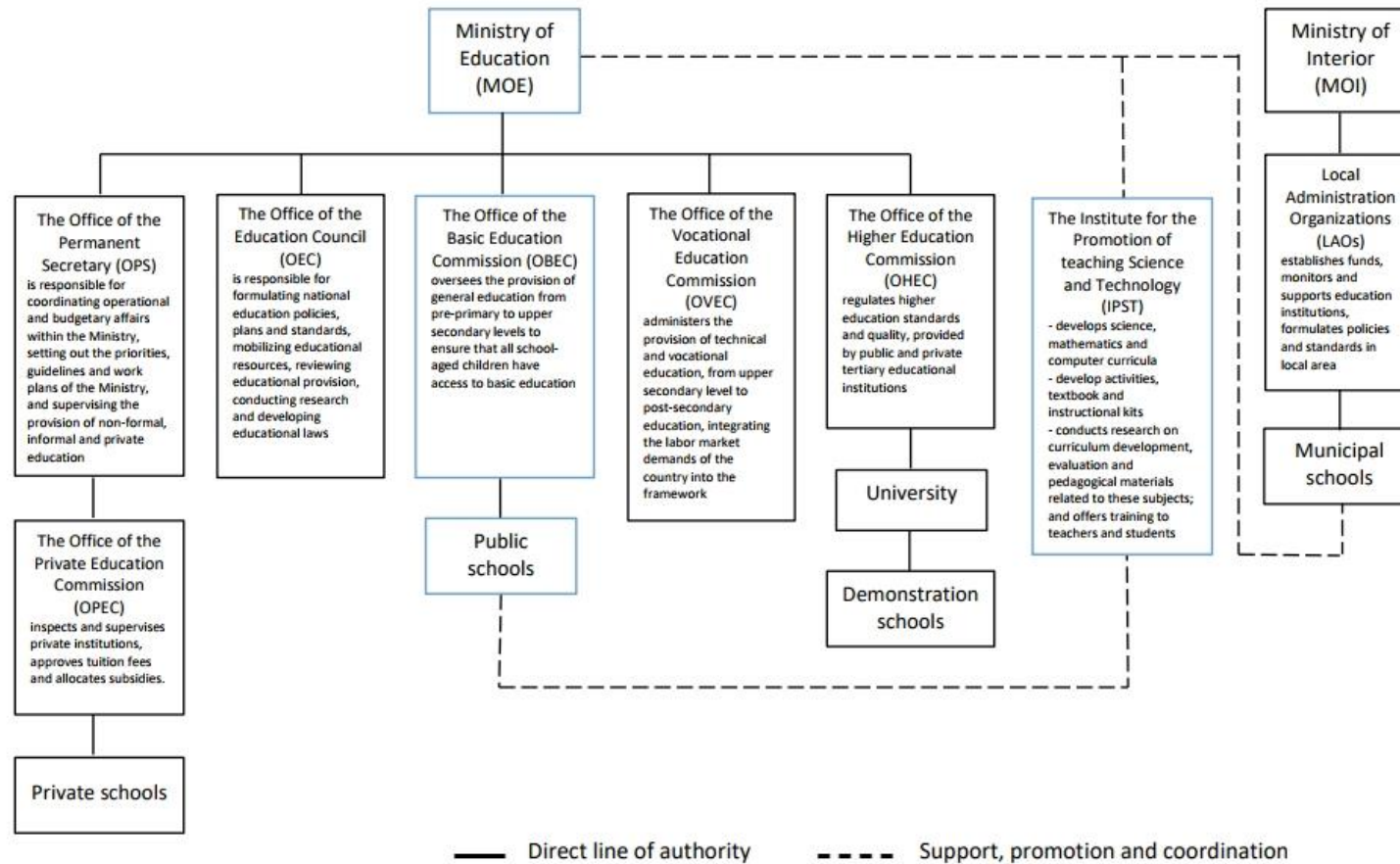


Figure 1.1. Thai education system

1.2.2 Education reform in Thailand. In the present economically competitive world, most modern industrial countries place a high value on education, in particular, scientific and technology literacy and skill development. Thailand, like other developing countries in Southeast Asia, has been influenced by globalisation and Westernization, especially the Thai education system. Thailand's response has been to develop an education curriculum that encourages young people to value learning while developing attitudes and skills needed for the cultural challenges of globalisation (Office of the National Education Commission [ONEC], 2003). This has led to the introduction of the most significant education reform in Thailand.

The first National Education Act was introduced in 1999, to serve as the fundamental law for the educational administration, management, and standards in Thailand. The recent educational reform, prescribed by the Act of 1999, requires all 7-year-old Thai children to enrol in compulsory education from primary to lower secondary levels. The Thai government supports the right of all children to receive equal opportunities and access to free basic education, i.e., 12 years of education which includes three years of early childhood education, six years for primary education and three years of lower secondary education (Office of Education Council [OEC], 2004). Through this Act, the MOE also hoped to prepare Thai students to have more strength and stability in the age of globalisation.

The Act policy sets out a vision in which teaching should aim at enabling students to develop themselves at their own pace and to the best of their potential (ONEC, 2000). In doing so, the Act publicly introduced a student-centred approach for all educational systems operating in Thailand (ONEC, 2000) in an attempt to help students become more critical and analytical thinkers as well as to be more competitive in the era of globalisation. With learning achievement established as the ultimate objective of teaching and learning, Thailand developed a system of assessment based on authentic learning and assessment experiences. Authentic assessment has been defined in Thai policy as learners participating in the evaluation of their own learning

development (ONEC, 2000). It requires assessment processes based on a real situation (ONEC, 1999).

In 2008, the Ministry of Education announced the Basic Education Core Curriculum (MOE, 2008) categorised into eight learning areas:

1. Thai language;
2. Mathematics;
3. Science;
4. Social studies, religions and culture;
5. Health and physical education;
6. Arts;
7. Career and technology; and
8. Foreign languages.

All curricula were required to emphasise the student-centred approach to reflect the aims of the 1999 Act. Thus, the objectives of the Basic Education Core Curriculum reform document sees students as most important, and learning processes should, therefore, be organised through the use of a student-centred approach to enable students to achieve curriculum goals (MOE, 2008). Learning activities design and teaching practice should facilitate and motivate students to construct their own understanding as meaningfully and effectively as possible (MOE, 2008).

In 2017, Thailand had prepared a new 20-year plan, the National Scheme of Education B.E. 2560-2579 (2017-2036), which responds to the 20-year National Strategic Framework and the 12th National Economic and Social Development Plan B.E. 2560-2564 (2017-2021) (MOE, 2017c). The vision of the National Scheme of Education is to see that “all Thai people are provided with quality education and engage in lifelong learning as well as live happy lives on the basis of the principles of a sufficiency economy and global changes in the 21st century (MOE, 2017c, p. vi)”.

To respond to the National Scheme of Education, three learning areas (1) mathematics, (2) science and, (3) social studies, religions and culture of the 2008 Basic Education Core Curriculum were revised (MOE, 2008, 2017a).

1.2.3 Science education in Thailand. Before the reform of the science curriculum in Thailand, primary science was incorporated as a part of Life Experiences subject. Currently, science is a separate subject that all students are now required to engage with (MOE, 2017a).

The main content areas include:

1. Biological science;
2. Physical science;
3. Earth and Space science;
4. Technology.

To support science learning, skills in analytical and creative thinking, problem-solving, technological application, capacity for teamwork, and the ability to apply life skills comprise the key competencies (MOE, 2008, 2017a). The goals of the Thai National Science Education Standards are to:

- allow students to participate in activities that position science learning as a lifelong pursuit with basic science learning helping students to understand, appreciate and realise the importance of nature and the environment,
- develop students' ability to apply knowledge to their higher education and daily lives,
- develop students' ability to solve problems systemically and make decisions using various types of data and investigated evidence; and
- develop students' science process skills and 21st-century skills (MOE, 2017a).

The MOE expects all students engaging with the reform-based curriculum to think, do, and learn on their own, and encourages them to construct their own knowledge in ways that effectively confront issues arising from science, technology and society.

Using this reformed curriculum is seen as the most crucial action within the teaching and learning reform. With an emphasis on teachers as being responsible for addressing learners' needs, they must actively shift their teaching focus from a teacher-centred approach toward a more student-centred approach (IPST, 2005). In a student-centred approach, teachers are facilitators, providing opportunities and an appropriate atmosphere conducive to quality learning enabling students to construct knowledge that is personally meaningful. The activities should be designed to meet the individual student's needs and should enable a student to construct their own understandings from their experience. As a facilitator, the teacher is also responsible for: challenging students; helping students clarify their ideas; giving feedback; suggesting appropriate guidelines for learners; and, assessing student learning. Moreover, teachers are encouraged to improve the quality of their teaching and be innovative with the assessment instruments and techniques they use (OEC, 2004).

Promoting and implementation of the student-centred approach in science have been the primary focus of the IPST. In the Thai National Science Curriculum Standards, the IPST (2005) highlights the importance of student ability to conduct scientific inquiries and develop the appropriate knowledge, process and attitude to enhance the process of learning science. Every student should be encouraged to be interested in and enthusiastic about learning science. Students should be curious and eager to learn about the surrounding natural world and be capable of accumulating data, analysing results, making decisions and communicating their discoveries to other students. The IPST introduced to science teachers approaches, such as 5E inquiry-based learning, problem-based learning, a hands-on and mind-on activity, a Think-Pair-Share learning activity, and a jigsaw activity as effective student-centred teaching strategies (Pisarn, 2001).

These strategies were developed and implemented by teachers to help their students accomplish the educational goals mentioned in the curriculum.

Although the Thai government has actively encouraged teachers to adopt this student-centred learning approach for many years, many Thai teachers still act as traditional lecturers by attempting to tell or transfer knowledge in all subjects (Buarapha, Singh, & Roadrangka, 2010). Recent research has also highlighted that many Thai teachers still lack understanding of content knowledge, pedagogical content knowledge, and analytical and critical thinking skills (Puengpang, Roadrangka, & Cowie, 2007). At the primary education level in Thailand, Thai primary teachers are generalist teachers and are therefore required to teach all subjects in the curriculum. Many of these teachers have not completed a science major in their initial teacher education studies. Furthermore, many primary teachers believe everybody can teach science at the primary level and that teachers do not need to deeply understand science to teach at these levels (Soydhurum, 2001). As a result, teachers at the primary level tend to cover science content using traditional teaching strategies (Soydhurum, 2001) through science taught in a lecture format, i.e., chalk and talk, with most teachers focusing on students' memorising science content (Pravalpruk, 1999). In these classrooms, teachers dominate the dialogue, and there are few interactive conversations between teacher and students. These teachers usually emphasise rote learning and content coverage rather than develop a conceptual understanding of phenomena. As a result, Thai science teaching has not improved students' experience of scientific processes, problem-solving skills, or provided an opportunity for students to develop an inquiring scientific attitude (Soydhurum, 2001). Moreover, the results of Thai national tests and international examinations such as TIMSS and PISA have shown that Thai students perform poorly in science and mathematics (Mullis, Martin, Foy, & Hooper, 2016a, 2016b; OECD, 2019; Soydhurum, 2001).

1.2.4 Teacher education in Thailand. Initial teacher education (ITE) in Thailand has a long history. It was established in 1892 (Thongthew, 2014), and it has changed over the period in response to changes in both the Thai political and economic context (Thongthew, 2014).

In early 1954, the Department of Teacher Training was established to help guide and ensure that the existing teacher training schools, as they are referred in Thailand rather than ITE providers, were of compatible standards, aligned to the development of the national economy, and to respond to the national needs (Thongthew, 2014). The initiation of the 2-2-2 standard criteria was set up by the Department of Teacher Training in 1956. Graduates with secondary school certificates who wanted to be a teacher were required to take the first two years in teacher training schools to get their first teacher certificates. With the first teacher certificates, they were eligible to teach in any primary school. If they continued their study for two more years, they were awarded a second teacher certificate that allowed them to teach in secondary schools. The last two years provided those who continued their study in teacher training schools with a Bachelor degree in teacher education (Thongthew, 2014).

After 1973, a major educational reform movement emerged. It was believed that there must be improvements in the Thai educational system with a renewed emphasis on subject knowledge and approaches to teaching and learning to prepare a more active population with the improved ability to cope with any changes in society and economy. Accordingly, the Teacher Training College Act of 1975 required both primary and secondary school teachers to obtain Bachelor degrees (Thongthew, 2014). Thailand, therefore, has undergone a rapid transformation from a traditional teacher training model to a graduate teacher education model.

The National Education Act of 1999, demanded a higher level of knowledge and skills, especially the critical thinking skills needed for citizens in the new decade of high technology. In response, teacher training institutes produced a five-year curricula programme. Pre-service teachers spend four years doing course work and one year placed in a school context (Narot,

Netthanomsak, Luanganggoon, & Yuenyong, 2011). The teacher training curricula provide pre-service teachers with learning and activities designed to prepare them to be effective teachers in accordance with the Act and the needs of Thai society. In terms of the delivery of ITE programs, there are a number of public and private teacher institutes working in this area, for example, the Faculty of Education in government and private universities (Chanbanchong, 2010). All ITE curriculum needs to be approved and certified by the committee of the Teachers' Council of Thailand (Faikhamta, Ketsing, Tanak, & Chamrat, 2018).

In response to the Teachers and Educational Personnel Council Act of 2003 and public concern over the quality of teachers, Thailand introduced a licensed and certified professional teacher model. Those who seek to work in the teaching profession only become qualified if they have met the knowledge, professional experience, and ethics standards. Only a qualified person has the right to obtain a Teacher Certificate, and they are entitled to teach in all schools for four years (Thongthew, 2014).

Despite Thailand's policy and continuous efforts to ensure the quality of ITE programs, a study from Grossman (1990) found that ITE programs in Thailand, especially for primary teachers, provided little focus on developing pre-service teachers' knowledge of content, pedagogical content knowledge and did not prepare teachers' with the abilities to selectively use strategies that maximise student outcomes. As a consequence, there is still a lack of basic education provided for teachers. Moreover, the ITE curriculum was inconsistent with the primary and secondary curricula, and the teaching process focused more on theory than practice (Faikhamta et al., 2018).

1.3 Significance of the Research

In recent years, the amount of research about the role of formative assessment in education is growing, and there is deepening interest in how this form of assessment can be developed in practice. However, there is still little literature available on teacher's thinking about

formative assessment, particularly in the Thai context. A few Thai-based studies have reported on: the development of a model for Mathematics classroom assessment (Junpeng, 2012; Marwiang, Junpeng, & Nakorn, 2014); the level of teachers' classroom assessment literacy (Yamtim & Wongwanich, 2014); and teachers' attitudes toward formative assessment with a focus on the use of student portfolios (Tangdhanakanond & Wongwanich, 2012). Researchers know very little about how Thai teachers' think about formative assessment and how they implement formative assessment in Thai classrooms, particularly in the context of science education. In light of the limited number of studies on teacher thinking about formative assessment in Thailand, this study hopes to fill this identified gap. Additionally, the findings of this research will potentially:

- Provide a more in-depth insight into Thai primary teachers' thinking about assessment in Thai classrooms and their understanding of the potential benefit of formative assessment in classroom teaching;
- Benefit teacher participants through generating informed reflection on their own experiences of formative assessment practice;
- Help to raise awareness about what matters to Thai primary teachers and how best to bring formative assessment as part of routine practice in primary schools;
- Inform policymakers and curriculum developers about how to more effectively inform teachers about how to develop pedagogy that focuses strongly on developing formative assessment to promote and improve student learning; and,
- Inform policymakers and curriculum developers, in particular, those who formulate and shape Thai assessment policy, and teacher training and retraining, to more effectively develop and implement PD that enables Thai teachers to recognise the value of formative assessment in science teaching and learning.

1.4 Research Aim and Research Questions

This study was conducted in Thailand utilising a qualitative approach to explore the diverse ways in which Thai primary teachers' think about and understand the nature of formative assessment in their science teaching. This study also investigated the potential factors that influenced Thai primary teachers thinking and decision making to implement formative assessment in their science teaching, including the impact of the Thai context in terms of the opportunities available for teachers to experience and learn about formative assessment and the impact this has on their ability to use formative assessment. A richer understanding of the practices Thai teachers associate with formative assessment, particularly in their science classroom, is also explored. This study investigates how these practices are manifestations of teachers' science teaching and learning practices. The key research questions for this study are:

1. What do Thai primary teachers' think about the place and value of formative assessment to support science teaching and learning?
2. Why do Thai primary teachers hold these ideas about formative assessment?
3. What practices do Thai primary teachers describe when asked about formative assessment and what do these reveal about science teaching and learning in Thai primary classrooms?

1.5 Organisation of the Thesis

This thesis is organised into nine chapters.

Chapter 1: Introduction provides an overview of the study that includes information on my background and research interests, the context of education in Thailand, the significance of the study and research aim and research questions.

Chapter 2: Literature Review presents a review of literature that guides and structures the study. The first section aims to review research on teacher thinking giving information about definitions and presenting factors affecting teacher thinking and practice and potential

contribution to student learning. The second section provides a review of formative assessment. This section begins with information about types of assessment and then presents the characteristics associated with formative assessment including a range of different factors that influence teachers' decision making when it comes to the implementation of formative assessment in the classroom. Research on formative assessment in the context of non-Western education and science education follows. The section ends with research on teacher thinking on topics related to formative assessment.

Chapter 3: Assessment in the Thai cultural context is a review of the literature that includes Thai cultural dimensions and formative assessment in Thai education. Information is also provided here about the position of researcher in this study. The chapter begins with a review of the characteristics and dimensions of the national culture in Thailand and the influence of Thai culture on education. The chapter goes on to address how cultural understandings may affect teacher and student thinking and behaviours and then considers how these Thai cultural factors may also impact upon teacher understandings of assessment and assessment practices. Background information provides a synopsis of assessment in Thai education curriculum. This chapter also addresses the role of the researcher as that of an insider who understands Thai culture and as an outsider who is seeking to understand the role of assessment from a perspective that is different from the Thai teacher lens.

Chapter 4: Methodology presents the research methodology. This chapter initially presents the research approach and the rationale for choosing the constructivist qualitative paradigm. Then, an overview of the research design is introduced, providing information about participant selection criteria, how I conducted the study, and how the data was collected, coded, and analysed. This chapter ends with a discussion of criteria ensuring the quality of the research and ethical considerations.

Chapter 5: Thai primary teachers' thinking about the place and value of formative assessment in science. This chapter presents the findings in relation to research question one. This information includes participant teachers' general descriptions of when formative assessment took place in their classrooms and explanations of formative assessment practices which serve as evidence of teacher understanding. The discussion also presents participant teachers thinking about the perceived benefits and role of formative assessment and their understanding of the relationship between formative assessment and change in teaching practice and professional growth.

Chapter 6: Potential factors influencing Thai primary teachers' thinking about formative assessment in science. This chapter presents the findings in relation to research question two. Information includes participant teachers' descriptions of and perspectives about the constraints that impact their thinking and decision making when implementing formative assessment in their daily science teaching practices. Three main areas of influence discussed are teacher-related factors, student-related factors, and school-related factors.

Chapter 7: Formative assessment practices as described by Thai primary teachers. This chapter outlines the findings in relation to research question three, including information relating to formative assessment strategies used by participant teachers in the context of science teaching and learning. This chapter presents three significant ways Thai primary teachers implemented formative assessment: strategies designed to elicit evidence of student learning; providing feedback to students; and making adjustments to subsequent instruction. These practices reflect the nature of science teaching and learning in Thai primary classrooms.

Chapter 8: Discussion. This chapter presents an analysis and discussion of the key findings presented in Chapter 5, 6 and 7 in relation to the research literature. Included in this discussion are considerations about Thai primary teachers' understanding of the concept of formative assessment and the range of factors contributing to teachers' decisions about adopting

formative assessment practices in the science classroom. This chapter highlights how Thai primary teachers implement formative assessment in their context. Following this, some recommendations for relevant stakeholders are outlined, in particular, what this information reveals about appropriate action and the need to work collaboratively with teachers to address assessment and educational equity issues that are problematic in Thai education system.

Chapter 9: Conclusion. The final chapter draws the thesis to a conclusion with a summary of the key research findings, an outline of some possible areas for future research and a personal reflection on this research process including the personal implications of what I learnt along the journey of doing a PhD thesis.

1.6 Summary

This chapter aims to provide the overview of the study which includes my personal interest in conducting this research, Thai education context, research significance, research aim and research questions, as well as the structure of the thesis.

This study arises partly from my work experience, which leads me to an interest in understanding Thai primary teachers thinking on their existing assessment practices, particular in formative assessment.

The National Education Act of 1999 announced by the MOE introduced a student-centred approach for all educational systems operating in Thailand. In response to the Act, organisation of all Basic Education Core Curriculum, including science, should be through the use of a student-centred approach and a system of assessment based on authentic learning. Additionally, ITE program emphasises the development of teaching skills and knowledge in the areas of teaching practice.

This research contributes to the knowledge about teachers thinking and experiences of formative assessment, particularly in the Thai context. The deep understanding of Thai primary

teachers' thinking about formative assessment has facilitated a rethink of educational curriculum development and action to better support the development of formative assessment to promote and improve student learning and teachers' ongoing professional development in the Thai context.

This study aims to generate more in-depth insights into Thai primary teachers' thinking about formative assessment and the research questions are:

1. What do Thai primary teachers' think about the place and value of formative assessment to support science teaching and learning?
2. Why do Thai primary teachers hold these ideas about formative assessment?
3. What practices do Thai primary teachers describe when asked about formative assessment and what do these reveal about science teaching and learning in Thai primary classrooms?

The next chapter presents the review a critical review of the relevant literature, which corresponds to the dimensions of this study, teacher thinking; formative assessment; and teacher thinking on topics related to formative assessment.

Chapter 2: Literature Review

2.1 Introduction

The primary purpose of this study is to gather insights about how Thai primary teachers think and understand the nature of formative assessment, the factors that influence Thai primary teachers thinking, as well as the practices they use when implementing formative assessment in their teaching of science to support student learning. In unpacking this purpose, this chapter presents three sections.

The first section reports on a review of the literature focusing on teacher thinking. It begins with a discussion of the literature related to definitions before presenting potential factors that affect teacher thinking and subsequently influence classroom practices. The end of this section introduces contributions regarding teacher thinking about student learning. The second section is a review of the literature on formative assessment. This section begins with an exploration of assessment in education. Specifically, the focus is on the nature of formative assessment as well as the application and use of this type of assessment in school classrooms followed by an outline of the potential factors impacting teacher practice in relation to formative assessment. This section concludes by highlighting what the literature says about formative assessment in two different contexts: non-Western settings and science education. These dual contextual features are particularly important given this study was conducted in Thailand and focused on formative assessment as part of science teaching and learning. The third and final section presents a review of the literature on teachers' thinking about formative assessment.

2.2 Teacher Thinking

Teaching is a complex activity which centres around enhancing student learning. It requires teachers to undertake extensive planning, research, and reflection in order to meet the needs of diverse groups of students (ONEC, 2003; Phanchalaem & Sujiva, 2016; Shulman,

1986). When a student finds learning challenging, a teacher must be able to think, make decisions, and understand how to provide instruction that supports the needs of the student (Black, 1998; Gravois & Gickling, 2008). The teacher is one of the most critical factors in student achievement (Chetty, Friedman & Rockoff, 2011; Opfer & Pedder, 2011), which means that what teachers say and do in their classroom has a direct impact on learning (Costa, 1998; Duschl, 2003).

Understanding teacher thinking matters because thinking guides teacher attitudes and actions (Brown, 2008; Clark & Yinger, 1977; Tartwijk, der Brok, Veldman & Wubbels, 2009). A teacher's thinking also shapes the way they understand teaching and how they prioritise the various aspects of their work (Tsang, 2004). In other words, teachers' behaviour is an active expression of their thoughts. Additionally, understanding what teachers think, know, and believe contributes to a better understating of what they do in their classroom (Clark & Lampert, 1986). Thus, it is important to understand teacher thinking to make sense of teacher behaviour and ultimately identify the conditions that teachers create to support student learning.

2.2.1 Defining teacher thinking. Research related to teacher thinking has a long history. Over the past three decades, there has been a growing body of literature connected with understanding teachers' thought processes and the knowledge that teachers hold as part of a movement underpinned by the notion that "teacher behaviour is substantially influenced and even determined by teachers' thought processes" (Clark & Peterson, 1986, p. 255). By further examining teachers' thought processes, more nuanced understandings of teachers' classroom practices emerge (Clark & Peterson, 1986).

Early research into teacher thinking reveals that the ways teachers interpret and make sense of teaching influences the type of educational environment they create within their classroom (Calderhead, 1987; Clandinin & Connelly, 1987). The work from prominent scholars in this area, such as Clandinin and Connelly (1987), Clark and Yinger (1977), and Elbaz (1983),

reflect a concern that research in teacher thinking should not only emphasise content knowledge but the nature of teacher knowledge and the inclusion of professional knowledge in teaching. Calderhead (1987) defined teacher thinking as the place in which knowledge is acquired and used by teachers. This process involves knowledge about curriculum planning, teaching methods, subject matter and classroom management together with the information gained through personal teaching experiences. According to Calderhead (1987), teachers use all this information to develop their teaching skills.

Fenstermacher (1994) used the term “formal knowledge” (p. 6) of teaching to encompass the numerous facets that make up teacher thinking including knowledge about curriculum planning, theories of teaching and learning, teaching methods and approaches, subject matter, and classroom management. These insights into formal knowledge gained through empirical studies seek to understand what knowledge is essential for teachers in order to act professionally along with what aspects of this knowledge are determinants of successful and effective teaching.

Teachers build a personal understanding of teaching and themselves as a teacher through their teaching experiences. Elbaz (1983) and Fenstermacher (1994) referred to this knowledge as a ‘practical knowledge’ of teaching. Practical knowledge of teaching, also known as ‘personal practical knowledge’ (Connelly & Clandinin, 1985), has been described as the store of information and skills that guide and shape a teacher’s actions (Connelly & Clandinin, 1985; Tsang, 2004).

Personal practical knowledge is not necessarily consistent from teacher to teacher as it is diverse and contextually-derived from each teacher’s beliefs and values about the teaching profession (Elbaz, 1983). Knowledge learned through initial teacher education programs and during professional development opportunities (de Vries & Beijaard, 1999; Kagan, 1992; McGhie-Richmond, Jordan & Underwood, 2002; Stofflett & Stoddart, 1994) also have a role to play. Moreover, other sources play an important role in developing personal practical knowledge

in particular teacher's experiences of classroom teaching. Classroom experience is influential as it is highly contextual (Verloop, van Driel, & Meijer, 2001) and informed by the challenges encountered through daily practice, but made sense of through reflection (Minott, 2010; Schön, 1983). As such, personal practical knowledge develops from an individual's experiences before, during, and following their current teaching context, indicative of teachers having a repertoire of knowledge upon which they can draw while teaching.

According to Loughran (2010), formal knowledge is stereotyped as being empirically based and has little impact on teacher practice. Loughran (2010) cites a number of reasons for this, including the use of academic writing styles that are unfamiliar to teachers and that are not always compelling to the dilemmas teachers face in everyday classroom teaching. However, teachers can leverage this knowledge to inform their teaching in a meaningful way. Teachers use personal practical knowledge to interpret new information (Pajares, 1992) and apply to as well as guide their actions in practice (Johnston, 1992). According to Carter (1990), teachers use this knowledge to cope with the day-to-day practical dilemmas they face in carrying out appropriate actions where necessary, therefore, intimating that both forms of knowledge—formal knowledge and personal practical knowledge—are essential for teachers to understand their teaching.

2.2.2 Factors affecting teacher thinking and practice. During the teaching and learning process, teachers face numerous challenges that are shaped by a range of factors. Therefore the connection between teacher thinking and actions can be unpredictable, unexpected and subjective (Day, 1999). Studies have shown that teacher thinking can be influenced by the following three factors:

1. Teacher content knowledge (e.g., Gess-Newsome et al., 2019; Hashweh, 1985; Mulholland & Wallace, 2005);
2. Teacher beliefs of teaching and learning (e.g., Richardson, 1996; Roehrig & Kruse, 2005); and

3. Contextual factors (e.g., Clark & Lampert, 1986; Smith, 2017)

While touched on briefly in the previous section, I Follow with exploring each of these factors in detail.

2.2.2.1 Teacher content knowledge. Researchers such as Gess-Newsome et al. (2019) and Hashweh (1985) cited that teachers' knowledge of the content they teach influences teaching. What teachers know about the subject matter and the way in which they represent it to students influences their thinking. For example, when teachers have limited knowledge of science content, they seem reluctant to teach science due to a lack of confidence in their knowledge base (Abell & Roth, 1992; Akerson, 2004). Teachers avoid teaching science topics that they are not comfortable or knowledgeable about as they feel they might be asked content-based questions by their students that they will not be able to answer (Tilgner, 1990). The lack of self-confidence in teaching science tends to guide teachers to use teaching strategies that allow them to maintain control of the knowledge flow in the classroom, which often does not include appropriate ways of engaging students in science (Appleton, 2003). This claim aligns with the findings from a study of a primary teacher in Australia by Mulholland and Wallace (2005). They found that the teacher wanted her classroom to be under control and was embarrassed in front of students if she perceived herself as having an inadequate level of the required science content knowledge. In this instance, having control over the classroom context helped the teacher to feel confident about what the students were learning in science.

2.2.2.2 Teacher beliefs of teaching and learning. Teacher thinking is framed by personal beliefs about the nature of teaching and learning (Richardson, 1996; Tamir, 1991). These beliefs function as guiding principles and influence how teachers make decisions during teaching (Brunning, Schraw, Norby & Ronning, 2004; Pajares, 1992; Richardson, 1996).

Many researchers, involved in studying teacher beliefs, argue that teachers plan their classroom instruction in a way that is consistent with their beliefs about knowledge, teaching,

and learning (Bybee, 1993; Kagan, 1992; Pajares, 1992; Richardson, 1996; Southerland, Sinatra & Matthews, 2001). This is evident in that ways that teachers with different beliefs about teaching and learning provide different types of classroom activities for learners to engage with (Calderhead, 1996). For example, teachers who hold beliefs, such as students being passive learners who act as empty vessels waiting to be filled with knowledge, tend to enact this through their practice, which in this case would be the teacher providing knowledge for students to absorb (Darling-Hammond, 1997).

In illustrating this point, the findings from the Hashweh (1996) provide some evidence of the relationship between 35 Palestinian science teachers' beliefs and their subsequent classroom behaviours. Essentially, the findings confirmed that teachers' beliefs influenced their classroom practices. In this study, for example, the teachers with constructivist beliefs were likely to examine the alternative conceptions of their students, draw upon a range of effective teaching approaches, and efficiently implement learning activities that promote conceptual change. Similarly, Roehrig and Kruse (2005) conducted a study with 12 high school chemistry teachers to explore the effect of a reform-based curriculum on teachers' beliefs and classroom practices. The Teachers' Beliefs Interview (TBI) and a modified Reformed Teaching Observation Protocol (RTOP) facilitated qualitative and quantitative data collection. Based on the participant's TBI responses and RTOP scores, the TBI and RTOP found a statistical relationship between teacher's beliefs about teaching and learning and their classroom practices.

In this study, teachers' experiences of what their initial teacher education programs taught them are considered as contributing to the belief systems they hold as teachers. These experiences give rise to individual conceptions of what teaching is as well as influence how a teacher interprets specific incidents and experiences that occur in a classroom or school (Leavy & Hourigan, 2018; Mansfield & Volet, 2010; Ní Chróinín & O'Sullivan, 2014). According to Kagan (1992) and Stofflett and Stoddart (1994), the practice of a teacher is powerfully shaped by

the teachers' own experiences of how they experienced teaching in their lives, with many teachers often believing that a particular teaching approach, which worked well in their own learning as a student, could work as well for their students' learning.

2.2.2.3 Contextual factors. Teacher thinking is not only the result of individual personal history and experiences but also due to the interactions between individuals and their context. For example, cultural context has a significant role in shaping teacher thinking as it permits teachers to make sense of and use knowledge in ways linked to their immediate social environment (Clark & Lampert, 1986). Environmental factors can also have an impact evidenced when teachers work under conditions which encourage them to engage actively in decision-making about the direction of their learning and implementation of teaching procedures. When teachers feel supported and valued in their workplace, they are more likely to generate meaningful knowledge and articulate in-depth understandings about teaching and learning (Borko, 2004; Plummer, 2005). Smith (2017) suggested that school principal support and the workplace context were particularly crucial in affecting the development of teacher's personal practical knowledge. The school principal and relevant lead teachers are influential figures in this instance as they have the ability (or otherwise) to work with teachers productively, provide opportunities for teachers to work together, and help teachers to learn from others to make their teaching more effective. Teachers develop personal practical knowledge when they work with others to establish a shared vision and subsequent actions (Smith, 2017).

2.2.3 Potential contribution to student learning. Research indicates that the quality of what teachers know and can do has a significant influence on student learning (Darling-Hammond, 2000; Wenglinsky, 2000). Teacher thinking enables teachers to consider and influence significant functions within their work as a teacher, which can impact student success (Huang, 2015).

Huang (2015) stated that teachers develop the habit of thinking about what they do and why to assist in making good decisions in relation to student learning and promoting students' success. Moreover, Tartwijk, den Brok, Veldman, and Wubbels (2009) suggested that teachers' practical knowledge about classroom management strategies guide teachers in creating a positive working atmosphere in their classrooms. Similarly, Tsang (2004) investigated the role of teachers' personal practical knowledge by looking at pre-service teachers interactive decision making. The findings of this study showed that teachers make decisions based on their interactions with students. Teacher personal practical knowledge also plays a role in informing decision-making following a teaching episode as a means to improve future lesson planning and implementation (Tsang, 2004). When teachers have the opportunity to notice and think about what they do and reflect on why they do certain things, they are in a better position to make decisions to ensure positive student learning outcomes (Huang, 2015).

Figure 2.1 below provides a conceptual representation of teacher thinking as it will be applied through this study. To summarise this figure, in the context of this study, teacher thinking is a personal construct and process which comprises two domains: (i) the formal knowledge of teaching and (ii) the practical knowledge of teaching cultivated through existing knowledge, values, experiences as a teacher, and reflection on these experiences. Teacher thinking provides teachers with a platform for understanding their practice, making sense of new ideas, making decisions about teaching and learning, and influencing the way in which they create the appropriate conditions to support their students' learning. Teacher thinking, importantly, has an impact on teacher behaviour in classroom and student success and the learning experience.

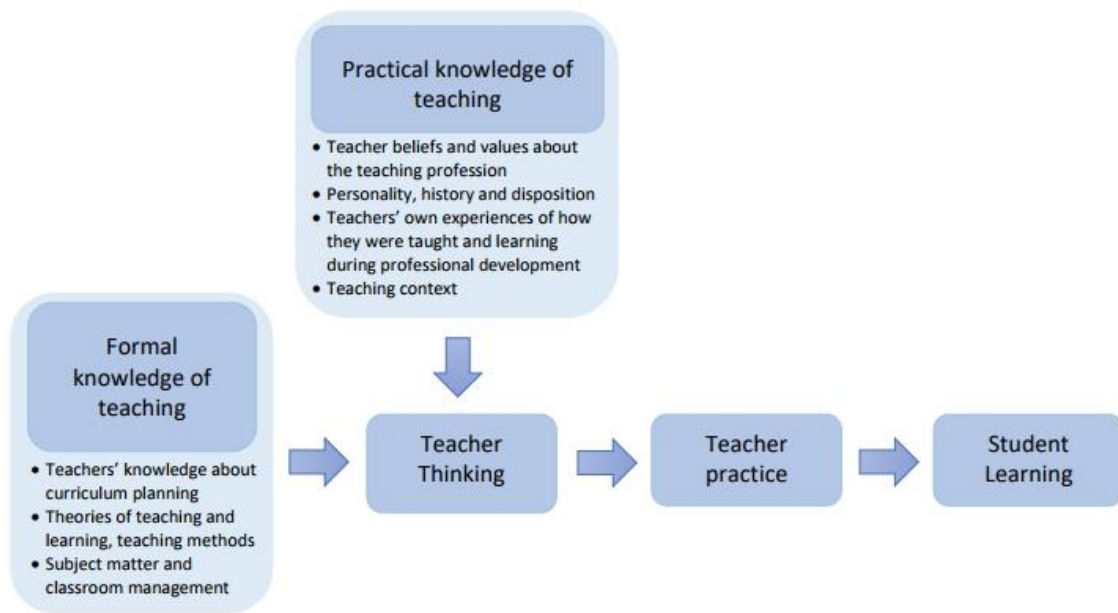


Figure 2.1. A conceptual model of the processes influencing and influenced by teachers' thinking

2.3 Assessment and Formative Assessment

According to Pellegrino (2006), assessment is one of the three aspects of an education system: curriculum, instruction and assessment. These three aspects are the cornerstone of all education endeavour (Kulasegaram & Rangachari, 2018). The curriculum relates to the educational objectives of the learning program as well as the daily instructional lessons (Pellegrino, 2006). In other words, curriculum defines learning content with instruction seen as teaching and learning activities in which engage both teacher and student. Assessment is defined as the way of measuring educational outcomes (Pellegrino, 2006). Meaningful assessment, therefore, should align well with the stated curriculum (Kulasegaram & Rangachari, 2018).

Research studies show that effective assessment practices are crucial for students to ensure theirs is a more dynamic learning process (Black, 1998; Crooks, 1998; Hattie, 2009; Kulasegaram & Rangachari, 2018). When teachers are aware of how to use assessment in the

classroom and recognise the role of assessment, they can better inform their teaching, make appropriate decisions, interpret and respond to assessment (Brown, 2008; Popham, 2011).

2.3.1 Definition and type of assessment. The field of education often associates assessment with testing providing a way of collecting consistent data across schools, districts, states, and even countries (Black, 1998). This approach is in place in order to use the test attainment, rather than a percentage, as a measure of success. Wilson and Wing Jan (2009) defined assessment as the process of gathering information to establish individual students' progress, improve their learning, and provide information to inform planning. Oosterhof (2009) stated that assessment might be defined as a process used to measure the cognitive domain or intellectual ability of a student by collecting and interpreting information gathered about student understanding, behaviour and academic performance. This information is then used by the teacher to make decisions about student learning needs, which then informs the learning direction (Oosterhof, 2009). Similarly, Cowie and Bell (1999) identified that the information gathered from assessment can be used to inform and improve teaching programs and student learning. Wiliam (2011) considered assessment as the bridge between teaching and learning and that without assessment, it is difficult to know what students know and, therefore, what students are learning.

Additionally, assessment is part of daily classroom interactions that take place between teacher and students and provides opportunities for considering the quality of student work (Atkin & Coffey, 2001). In this research, assessment is referred to as the activity used by teachers to gather information about student learning, performance and academic achievement. The analysis of assessment information and the decisions a teacher makes in response to this information critically influences the effective monitoring and enhancement of student learning.

According to Corrigan, Gunstone, and Jones (2013), assessment practices frequently take three forms: assessment *as* learning, assessment *of* learning, and assessment *for* learning.

Assessment as learning refers to activities that provide an opportunity for students to construct their own knowledge, while *assessment of learning* focuses on the monitoring of learning. The process that teachers use to improve their teaching refers to *assessment for learning*. Another way to characterise assessment is through the constructs of diagnostic, formative and summative (Collette & Chiappetta, 1989). Some studies argue that assessment for and as learning is connected to formative assessment, whereas assessment of learning generally refers to summative assessment (Bennett, 2011). While formative assessment is the focus of this study, I will briefly describe each area—diagnostic, formative and summative—before moving into a more in-depth exploration of formative assessment in science education.

Diagnostic assessment helps teachers determine students' prior knowledge and level of understanding of content usually occurring at the beginning of the lesson though sometimes used between lessons or during instruction. Using information gathered through this form of assessment, teachers can design lessons that are appropriate for each student's level of knowledge and ability (Collette & Chiappetta, 1989).

Formative assessment involves identifying current student understanding and student weaknesses and strengths. Formative assessment seeks to identify the gap between present understanding and established proficient understanding and provide feedback that leads to the student recognizing the next steps. Formative assessment provides necessary information based on students' needs so that teachers are able to adjust teaching to better meet students' learning needs (Black & Wiliam, 2003; Corrigan et al., 2013; Harlen & James, 1997). Formative assessment is an interactive process that takes place throughout stages of instruction. It requires the active involvement of teachers and students (Black & Harrison, 2004). It exists to improve student learning.

Summative assessment helps to determine student's learning for accountability usually to determine whether students accomplished learning goals together with tracking progress and

reporting data about achievements (Harlen, 2008). Teachers typically use summative assessment at the end of a unit of work to ensure students meet standards (Earl, 2003; Shute & Kim 2014). Strategies to gather summative data may include a unit test or final exam to evaluate students' achievement and assign a grade for overall performance.

Historically, assessment had a limited purpose when it was constrained to grading purposes. However, in the last two decades, the research on assessment has shifted to focus on the impact of different forms of assessment on student achievement and, in particular, the exploration of formative assessment as a means to benefit teachers' instructional decision-making (Popham, 2008; Popham, 2014).

2.3.2 Formative assessment. Definitions of formative assessment have been an ongoing discussion amongst education researchers (Atkin & Coffey, 2001; Black & Wiliam, 1998; Shepard, 2000). The term formative assessment was first introduced by Scriven in 1967 (Black & Wiliam, 2003; Popham, 2008) with a distinction made between summative and formative assessment. The key difference between the two being that formative assessment is improvement focused (Black & Wiliam, 1998). According to Popham (2008), formative assessment is not a product, like a test or an instrument, but it is an ongoing, dynamic, and progressive process. Similarly, other researchers (e.g., Bell & Cowie, 2001; Black & Wiliam, 1998; Shepard, 2008; Sumantri & Satriani, 2016; Volante & Beckett, 2011; Wiliam & Thompson, 2008) have proposed that formative assessment is a process used by teachers and students to enhance students' learning.

According to Bell and Cowie (2001) and McMillan (2014), formative assessment is a way of evaluating students' progress during teaching in order to make decisions about further or future teaching instructions. In other words, evidence of student progress is not used for judgment as is common with summative assessment, but instead, it provides teachers with information to know what should be done in order to help the students in their learning.

Formative assessment also helps teachers to collect evidence of student understanding of concepts as a means for seeking and interpreting where the student is in their learning, where they need to go and how they can get there and make adjustments to a lesson (Atkin & Coffey, 2001). Bell and Cowie (2001) and Shepard (2008) claim that the formative assessment process provides insights into students' understandings, which is useful information to support the improvement of teaching and learning practices. Moreover, Bennett (2011) suggested formative assessment should be understood as part of a comprehensive process in which all elements work together to facilitate learning for students and help teachers improve assessment skills.

Black and Wiliam (1998) find that student learning is improved when formative assessment is used to assess students' learning over more traditional means because formative assessment helps to determine students' acquisition of knowledge and skills (Abell & Volkmann, 2006). Black and Wiliam (2009) also suggested that the use of feedback will encourage students to take responsibility for their own learning. Giving feedback to students about how their existing conceptions relate to the scientifically accepted concepts is a part of teaching for conceptual development. As feedback forms part of formative assessment, researchers view formative assessment as a critical component in successful teaching for conceptual development (Sadler, 1989). Moreover, Ash and Levitt (2003) found that teachers developed a deeper understanding of their own teaching practices when formative assessment aligns with their teaching. However, the variation in conceptualization and implementation of formative assessment has led to controversy over the evidence available for large achievement gains from formative assessments. As Bennett (2011) argued that the existing concepts of formative assessment include a wide range of methods but a lack of continuity in implementation. Therefore, when referring to the effects of formative assessment, it is important to be explicit about the conceptualization and application of formative assessment.

It is, therefore, clear that formative assessment seeks to facilitate and enhance students' learning through various in-class activities and provide teachers with evidence to modify their instruction to meet students at their current level of understanding and promote teaching to reach higher standards.

2.3.2.1 Formative assessment strategies. Wiliam and Thompson (2008) describe practical approaches for teachers in implementing formative assessment in the classroom through the identification of five key formative assessment strategies. The intent of these strategies is to provide teachers and students with the evidence required to adapt teaching and learning to meet learning needs. Clarke (2005) stated that the student should be actively involved in each strategy and that the role of teacher should shift from controller to coordinator. An outline of the five strategies follows.

1. *Clarifying and sharing learning expectations and criteria for success to students.*

When teachers share the learning expectations with their students, the students will be aware of what they are expected to know, understand and be able to do as a result of the learning activities (Glasson, 2009; Heritage, 2007).

2. *Providing effective classroom discussions, questions, and activities in order to elicit evidence of student understanding.*

Teachers gather information about what students have learnt by identifying evidence of student understanding of particular content.

This information is essential for moving the learning forward (Cowie & Bell, 1999).

3. *Providing evidence based feedback that links to the criteria for success to activate and motivate students.*

Feedback is a central element in formative assessment (Sadler, 1989). Formative feedback is the information communicated to students by teachers and sometimes by other students. A significant role for the teacher in the learning process is to provide feedback to students that provide the direction and encouragement for future learning (Black & Wiliam, 1998; Clarke, 2005; Earl, 2003;

Glasson, 2009). An essential aspect of providing feedback is maximising individual learning and promoting personal improvement rather than comparing an individual's performance with others. Popham (2008) stated that providing personalised feedback to students leads to significant gains in learning and feedback can help students evaluate and improve their learning and behaviour.

4. *Activating students as the owners of their own learning (self-assessment).* Feedback does not only have to come from the teacher, but it can sometimes come from the students themselves. Students have an opportunity to think meta-cognitively about their learning when they are providing feedback through self-assessment. Students identify what they know, what they understand, and what they need to achieve in terms of their own learning. This meta-cognitive reflection can help students correct their own misconceptions as well as deepen their understanding of why an answer is correct (Heritage, Kim, Vendlinski, & Herman, 2009).

5. *Activating students as instructional resources for one another (peer-assessment).*

When students provide feedback to their classmates through peer-assessment, they have an opportunity to learn as they assess themselves and their classmates.

Formative assessment has a vital role to play in education as highlighted by Black and Wiliam's (1998) report on the critical role of formative assessment. This report advocated for a review of the use of assessment for learning and indicated that formative assessment is effective at all education levels and across all content areas. Since this review, many educators have found similar results in their research (Kay, Li & Fekete, 2007; Popham, 2008; Weurlander, Söderberg, Scheja, Hult, & Wernerson, 2012) showing that formative assessment is considered a powerful instrument in assessing and enhancing student learning.

In summary, valuing and including the following five components characterises formative assessment:

1. Teachers and students are partners in the formative assessment process;
2. The purpose of formative assessment is to enhance student learning, and provide activities and opportunities where students are able to construct their own knowledge actively;
3. Teachers interpret and use evidence elicited from student learning for subsequent instruction;
4. Formative assessment is an integral part of teaching and learning. It provides a continuously developing instrument of information, and multiple ongoing processes to support student learning and it happens throughout instruction; and
5. Feedback forms part of the process.

Formative assessment demonstrates an effective strategy to explore students' understandings of concepts, evaluate alternative conceptions and respond to these in order to enable concept development. However, implementation of formative assessment often presents challenges for teachers (Brown, Kennedy, Fok, Chan, & Yu, 2009; Edman, Gilbreth, & Wynn, 2010; Hall & Burke, 2003; Torrance & Pryor, 2001). For many schools, the pressing issue is no longer whether formative assessment can enhance student learning, but how best to execute the strategies of formative assessment to enhance and inform student learning (Earl, 2003).

2.3.3 Factors affecting teachers' formative assessment practice. Research has identified a number of different factors that influence teachers' decision making when it comes to the implementation of formative assessment in the classroom. There are three factors of particular relevance for this study:

1. Teacher knowledge (e.g., Matese, 2005; Otero & Nathan, 2008)

2. Teacher attitude (e.g., Berry, 2010; Heitink, Van der Kleij, Veldkamp, Schildkamp and Kippers, 2015; Heritage, 2007); and
3. Internal school support (e.g., Buck & Trauth-Nare, 2009; Leong 2014; Ofsted, 2008).

I follow by exploring each of these factors in detail.

2.3.3.1 Teacher knowledge. Teachers' science content knowledge is important for the use of formative assessment because it influences both instructional quality and teachers' abilities to teach students to understand the key ideas, pose precise questions to elicit students' understanding (Matese, 2005) and identify students' prior science knowledge that may contradict a science concept (Otero & Nathan, 2008). Magnusson, Krajcik and Borko (1999) pointed out that teachers need to be knowledgeable about areas where student difficulties and misconceptions arise in science particularly when using formative assessment in the science classroom because in doing so teachers continually analyse and gather information about student reasoning and difficulties in order to address them.

Often, in many countries, primary teachers are generalist teachers and are therefore required to teach across all key learning areas. Many primary teachers may not have in-depth knowledge of all subjects. Research has shown that primary teachers who lacked science content knowledge were not confident to use formative assessment when teaching science in their classrooms. For example, they feel reluctant to allow students to ask questions in subject areas that they are not confident with (Hondrich, Hertel, Adl-Amini, & Klieme, 2016). Lack of content knowledge could reduce teacher confidence and increase the level of risk associated with losing a sense of control in teaching, leading to primary teachers ascribing minimal attention to implementing formative assessment.

However, being knowledgeable about science content does not guarantee success in implementing formative assessment. Effective implementation of formative assessment requires

a varied and complex set of specific knowledge. Teachers need assessment knowledge in determining how effective they are in implementing various formative assessment practices and in making instructional decisions related to student learning (Birenbaum, Kimron, & Shilton, 2011; Harlen, 2005; Matese, 2005). Moreover, the literature shows that teachers with substantial pedagogical content knowledge, or PCK, integrate formative assessment practices in teaching and learning, make judgments during instruction, make sense of how students think and understand, highlight the quality of students' work, and show their strengths and weaknesses to promote self-learning (Black, Harrison, Lee, Marshall, & Wiliam, 2005; Gioka, 2008). Some may assert that the nature of formative assessment requires a teacher to have substantial PCK to be able to connect subject matter to students in meaningful ways, confidently meeting the emerging needs of students, and adjusting instruction to suit the way students respond to advance their learning. A research review conducted by Heitink et al. (2015) suggested that content knowledge and pedagogical content knowledge have a major impact on teachers' ability to provide feedback to students, which can, later on, affect their learning and progress.

2.3.3.2 Teacher attitude. Research acknowledges that teacher attitudes have significant influence and impact on classroom activities (Carless, 2005; Heitink et al., 2015; Lee & Wiliam, 2005). Specifically, teachers' attitudes about students, teaching, and learning influence assessment practices (Asch, 1976; Kahn, 2000; Tittle, 1994). In illustrating this point, the findings from Yin and Buck (2015) provide some evidence that Asian teachers who hold an attitude that students need to master the basic knowledge in the textbook by memorising, prefer teaching students to find the correct answer without providing opportunities for classroom discussion generated by follow-up questions to enhance student thinking. Teaching in this way makes formative assessment practice more rigid and prescriptive. Similarly, Berry (2010) provided some evidence that teachers whose attitude toward teaching and learning is dominated by a teacher-centred view emphasised a need for student control and were more likely not to

adopt formative assessment. In contrast, teachers who hold a positive attitude toward the role of formative assessment in students' learning are more likely to incorporate formative assessment in their classroom practices (Lee & Wiliam, 2005). Moreover, Heritage (2007) claimed that "even if teachers have all the required knowledge and skills for formative assessment, without the appropriated attitudes toward the role that formative assessment can play in teaching and learning, their knowledge and skills will lie dormant" (p. 145). In other words, the implementation of formative assessment requires teachers to have a favourable attitude towards the role of formative assessment in teaching and learning.

2.3.3.3 Internal school support. Scholars have reported that the success of the implementation of formative assessment practices is strongly related to schools' support and leadership (Ofsted, 2008). Leong (2014) highlighted the critical role of school principals as an effective factor in teachers' decisions to implement formative assessment. When school principals hold a positive attitude toward formative assessment and their knowledge is appropriate, they can support teachers to adopt formative assessment. On the other hand, it could be said that when school principals do not have appropriate knowledge and attitude toward formative assessment, they apply pressure on teachers to use summative assessment to improve school success rather than students' learning (Izci, 2016).

Additionally, the successful implementation of formative assessment in schools is related to how schools perceive accountability-related demands. Many studies (e.g., Birenbaum et al., 2011; Harlen, 2005; Lamprianou & Christie, 2009; McClam & Sevier, 2010) reported teachers' experiences where the implementation of formative assessment creates tension in relation to high-stakes examinations such as with traditional grading practice. Thus, their instructional practices tended to align with the expectation of high-stakes assessment, which usually consisted of a paper-based examination at the end of semester. Moreover, studies showed that high-stakes assessment motivates teachers to focus on planning the teaching instruction to support the

accountability demand (Whitford & Jones, 2000), and devote instruction time preparing students to perform well on tests (Grant, 2000). Teachers view their role in the assessment process as giving students a pass or fail grade, recording students' test scores and reporting to the school and parents.

Some general aspects may affect the implementation of formative assessment practices. Timing and class size are critical issues in relation to formative assessment having a place in classrooms. For some teachers, there is a tension between covering the curriculum and applying formative assessment practices that take more time than more summative assessment practices (Buck & Trauth-Nare, 2009). Teachers might feel pressured to strictly follow their schedule to ensure that their students meet learning expectations in a timely manner. Timing, therefore, interferes with the efforts of teachers to implement this approach in the classroom. Teachers have commented they were not motivated to implement formative assessment if they have large classes because it required additional resources and they often felt overwhelmed to provide subjective judgement to students (Blanchard, 2008; Brown et al., 2009; Peček, Zuljan, Cuk & Lesar 2008). Teachers need to spend more time and attention in order to assess student and provide feedback. It is stressful and impractical for teachers within the limited duration of class time (Nguyen & Khairani, 2016).

The implementation of formative assessment is a big challenge for teachers because various limitations might hinder the process. However, implementing formative assessment is a global trend for use in many learning areas.

2.3.4 Formative assessment in contexts. Due to its effectiveness in promoting student learning, formative assessment has been applied in many contexts and learning areas, including science education and become an educational focus globally. In particular, formative assessment has recently had a rise of influence in Asian countries.

This section will explore two contexts – non-Western countries use of formative assessment and formative assessment in science education.

2.3.4.1 *The formative assessment movement in Asian countries.* Asian nations have been widely criticized as being examination-oriented and teacher-led, which encourages a passive approach to learning and can result in a lack of depth to understanding (Biggs, 1993). McKay and Kember (1997) reported that this more surface approach to learning could impact on student critical thinking skills, and ability in making deductions, inferences (McVeigh, 2002), in-depth conceptual understandings and real-world problem-solving (Darling-Hammond & Falk, 1997). Lack of these abilities has limited Asian students in today's global economy and continues to be a concern for governments of Asian countries (Thanh & Renshaw, 2015). One solution has been to draw upon Western teaching and learning practices to improve this situation. Formative assessment is an example of one strategy used due to the reported success of this approach in improving student learning outcomes in Western contexts (Brown et al., 2009).

Not only in Thailand, the context of this study, but across other Asian countries such as Hong Kong, China, Singapore, Malaysia, and Vietnam, formative assessment has recently played an influential role in educational reform (Duong, Cuc, & Griffin, 2011; Wong, 2014). In Hong Kong, formative assessment plays a role in education (Curriculum Development Council, 2014) as a reform designed to cater to the needs of students and prepare them to deal with future societal change. The Ministry of Education in China issued a guideline document in 2007, advocating the incorporation of formative assessment into school assessment (Chen, Kettle, Klenowski, & May, 2013). In Singapore, the Ministry of Education introduced the use of assessment tools such as checklists, observation sheets, portfolios, and rubrics to evaluate students' understandings of concepts as part of classroom assessment practices (Wong, 2014). In the Malaysian context, assessment has been explained as a process to help students improve their learning and teachers have been encouraged to view assessment as a part of a learning process

(Lee, 1999). Various ways put forward to implement formative assessment during course work included, for example, interviews, quizzes, discussions, and portfolios. The Vietnamese government also announced that their new curricula must aim to promote students' ability to construct their own knowledge (Duong et al., 2011).

Since the enactment of the National Education Act of 1999, Thailand implemented educational reform involving various areas, including curriculum, teaching and learning, and assessment (ONEC, 2003). In terms of the assessment reform, the Act introduced a new approach shifting from using traditional testing mechanisms (e.g., true-false, multiple-choice, and fill-in-the-gaps) to implement a variety of authentic assessment methods (ONEC, 2003). In addition, the act highlighted the need for students themselves, their peers, and/or their teachers to undertake assessment holistically.

2.3.4.2 Formative assessment in Asian classrooms. Asian classrooms tend to be characterised by teachers and students who do not engage in question-and-answer activities in front of the whole class; the culture expects students to obey and listen to teachers. In response, classrooms, environments reveal students as tending to remain silent to avoid the embarrassment and awkwardness associated with disagreement and to maintain harmonious relationships with their peers. Yin and Buck (2015) identified notions of face saving as a barrier which was potentially problematic for the implementation of formative assessment in Confucian culture due to students' need to be respected by others and to avoid embarrassment in social interactions a claim aligned with studies on peer-assessment with Vietnamese students by Nguyen (2008) and Thanh (2013). They found that students were not generally interested in face-to-face discussions and assessing their peers' work. The findings indicated that students were mainly afraid to hurt their friends or damage their friendship if they shared their honest opinions. Moreover, culture traditionally positions the relationship between teachers and students as one of authority/subordinate with teachers placed above in the hierarchical relationship (Deveney,

2005). For example, students show their obedience to their teachers as an authority when it comes to providing knowledge. Furthermore, because of the strong cultural belief that knowledge mastery belongs to the teacher, students prefer feedback from teachers rather than their peers (Scollon 1999; Tepsuriwong & Bunsom, 2013; Thanh & Renshaw, 2015; Yan & Cheng, 2015).

In Singapore, Divaharan and Atputhasamy (2002) reported findings from research about peer-assessment. They found that student participants tried to avoid commenting so as not to cause conflict with other pupils even though peer-assessment demonstrates benefit for students, they felt reluctant to talk aloud and challenge other students' point of view. The findings from Wong's (2016) study about Singaporean primary students' self-assessment ability discovered that although students could assess themselves, they were not confident in assessing themselves accurately and needed more practice in using self-assessment. A possible reason for the students feeling less than confident to assess themselves accurately is that teachers have traditionally been the ones to assess student learning.

Many research studies (e.g., Brown et al., 2009; Carless, 2012; Han & Yang, 2001; Luu, 2010) published concerning formative assessment suggest difficulties in implementing formative assessment in Asian classrooms leading to summative assessment remaining the focus in terms of preferred assessment tools. Many Asian countries focus on traditional exam-oriented culture and value the product of learning more than the process (Poole & Adamson, 2016; Watkins & Biggs, 1996) contributing to tension between summative and formative assessment, often forcing teachers to adopt summative assessment because it is easier to report a grade. For example, the research conducted by Chan (2007) reflected that Hong Kong teachers did not consider formative assessment implementation as equally important as the need to prepare students for high-stake examinations. Chen et al. (2013) reported findings from research conducted with two Chinese universities. They reflected the difficulties of implementing formative assessment in

Chinese classrooms. Yin and Buck's (2015) collaboration also with Chinese teachers highlighted that the nature of formative assessment was the exploration of both correct and incorrect answers, but the participating students tended to fall back to the one right answer typical of summative assessment tests. Furthermore, Thanh and Renshaw (2015) in a study conducted with Vietnamese students suggested that students' experiences with summative dominated assessment, with grades competitively compared with other students, caused tensions and students resisted formative assessment practices. Although students acknowledged the advantages and significance of the formative assessment strategy, they also raised concerns about maintaining their academic achievement in high-stake test outcomes, particularly those associated with college admission. The finding from this particular study indicated that teachers took up a local interpretation of formative assessment and engaged with assessment in their preferred way.

These studies suggest the development of assessment approaches based on cultural norms and expectations of Western society, when applied to non-Western settings such as Asia, without the careful examination of the appropriateness for the cultural context, may lead to the failed implementation of such assessment initiatives (Biggs, 1993). In particular, formative assessment reflects a sociocultural practice based on cultural norms, beliefs, and expectations about what assessment in education might look like and what it intends to achieve (Hang, Mene, & Bell, 2015). In the case of applying Western approaches to assessment in Asian countries, one of the main barriers faced is the influence of culture which has teachers focused on students memorising content rather than developing the necessary skills to support critical and analytical thinking (Purdie & Hattie, 1996).

In the Thai context, formative assessment is a key feature of education reform, and yet formative assessment practices present a challenge for teachers namely because many Thai primary teachers are familiar with traditional testing methods, such as the end of semester and

multiple choice tests (Baumgart & Halse, 1999). Practice emerging from Western ideologies and cultural values run the risk of opposing certain aspects of Thai culture and norms. Despite the governmental focus, the Thai context may not be conducive to the practice of formative assessment as understood and carried out in Western contexts. Furthermore, studies by the Thai Ministry of Education found that Thai teachers were able to collect information from assessment for student development and that there were different interpretations of authentic assessment among Thai teachers (Office of Academic and Educational Standard, 2008).

Currently, few studies investigate the practice of formative assessment in Thailand. These key studies focused on, classroom assessment in mathematics education (Junpeng, 2012; Marwiang, Junpeng, & Nakorn, 2014), the level of teachers' classroom assessment literacy (Yamtim & Wongwanich, 2014), and the use of student portfolios (Tangdhanakanond & Wongwanich, 2012). The researcher could not locate any Thai-based research with primary teachers or focused on teacher thinking in science education.

2.3.4.3 Formative assessment in science education. Formative assessment has emerged as a critical component of effective classroom instruction in science education (Heritage, 2007). In science education, the intention is to support students in constructing meaning in relation to different scientific concepts (Faikhamta & Ladachart, 2016). Laohaphaibool (1992) further refines the focus by identifying that science education should be a dialogue between teacher and students to clarify students' ideas. Moreover, Faikhamta and Ladachart (2016) suggested that teaching in science should not only provide the content but also consider strengthening students' skills and abilities with respect to thinking, inquiry, and problem solving. Meaningful learning of science should involve not only performing investigations to collect data, but also the construction and evaluation of scientific claims (National Research Council, 2001). Duschl (2003) stated that when students are taught science in the context of inquiry, they will know what they know, how they know it, and why they believe it. However, the implementation of effective

scientific inquiry is still a challenging task for teachers (Welch, Klopfer, Aikenhead, & Robinson, 1981). Frequent and ongoing assessment activities in the classroom can help improve these abilities by providing insights into students' learning in science (Duschl, 2003; Ruiz-Primo & Furtak, 2007).

Many studies (e.g., Abell & Siegel, 2011; Coffey, Sato & Thiebault, 2005; Furtak, 2012; Ruiz-Primo & Furtak, 2007) reported the effect of formative assessment in science classrooms and acknowledged the role of formative assessment in addressing students' thinking about science content and showed that the use of formative assessment was useful in promoting classroom practices related to questioning strategies, feedback and scientific inquiry. Moreover, Furtak (2012) found that the use of formative assessment helped teachers to be more reflective about students' understanding and better able to identify students' science conceptualisation and increased their pedagogical content knowledge. Patently, the benefits of this assessment would logically lead to improved teacher practice and enhanced student understandings of science concepts.

2.4 Teachers' Thinking about Formative Assessment

As discussed above, many factors influence teachers thinking around the value of and the decision to implement, formative assessment. Researchers such as Brown, Hui, Yu & Kennedy (2011) and Brown et al. (2009) have cited that teachers' thinking about assessment seemed to be dominated by summative assessment, in particular, in Asian countries where an examination-driven society exists. Moreover, studies conducted in non-Asian countries revealed similar findings. For example, Taber et al. (2011) through their study with pre-service teachers in England found that these pre-service teachers saw the value of formative assessment but summative assessment modes and outcomes dominated their conceptions of the nature of assessment. In this study, for example, teachers understood assessment as having a summative function (e.g., assessment as a measurement of how much students know and assessment for

external agencies). At the same time, they saw assessment as a way of informing decision making about the best action(s) to benefit the student, ways for motivating student learning by grade, and a way to provide guidance and support for student learning by providing feedback and grade. Similarly, Tolgfors (2018) conducted a study with 17 students and two male Physical education teachers in Sweden to explore their understanding of formative assessment. All participants responded to questions about their experiences of the integrated assessment process in the subject of Physical education. The findings identified five aspects of formative assessment:

1. formative assessment as *Empowerment* constitutes teachers as an instructor to guide individual students towards goal attainment;
2. formative assessment as *Physical Activation* constitutes teacher as a supporter to give feedback to the student and encourage the student to be active in their learning;
3. formative assessment as *Constructive Alignment* constitutes teacher as a deliverer of prescribed subject content and use formative assessment to bridge the gap between teaching and learning;
4. formative assessment as *Grade Generation* constitutes teacher as an administrator for standardised assessment practice; and
5. formative assessment as *Negotiation* constitutes a teacher as a moderator adapting teaching and assessment to the prerequisites of the group rather than the individual.

Based on participants' responses, Tolgfors (2018) found no clear and definitive teacher understanding of formative assessment as some aspects seemed to be overpowered by summative assessment.

2.5 Summary

This chapter aimed to review teacher thinking and formative assessment as the key conceptual areas underpinning this research. As revealed through a review of the literature, teacher thinking refers to the process of thinking as a personal construct consisting of two domains, formal knowledge and practical knowledge cultivated through individual understanding, values, experiences, and reflection. Teacher thinking enables teachers to understand and make sense of their practice and to create the conditions to support student learning.

Formative assessment has an important role in increasing student achievement in general and, in terms of this particular study, in science education in a Thai context specifically. Importantly, formative assessment provides useful information to teachers to modify their instructional practice to better support their students' needs. While formative assessment has gained attention in terms of understanding its application in the classroom, a gap between theory and practice remains.

From the literature review, there is evidence that contextual factors influence teacher thinking and formative assessment practices. In order to better understand the impact of culture on influencing and shaping Thai teacher thinking and understanding of formative assessment, the next chapter provides background details and discusses the culture and value of Thai where is the context of this study.

Chapter 3: Assessment in the Thai Cultural Context

3.1 Introduction

Chapter 2 highlighted that their context and culture influenced teachers' personal thinking. Therefore, when considering the impact of any educational innovation on teaching practice, it is crucial to identify the defining features of a specific educational context, particularly the many cultural elements that shape teacher thinking and action within that context. This information becomes particularly critical when the chosen innovation involves the adoption of teaching ideologies from one country to another, as may be the case with the implementation of formative assessment within the Thai education context. In light of these concerns, this chapter aims to provide information about the specific Thai cultural considerations that influence the work of Thai teachers. It will also provide information about the current assessment framework in use in Thai education. Three sections shape the structure of this chapter.

The first section is a review of the characteristics and dimensions of the national Thai culture. This section addresses how cultural understandings can impact individual thinking and behaviours. It considers how the cultural framework in place in Thailand, including beliefs, attitudes, and behaviour, influences the thinking, behaviour and characteristics of Thai teachers and students. The second section presents a review of the assessment curriculum presently integrated into initial teacher education programs in Thailand, along with an overview of the prevailing assessment framework used in the basic education core curriculum. The third and final section addresses my role in this research as an insider who understands Thai culture and school context. I also present my role as an outsider who is seeking to understand the role of assessment from a perspective different from the Thai teacher lens.

3.2 Thai Culture

Thailand culture, religion, politics, and education are all intricately bound together. At its core, Thailand's culture has its basis in religion, in this case, Buddhism (Wallace, 2003). Thai arts, social systems, habits and customs are all developed and informed by religion and religious norms and expectations. Buddhist principles appear to strongly influence people's values, behaviours, and relationship patterns. However, while some cultural changes are currently taking place due to Western influences and globalisation, religious culture is still the dominant living pattern of Thai people supporting the view that considers religion as the cultural backbone of Thai society (Wallace, 2003). The literature paid significant attention to the role and influence of cultural issues in educational settings. Researchers are in agreement that culture plays a significant role in educational practices (e.g., Gu, 2010; Hofstede, Hofstede & Minkov, 2010; Mahon, 2006; Masemann, 2007; Ohmae, 1995). The cultural patterns of society guide their educational patterns. With this consideration and the Thai context in mind, it seems valid to conclude that religion strongly influences Thai education.

Studies conducted by Hallinger (1998) and Masemann (2007) both found that schools are one of the most common and important institutions where cultural transmission takes place. In addition, Gu (2010) highlighted that teachers use culture to guide their teaching, particularly in terms of their evaluation and assessment of students. Thus, teaching is a cultural practice. Teachers often develop their teaching approaches in ways that imitate how they experienced teaching, or they follow the practices of other teachers whom they consider to be successful in teaching. These teaching practices may differ to the learning preferences of their students. Therefore, teaching and learning need to be negotiated and made sense of on a cultural level.

This section discusses and presents a traditional culture pattern of Thailand which is maintained and illustrated by most Thai people. However, there are ongoing changes in Thai culture, particularly due to the increase of globalisation leading Thai culture to experience many

new influences such as urbanisation, a widespread change in life-style where young people are becoming more independent and expected to look after themselves. The discussion presents two dimensions of Thai culture that for use as a basis for analysis and understanding of how Thai culture impacts on education. These two dimensions of Thai culture are:

1. Collectivism; and
2. Hierarchies

3.2.1 Collectivism. Thailand exemplifies a highly collective society rather than individualist (Hofstede, 1997; Hofstede et al., 2010; Niffenegger, Kulviwat & Engchanil, 2006; Trompenaars & Hampden-Turner, 1998). In practice, this means that Thai people consider the importance of functioning as a group, more than functioning as an individual. Instead of independence, Thai culture encourages interdependence and promotes thinking in terms of ‘We’ rather than ‘I’. According to Kirkpatrick and Young (2014), Thai people expect that other people in a group they are a part of will protect them when they are experiencing difficulty. In return, they are loyal to the group and accept the sacrificing of individual interests for the collective (Kirkpatrick & Young, 2014). Thai people position a group before their own happiness and wellbeing as they believe the group's wellbeing will benefit individual members eventually (Komin, 1991). Such thinking means that they consider personal views differing from the collective belief of the group inappropriate leading to consider direct conflict with others as undesirable.

In addition, Thai people believe it is essential to maintain a good relationship with others, a belief that takes precedence over individual hard work and personal achievement (Hofstede et al., 2010, Komin, 1991). This way of seeing the world means that Thai people value the importance of maintaining good relationships over earnest devotion to work. Komin (1991) warns against misinterpreting this mindset as Thai people disliking hard work. Rather, success in

Thai culture does not equate with hard work alone. Consequently, Thai people work hard to build and maintain relationships among people.

Moreover, in Thai society, any relationship, established at any social level, is considered as family. In Thailand, familial words are often used for other close members of the community and are used to indicate both closeness and respect. For example, it is common for Thai people to use '*Lung*' (uncle) or '*Pa*' (aunt) to indicate affection for someone in a group. Thai people present forms of care and a sense of friendliness to groups. People tend to spend their time engaging in activities that build trust and relationships with each other and discussing broad topics, such as personal matters and well-being a cultural dimension highlighted in the deep respect felt by all Thai people for their last King. The King Bhumibol Adulyadej was recognised as the 'Father of the Thai Nation' and was sometimes referred to by his subjects as '*Pho Luang*', royal father. The King Bhumibol Adulyadej's Birthday is still a national holiday marked as national Father's Day, in the same way as national Mother's Day, which is Her Majesty the Queen Sirikit's birthday.

With respect to the notion of collectivism, Thai people operate in ways to save 'face' meaning that they avoid embarrassing others or creating conflict. They are aware that their behaviour may create an uncomfortable and unpleasant feeling which may ultimately affect their relationship with others, and this is not desirable. Consequently, Thai people accept they have an obligation to maintaining smooth relationships (Komin, 1991) and therefore, retain a low tolerance for conflict (Roongrengsuke & Chansuthus, 1998) as conflict usually results in a loss of 'face'. As a result, in Thai culture, putting someone into an uncomfortable situation is generally avoided (Komin, 1991).

Thailand is often referred to as 'the land of smiles', reflecting a culture of people who are friendly and hospitable. Generally, Thais believe in and are concerned about harmony and respect. As detailed above, Buddhist doctrines are at the root of this traditional consideration for

others over self. Buddhism also encourages people to forgive and apologise to others to avoid the potential for any opposition or thoughts of revenge that may have an impact in the future or another life. Therefore, avoiding unnecessary friction or tension in connections with others maintains social harmony effectively. This belief underpins the extreme reluctance of Thai people to challenge, directly criticise, or confront others due to their discomfort in potentially imposing on anyone or disturbing their privacy and harmony. Social relations and harmony are of utmost importance. Thai culture considers displays of rude behaviour and anger as inappropriate behaviours. Furthermore, Thai people are uncomfortable with uncertainty (Hofstede, 1997). They avoid unexpected and ambiguous circumstances, and as a result, they do not readily accept change and find risk unpleasant. Many accept that, in general, Thai people choose not to question, confront or be critical in any challenging situations.

In terms of the classroom context, collectivism means that teachers deal with students as part of a group rather than as an individual. For example, to prevent individualisation, a teacher would avoid publicly praising an individual student or having fun with a specific student. Thai belief systems discourage students from expressing independent behaviours and/or opinions. As a result, Thai students are more likely to function as a group than as individuals. In practice, this can be experienced as Thai students not seeking help or asking a question if it seems that other students understand a concept. If a student did have a question, they would be more likely to ask the teacher after the class rather than during the class.

Thai people value obedience and harmony over personal choice and exploration. The mindset of seeking harmony and avoiding uncertainty is a determining factor in teachers' practices and students' expectations. Thai teachers tend to become anxious in an unexpected teaching situation and tend to prefer teaching methods where they have a high level of control over the educational environment. Thai teachers also avoid allowing students to ask questions due to the fear of students' different ideas and the potential of not being able to respond in the

moment. As a consequence, students respond as passive rather than active learners, demonstrating obedience towards their teacher. Thai students are expected to exhibit politeness, quietness, modesty, acting respectfully, rarely expressing themselves assertively, nor talking back, arguing with, or generally disrespecting teachers (Phongsakorn, 2009). In my personal experience through classroom observations, Thai primary teachers prefer to give students explicit instructions in order to ensure that students will meet his/her expectations. Students also prefer teachers to give them detailed and structured assignments rather than a general guideline, which would allow them to present a personal idea.

Saving the teacher's 'face' means that students avoid a situation, which would make teachers feel offended, and this is the most important aspect of the teacher-student interaction. Therefore, these characteristics may further reinforce a tendency of Thai students to wait to receive knowledge from teachers. Students try not to raise questions in class or ask teachers to repeat or explain something in the class because they do not want to make a teacher lose 'face' or credibility, which might be the case if the teacher does not know the answer. Of equal importance to Thai students is maintaining the 'face' of their friends by avoiding placing their friends in an embarrassing or shameful situation, characteristics deeply embedded in student learning behaviours, clearly observed as students' unwillingness to express feedback or ask direct questions when their friends do not give clear explanations.

According to Komin (1991), the value of collectivism provides a strong sense of community for Thai people. In rural communities, in particular, the teacher-parent relationships are stronger than those in urban areas as a result of interdependence on each other. They help each other in many ways, for example, a student's parent may ask their child's teacher for advice and use this information to make decisions on major issues. In return, they will look after the teacher's house when the teacher is away. Equally, from my own experience, parents of students are very appreciative and grateful for their children's teachers. The sharing of food with a

teacher is a way to express this gratitude and a way to return a teacher's kindness. In many ways, teachers take on a parental role with their students, for example, by taking care of children in school and transporting them to school if parents are unavailable. Not only do they teach to provide knowledge and skills, but teachers also guide appropriate attitudes and behaviours based on Buddhist teachings, and instruct students on how to behave according to Thai traditions and culture.

3.2.2 Hierarchies. Buddhist teachings identify that the young must pay respect and show deference to seniors because obedience contributes to social harmony. This strong religious influence is instilled in Thai children from a very young age with respect and deference expected to all elders, particularly parents and teachers. This belief applies not only to the relationship between parents and children but between siblings of different ages. The actions stemming from this belief remain deeply embedded throughout life for the Thai people. In making sense of this relational component, many scholars report Thai society as being characterised by a robust hierarchical social system (Holmes & Tangtongtavy, 1997; Komin 1991; Mulder, 1979; Podhisita, 1998). It is usual for Thai people to be classified in relation to one another using characteristics such as younger or older, senior or junior, superior or inferior (Podhista, 1998). There is an inferred inequality in power or position within these differentiating terms, which in Thai society is acceptable. As a consequence, the position that an individual holds determines their importance or lack thereof. Age, income, occupation, education, social connection, and family are all factors that underpin the positioning of a Thai person within the societal hierarchy (Kirkpatrick & Young, 2014).

Within the family context, Thai children are taught to understand and accept their role and other roles in the family within the hierarchical system. They learn to understand how they are to treat others according to their position. This well understood process of hierarchy means that Thai people are able to identify their position in relation to others in their broader

community. Support for this hierarchy also plays out in Thai language. For example ‘*Phi*’ meaning elder brother or sister, and ‘*Nong*’ meaning younger brother or sister. Children are supposed to use formal particle, *Khrap/Kha* (masculine and feminine respectively), in order to speak respectfully to elders, parents, and teachers. There are many pronouns for “I” such as *Kha-pha-chao*, *Phom*, *Kra-pom*, *Chan*, *Di-chan*, *Rao*, *Noo*, *Kha* used according to the status of the person with whom the speaker is interacting. Additionally, the awareness of differences in social status often leads Thai people to enact behaviours that are respectful, humble, and extremely considerate when interacting with one another, especially with an individual deemed as having a higher social status.

Historically and culturally, teaching in Thailand is not viewed merely as an occupation, but rather as a highly respected position in society. Thai society generally treats teachers with great respect as authoritative and knowledgeable figures. In return, there is an expectation that Thai teachers will maintain good behaviour and be positive role models for students by being moral, patient, caring, and recommending the right way of living according to Buddhist teaching and societal norms leading to a belief and strong trust that teachers, as elders in the community, are superior, expert and always right. The Thai proverbs, ‘*phu-yai aap naam ron maa gon*’ and ‘*dern tarm phu-yai mha mai khud*’, which mean that ‘elders are expert and have more experiences than younger [people]’ and ‘follow the elders [and] you will be successful’, respectively highlight this belief.

The high regard in which Thai teachers creates a significant power imbalance between teacher and student, meaning that teachers’ perspectives, opinions and actions remain unchallenged. A teacher views him or herself as having a high status and usually keeps a distance from students as they are ranked lower in position. Teachers accept responsibility as a ‘second parent’ not only in educating Thai students with knowledge and necessary skills but in showing good social characteristics, values of culture, beliefs and morality, and shaping the

students to be good citizens according to Thai tradition and culture as the nation desires (Deveney, 2005; Komin, 1991, Thamraksa, 2003). Teachers prefer students to express a high level of obedience, humbleness and non-assertiveness in their behaviours. Teachers will also interpret any assertiveness from students as personal disloyalty and a lack of respect (Wallace, 2003). Maintaining silence in the classroom is seen to convey respectfulness to teachers and demonstrates the behaviour of a good student. Students usually do not oppose or confront teachers, seek help, ask for clarification, or discuss any questions they have with their teachers. These societal norms limit teacher-student interactions and result in teacher-centred practices.

With respect to Thailand being both a hierarchical and collectivist society, Thai people try to avoid standing out. Thus, introducing new and/or innovative practices or ideas tends to be an unfamiliar practice. The existence of a hierarchical structure may restrict opportunities for teachers to make individual decisions about their teaching practices. For example, if a younger teacher has an idea that differs to a senior teacher or school principal, he may choose to stay silent and enact his idea in secret or instead enact the needs/instructions of his seniors. It is interpreted as extremely disrespectful for a younger teacher to publicly disagrees with a senior teacher or school principal. Therefore, a younger teacher may choose not to share his/her own thoughts or argue for his/her own ideas as a way to avoid any possible conflict that might negatively influence his/her relationship with senior staff and school leadership.

According to Hofstede et al. (2010), people impacted by a power imbalance are often willing to follow those deemed in charge. Applying this understanding suggests that Thai teachers simply cannot move towards the implementation of innovation until their principal has provided active support. Teachers tend to obey and follow expectations as part of a top-down approach to education and accountability. In the context of this study, while the assessment framework calls for the use of both formative and summative approaches, at present, Thailand places significant weight on standardised testing rather than using a broad range of assessment.

Actions such as publicly releasing the high-stakes national ONET results to enable the comparison of school performance across the country also have an impact on this lack of change in assessment practices.

3.3 Assessment in Thai Education

The influence of Buddhist principles is strong and powerful in Thai culture and Thai classrooms. It is safe to say that religious beliefs are an inside force that firmly plays a role in classroom interactions, behaviours, and practices of Thai teacher and student. However, the influence of globalisation has a significant impact on guiding Thai education, especially the reforms and policy development.

Formative assessment, as reviewed in the previous chapter, has been developed in Western countries and has recently been adopted and played an influential role in Thai education reform. Transferring the Western style of pedagogy to other countries is challenged by differences in culture, which may result in the restriction of implementation (Walker & Dimmock, 2000). The mismatching of patterns of cultural values such as differing classroom norms, expectations, communication patterns, and teaching and learning styles, can potentially create many challenging situations and serious value conflicts. Implementation of formative assessment in Thailand is more complex than the notion of applying it in every classroom according to a government edict.

This research aims to explore Thai teacher thinking about formative assessment in the Thai context. Thus, background and overview information about assessment in Thai education considers the analysis of how these Thai cultural factors impact teacher understandings of assessment and assessment practices. This following section explores each of the three parts, in detail.

1. Initial teacher education;
2. Basic education core curriculum; and

3. Guidelines for measuring and assessing learning.

3.3.1 Initial teacher education. As discussed in Chapter 1, the Thai National Education Act of 1999 has served as the fundamental law for the administration and provision of education and training in Thailand. The Act sets out a vision for teaching and learning in all school and universities, in which teaching should aim to develop Thai students' capabilities for lifelong learning, to create powerful knowledge and learning processes that are relevant to the needs of Thai students and to improve the quality of life of Thai citizens (ONEC, 1999). The Act provides a set of guidelines for comprehensive educational reform with particular emphasis on learning reform through the student-centred approach, considered to be the heart of educational reform (ONEC, 2000). In terms of assessment, the Act calls for the application of authentic assessment which should be in line with students' needs, abilities, and interests by taking into account the knowledge, skills, attitudes, beliefs, and values students bring into their classrooms (ONEC, 2000). To comply with the National Education Act, all teacher education programs in Thailand have a responsibility to educate, research, develop and produce teachers whose knowledge and practice meets with the requirements of the Act (Office of Higher Education Commission [OHEC], 2007).

According to the OHEC (2015), all initial teacher education programs in Thailand should include the following six components: code of ethics; knowledge; intellectual skills; interpersonal relationship skills; numerical, communication and technological skills; and teaching skills. OHEC does not make any reference to assessment or evaluation as part of the skills and knowledge that they require pre-service teachers to acquire. In contrast, the Teachers' Council of Thailand is responsible for establishing standards for the teaching profession and accredit initial teacher education programs. The Council sets out requirements for delivering initial teacher education, including educational measurement and evaluation in initial teacher education programs as one of their standards of knowledge (OECD/UNESCO, 2016). These

requirements suggest a mismatch between the need for education policy and practice on how initial teacher education programs are preparing teachers.

In relation to assessment practices, Townsend (2007) conducted a study to review the assessment curriculum used in initial teacher education programs from five public universities in Thailand. Pre-service teachers are required to take a single course related to assessment, which is called education measurement course. The researcher interviewed eight professors who teach assessment courses, reviewed their university course syllabus and observed participants in their assessment courses. Results from Townsend's (2007) work revealed that:

- Each professor held a different level of knowledge about assessment;
- A variety of instructional approaches were used to deliver assessment content to pre-service teachers (e.g. lecture, individual work, group work);
- The assessment courses emphasised traditional assessment methods (e.g. paper and pencil tests, multiple-choice questions, and summative assessments);
- Bloom's Taxonomy of educational objectives, which incorporates three different domains - the cognitive, affective, and psychomotor development of students - was used to guide assessment development; and
- There was insufficient support for how to use assessment to make decisions about individual students, inform planning, and develop curriculum.

The result from Townsend's (2007) work suggested that Thai professors use a variety of instructional approaches to deliver assessment content to pre-service teachers. These approaches include lecture, individual work, and group work. The use of lecture and individual work on assignments are more traditional approaches to teaching and learning. These findings suggest that their course delivers assessment course curriculum to pre-service teachers through traditional teaching approaches, influenced by Thai cultural values, such as respect for authority

and a strong social hierarchy. Classroom interaction in the Thai context centres on the role of teachers as the authority and a source of knowledge in the classroom. Teaching is perceived as teacher dominated focusing on the transmission of knowledge and relying heavily on memorisation. Students are obedient, respectful to teachers, and reserved rather than expressing and sharing their ideas. Additionally, such teaching approaches may be in response to teachers' experiences of the course content in teacher preparation programs. For example, teachers often believe that a particular teaching approach which worked well in their own learning could work as well with their students' learning (Kagan, 1992). Thai professors taught with traditional teaching approaches exemplify that such experiences powerfully shape their teaching practices. Consequently, they used these approaches with pre-service teachers.

It is evident from Townsend's (2007) work that the assessment course emphasises training in traditional assessment methods and the development and utilisation of paper and pencil test. The findings from Townsend's (2007) work aligns with the report from OECD/UNESCO (2016). According to OECD/UNESCO (2016), education measurement courses adopt content designed to teach pre-service teachers about the role and purpose of educational evaluation, test design and implementation, curriculum and test analysis, validity and reliability, and score interpretation and evaluation. Pre-service teachers, therefore, are not being trained in a wide variety of assessment methods. Training in assessment seems to be limited and not offering pre-service teachers the opportunity to develop the comprehensive range of skills they require to be able to make the instructional decisions and develop the new assessment principles as mandated in the National Education Act (1999) (Townsend, 2007). A partial explanation of this phenomenon is that Thailand has typically followed the traditional assessment paradigm and relies heavily on centralised testing.

3.3.2 Basic education core curriculum. In recent educational reform, prescribed by the National Education Act (1999), the Ministry of Education announced the Basic Education

Core Curriculum B.E. 2551 (MOE, 2008) and the revised version of three learning areas (1) mathematics, (2) science and, (3) social studies, religions and culture (MOE, 2017a). The objectives of the Basic Education Core Curriculum reform position students as most important with the intention that learning processes should adopt a student-centred approach which serves as a strategy for enabling them to achieve curriculum goals (MOE, 2008). The MOE (2008) favours learning activities designed and conducted to facilitate and motivate students to construct their own understanding as meaningfully and effectively as possible. Assessment, under a student-centred approach, frequently refers to the use of various assessment tools to evaluate student understanding and students participating in the evaluation of their own learning development (ONEC, 2003).

According to the 2008 Basic Education Core Curriculum in Thailand, assessment is used at four different levels. These include the national, local, school, and classroom levels (MOE, 2008). Nationally, Thai students in Grades 6, 9, and 12 are required to take the ONET, which aims to evaluate and monitor students' achievement and the overall educational quality (MOE, 2008). The regional level in Thailand conducts standardised assessments for accountability purposes (MOE, 2008). The educational services within each region prepare and administer standardised examination papers across all age groups (MOE, 2008). At a school level, the institutions themselves design assessment to determine the education achievement of their students in the areas of reading, analytical thinking skills, writing, and desirable characteristics required of Thai citizens such as love of nation, religion and king, honesty, and integrity. These assessments take place on a semester and an annual basis (MOE, 2008). In the classroom, the MOE (2008) suggests that assessment practices used by teachers must change to fit this new view of teaching and should be authentic and linked to real-life situations. Teachers must actively engage with regularly and continuously assessing students' understanding and performance using various sources such as classroom observations, student artefacts, student works, and student classroom behaviours. Reform policy suggests that teachers implement

assessments in a variety of ways to promote learning and support the goal of this reform, e.g., questioning, observation, examining, and portfolios (MOE, 2008). Additionally, teachers should provide opportunities for students to construct new understandings through building on prior knowledge and engaging with self and peer-assessment as a means to help build the likelihood of student success. Teachers should provide feedback that explains to students how well they are progressing in the learning process, identifying and highlighting ways in which students can work to improve their learning. By continuously assessing students' understanding, the teacher gains valuable information about what the students genuinely understand, and their progress in skills and work habits (MOE, 2008).

According to the assessment framework, although the terms formative and summative assessment does not appear in the 2008 Basic Education Core Curriculum, there are elements of these approaches mentioned in the curriculum. For example, teachers use a variety of assessment practices such as questioning, observation, and portfolios as well as an emphasis on implementing assessments that support students to construct new understandings by building on prior knowledge. Summative assessment components are measuring the student's level of achievement or skill acquired at the end of an instructional unit and comparing it to some standard or benchmark. However, the 2008 curriculum provides teachers with little concrete guidance on how to assess students in ways that contribute to achieving the objectives of the curriculum with a distinct lack of clear direction about assessment.

Thailand is a strongly hierarchical and collectivist society (Hofstede, 1986; Komin, 1991). Thai classrooms and traditional teaching practices, therefore, are likely to be different from Western practices. As a result, implementing assessment practices imported from Western literature studies in classrooms in the Thai cultural context can lead to conflict and confusion between course content in schools and acceptable practices in society. For example, assessment practices such as questioning, self and peer-assessment require students to be active in their

learning and able to express individual ideas in class while traditionally Thai teachers expect students to be passive in the class. Successful implementation of formative assessment originates from the establishment of two-way communication between teacher and student. However, in the Thai classroom, it has been the teacher who traditionally initiates all communication as students are supposed to be quiet and only speak when requested to do so. Trompenaars and Hampden-Turner (1998) stated that due to the collectivist culture of Thai society, change is essentially a group, not an individual process suggesting that Thai teachers are more likely to move towards the implementation of innovations as a group rather than as individuals. Thai teachers tend to wait to adopt an innovation until a large group of other institutions have already adopted it. According to Hallinger and Kantamara (2000), Thailand is classified as an hierarchical culture, suggesting that decisions made in schools must be supported and promoted by the school principal. Thus, Thai teachers simply cannot move towards the implementation of innovation until their principal actively declares their support.

Further, Thai teachers are encouraged to use the elements of formative assessment in classrooms, but there is much focus on summative assessment and the rote memorisation of facts at the national, local, and school educational levels. This knowledge measured through the use of multiple-choice tests to document student learning suggests that high-stakes summative assessment remains as having a significant role to play in Thai education. The end of year test is considered an indicator of learning achievement. Therefore, Thai teachers tend to assess students based solely on summative assessment techniques, e.g., completing an end of year test rather than performance over the course. These approaches may not provide the most appropriate strategy for really assessing student learning and do not always provide students with an opportunity to demonstrate what they have learnt and how their thinking is changing. As a consequence, Thai teachers focus more time on ensuring their students can memorise subject content affecting the adoption of some classroom assessment practices.

3.3.3 Guidelines for measuring and assessing learning. In 2008, the OBEC announced the Guidelines for measuring and evaluating learning according to the Basic Education Core Curriculum B.E. 2551. The guidelines encourage teachers to shift their classroom environment and assessment practices from a focus on the assessment of student learning using tests to focusing on student development and assessing using various techniques to improve student learning and teaching quality. Furthermore, the guidelines require teachers to change their perception and acknowledge that all students are capable of learning. Adopting such a notion requires new thinking placing the student at the centre of the learning and assessment understood as a process of gathering evidence of student learning in order to improve learning rather than assessing the level of achievement and comparing it with other students. The rationale for the change is to prepare Thai students better to be lifelong learners. Thai students should learn in a supportive classroom environment where assessment is used to improve the quality of teaching and learning.

The guidelines also provide definitions and significance of measurement, assessment, evaluation, and classroom assessment. According to classroom assessment, the guidelines provide information comparable to assessment at the classroom level in Basic Education Core Curriculum. The guidelines also introduce types of measurement and assessment of learning based on the purpose, which include:

- Measurement and assessment of learning according to the teaching and learning process, consisting of diagnostic assessment, formative assessment, and summative assessment;
- Measurement and assessment of learning according to the purpose of assessment, consisting of assessment as learning, assessment for learning, and assessment of learning; and

- Measurement and assessment of learning according to the interpretation of learning outcomes, consisting of norm-referenced assessment and criterion-referenced assessment.

The guidelines mention the term formative assessment as an assessment for learning, introduced as an ongoing process where teachers collect evidence of student learning using a variety of techniques and identify how to improve student learning to meet learning standards and improve teaching practices. Additionally, the guidelines suggest that the purpose of using an assessment technique is to know students, assess the learning methods of students, and assess student development. Teachers may choose to use or invent an assessment method to suit the purpose and intention of the assessment. The principal methods of collecting information are classroom observations, oral examination, communication, questioning, journals, performance assessment, tests, authentic assessment, self- and peer-assessment.

However, at the moment, it is unclear how Thai teachers use these guidelines distributed to schools, with no official national follow-up initiative supporting teachers to use them in their teaching or to promote ongoing professional development. Thai Teachers were not always provided with opportunities to attend PD training programs related to assessment techniques designed to elicit student understanding. Following this approach seems to indicate that the current curriculum assessment policy is dependent upon teacher knowledge of and teacher willingness to use good assessment procedures without the need for a teacher development program to sustain such work.

3.4 Researcher as Insider and Outsider

In this context, I moved between being a researcher and holding a professional role in the Thai educational system. In presenting myself as an insider-outsider in this research, I was trying to understand better and appreciate the participants' view.

I am a native Thai who has grown up in a Thai family and studied in Thai public primary and secondary schools. I first obtained my degree and achieved a post-graduate degree at Chulalongkorn University in Thailand. Since I was young, I learnt to respect my parents, teachers and older people in society. I also learnt the importance of achieving social harmony and empathy for the needs and desires of others. In a classroom context, I also developed familiarity with passive learning, top-down communication, and teacher-centred approaches. For example, I could only speak in the classroom when requested by the teacher.

In the role of an academic educator at IPST, I have worked with Thai public primary teachers and school principals for many years. Since its inception, IPST's mission has been the development and continuous improvement of science curricula and science instruction. I have the opportunity to be a part of the science curriculum development and teacher training program teams. Teachers who attended the training programs had opportunities to experience a range of science teaching strategies. I have also provided PD training programs about science teaching and learning to public primary teachers before interviewing them about the impact of these programs and observing their classroom teaching. I have had various experiences observing the teaching practice of different teachers who possessed varied beliefs about teaching and learning. For example, some teachers believed that the best way to learn science was to transmit science knowledge to students explicitly. Therefore, these teachers taught science by lecturing with limited room for students to construct their knowledge, whereas others preferred their students to become involved in classroom discussions and construct knowledge by themselves. These teachers never pointed out any mistakes. Instead, they paid attention to student ideas and helped them to build their knowledge beyond what each student already knew. I noticed that this teaching practice was different from how teaching occurred during my time at school, an experience that offered me a new perspective on teaching and learning.

With my cultural background and personal experiences, I truly understand how culture plays a substantial role in the classroom environment in terms of, for example, expected behaviours of teachers and students in a classroom, communication patterns between teachers and students, and teaching and learning approaches. I am aware of verbal or non-verbal cues and social behaviours that are known only to members of the community. I consider the hidden assumptions that may be underlying certain behaviours, which I can then properly acknowledge and interpret. This cultural knowledge also allows me to make sense of and better understand some of the struggles and difficulties that students and teachers experience in a Thai classroom.

My academic and professional background also enables me to be knowledgeable about the education system. I can see that culture has an impact on classroom environments, something that I could not see as a student. For example, when I was observing classroom teaching, I noticed that after classes, students sometimes came to ask the teacher questions or to seek clarification of an answer that their friend had given in class. I asked the teacher why these students did not raise the question in class, and the teacher told me that his students did not want their friends to feel embarrassed and lose 'face'. I truly understand the practice of saving 'face' as I used to be like them when I was a student.

However, the insider position can be too close and too familiar, which can lead to the loss of critical ability and objectivity, and this can subsequently impact on data interpretation. Due to this concern, I was always conscious of the role I played in this research. I was careful to present myself in this research as an outsider, because I was a researcher, from outside of the participants' schools, and I am not a primary teacher. The outsider view might have influenced me to have different personal perspectives, experiences, and values to that of the participants, positioning this experience as integral to the research. My perspective as an outsider led me to step back from the insider perspective and to establish some distance when interpreting and analysing the data.

Furthermore, the primary focus of this study is formative assessment, which was imported from the literature of Western studies. With this in mind, when making assumptions or interpretations about my data, I needed to be careful and remember to use multiple lenses, including Thai and Western perspectives, to interpret the data as one interpretation might be inaccurate in a different cultural framework.

3.5 Summary

This chapter explored and discussed the cultural dimensions that may have an impact on Thai teachers, student thinking and their consequent behaviours. It is evident that Thailand is a country constituted by a strong hierarchy and a traditional collectivism culture founded on Buddhism. Additionally, Thai people maintain social harmony and avoid uncertainty. Some unique cultural characteristics and dimensions of Thailand appear to play an important role in classroom interactions between teacher and student. The impact of culture strongly reflects in people's thinking and beliefs. It is difficult to change such values and so instead of demanding that teachers and students change the existing teaching and learning culture, teaching strategies are instead modified to be culturally appropriate to teachers' and learners' preferences. To effectively implement and sustain assessment in a classroom, one should not expect Thai teachers to suddenly change their role to facilitators and Thai students to suddenly embrace active learning.

According to the literature, assessment support in Thailand is likely to be fragmented and disconnected from the classroom leading to inconsistent quality across the nation suggesting that training in assessment practices may be inadequate in Thailand and teachers may not receive the full support required.

The next chapter discusses the search to find an appropriate methodological approach as well as identifying, describing and rationalising the methods of generating data and data analysis.

Chapter 4: Methodology

4.1 Introduction

The purpose of this chapter is to provide an explanation and description of the research design and methodological detail used to explore the three main research questions as revisited below.

1. What do Thai primary teachers' think about the place and value of formative assessment to support science teaching and learning?
2. Why do Thai primary teachers hold these ideas about formative assessment?
3. What practices do Thai primary teachers describe when asked about formative assessment and what do these reveal about science teaching and learning in Thai primary classrooms?

Three sections form the structure for this chapter. The chapter begins with an overview of the approach to the study. This section describes the rationale of choosing a qualitative approach and constructivism paradigm to investigate the complexity of the human meaning-making process. The second section is an overview of the research design, including research phases and participant recruitment. Additionally, I explain data collection approaches, data analysis procedures, and limitations across the two phases of this study. The third and final section describes measures taken to ensure the quality of the data and consideration of ethical issues.

4.2 Research Approach

4.2.1 Qualitative research approach. This study aims to gain a better understanding of teachers' thinking about formative assessment in public primary science classrooms in the Thai context. This research values the subjectivity of each teacher participant who brings unique interpretations of formative assessment and the implementation of this approach in the

classroom. With this in mind, a qualitative research approach seems to be the most suitable because a qualitative study is best at contributing to a greater understanding of thoughts, perceptions, attitudes and processes, unlike a quantitative study, in which researchers identify sets of variables and seek to identify their relationship (Glesne & Peshkin, 1992). Additionally, a quantitative approach would mostly generate data that are structured, abstract, superficial and generalised (Johnson & Christensen, 2008), which is not consistent with the purpose of an in-depth study of teachers' thinking about formative assessment.

Numerous researchers (e.g., Creswell, 2014; Maxwell, 2013; Merriam, 2009) have identified that qualitative research involves an inquiry into an individual's view of the situation, event, activity, and experiences and the personal meanings associated with these lived experiences. Denzin and Lincoln (1994) explain the characteristics of a qualitative study through the following quote:

Qualitative research is situated activity that locates the observer in the world. It consists of a set of interpretative, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memo to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world meaning that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, and phenomena in terms of the meanings people bring of them (p. 3).

According to these characteristics, qualitative research involves the collection of a variety of empirical evidence that describes routine and problematic moments and meanings in individuals' lives (Denzin & Lincoln, 1994). Moreover, Creswell (2014) suggests that qualitative research involves an inductive process where researchers collect data to build concepts, hypotheses or theories in order to understand how people interpret their experience and construct

meaning. The essential characteristics of a qualitative approach in this research align with the suggestions of previously mentioned researchers. These include:

- Data generation in a natural setting where participants experience the issue;
- Data collected from various sources;
- Researcher as the key instrument in data generation; and
- A focus on meaning making in understanding participants' perceptions rather than explaining the data.

Adopting these characteristics enabled me to explore insights into teacher participants' thinking and perspectives, as well as to understand the personal meanings teachers constructed from their experiences, the nature of their knowledge and associated practices of formative assessment and gain insight about teachers' personal and professional experiences in an everyday setting. The data gathered from teachers of different backgrounds, allowed me to make sense of the complex world of teacher thinking, their understanding and practice, and meaning-making in relation to formative assessment.

4.2.2 Constructivism. As this research is qualitative in nature, it seeks to understand how individuals construct multiple meanings of formative assessment based on their experiences. This aim aligns with the core idea of constructivist philosophy (Creswell, 2014). Constructivist philosophy is essential and relevant to this study because this philosophy recognises that humans construct their own knowledge and multiple meanings of the world in which they live and work by engaging in the world and understanding it based on their historical and social perspectives which are subjective and diverse (Merriam, 2009; O'Toole & Beckett, 2010). Patton (2002) also asserts that research conducted under a constructivist paradigm tends to report the participants' perceptions, truths, explanations, beliefs, and worldview. This research, therefore, was conducted using a constructivist lens.

Qualitative research conducted under the lens of constructivism refers to how researchers interpret and make sense of what participants say and do through the process of data generation rather than narrowing meanings into a few categories or ideas in specific contexts (Creswell, 2014). Lather (2006) and Merriam (2009) believe the researcher not only seeks to describe the experiences and the meaning people have constructed but also understand how individuals interpret their reality. Therefore, researchers try to translate and generate meanings from data collected in the field around the issues for study. Based on the fundamental philosophies of constructivism, I investigated teachers' thinking from participants' multiple perspectives in the Thai context. This approach enabled each teacher to share their unique interpretations of formative assessment practices.

Accordingly, this research focused on capturing the teachers' voices to inform the interpretations of their experiences. As a researcher, I considered the conversations that I had with the teacher participants during semi-structured interviews as opportunities to understand the meaning they constructed from their experiences.

4.3 Research Design

4.3.1 Research phases. This research conducted in two phases commenced in the first phase (pilot study) with administering a questionnaire to Thai public primary teachers. Since this was not a comparative research study, the purpose of this phase was not to compare the results but to determine the direction for conducting the next step of the research. The findings from pilot study guided the identification and selection of key interview participants and also the selection of items in the questionnaire suited for inclusion in framing interview questions for the second phase (main study).

The approaches used in main study generated qualitative data forming the primary data set for this research. In main study, I invited questionnaire respondents to interview. The purpose of the interview was to gain a more in-depth understanding of their thinking and the views held

by Thai public primary school teachers. Figure 4.1 shows the processes followed to collect data for analysis. Later sections of this chapter provided further detail of each Phase.

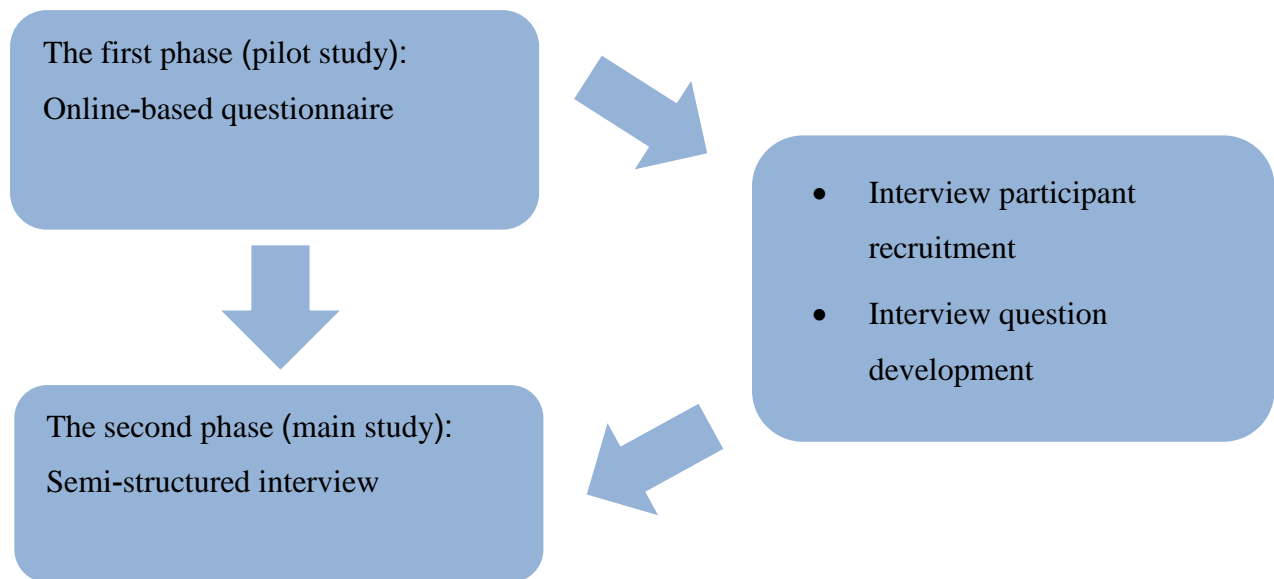


Figure 4.1. The process of collecting data

4.3.2 Research participants recruitment.

4.3.2.1 Target population. The target population for this research were teachers who met three criteria: (1) current teachers; (2) teaching subjects including science; and (3) teaching in Thai public primary schools. Public primary schools were the target site of this research because they make up the majority of schools in Thailand with over 30,000 schools across the country. I was also keen to invite teachers whose practices and knowledge was influenced by different geographical factors. Therefore, I invited public primary teachers from all regions (northern, eastern, central, north-eastern, western and southern) of Thailand to participate in this study. In order to contact participants from all regions across the country, an appropriate way was to contact the school where participants work. I obtained a list of public primary school names which have general school email addresses from the primary educational service area office website. Note though that not all educational service area office websites provided this information and not all public primary schools in Thailand have a school email address. Thus,

the collection of email addresses relied upon schools displaying retrievable information on their website.

4.3.2.2 Preliminary selection of research participants. Given the large size of the study area, a sampling technique, in this case, random sampling, became necessary in order to select participants. Random sampling provided an equal probability of being selected (Creswell, 2014). At the same time, I was also aware of the ethical issues associated with power relationships, as I had previously worked with some public primary school teachers, so I removed the names of their schools before applying sampling techniques. Once I removed schools, I divided the list into six, one for each of the six regions in Thailand. I then commenced with the northern region and assigned number to all of the schools in this region, selecting 28 public primary schools using a random numbers table. I repeated this process for the other five regions to obtain 168 public primary schools. On average, there are three or four teachers teaching science in a Thai primary school. I expected to finish with approximately 500 teachers as a sample. From this sample, I identified my potential participants for this study.

4.3.3 Pilot Study

4.3.3.1 Participants. There were 185 teachers participated in pilot study. The majority of participants were from the north-eastern region, then southern, western, central, northern, and eastern region, respectively. Table 4.1 presents a summary of the number of participants in pilot study.

Table 4.1

A summary of pilot study Participants by Region of Thailand

Region	Number of questionnaire respondents
Northern	24
North-eastern	74
Central	25
Western	28
Eastern	5
Southern	29
Total	185

4.3.3.2 Data collection method: Online-based questionnaire. A questionnaire was used as a data collection tool in pilot study as it is a useful method for collecting data from a large number of participants in a short amount of time (Bell, 2010). Several different types of questionnaire, including paper-based and online-based questionnaire, are used in educational research (Kelley, Clark, Brown, & Sitzia, 2003). In this study, an online-based questionnaire was an appropriate method because it was inexpensive with potential reach and access important considerations easily addressed in an online environment. Additionally, the time required for delivery and data entry of online-based questionnaires was short. Moreover, it did not require as much effort from the participants as they could complete an online questionnaire at a time and place that suited them.

The online-based questionnaire also helped to establish some overall trends in teachers' thinking about formative assessment. Moreover, the questionnaire data informed the development of qualitative interview questions so that more in-depth quality conceptualisations were gathered (Hesse-Biber & Nagy, 2017). In this research, the format selected for conducting the online-based questionnaire was Google Forms. The online-based questionnaire was self-

administrated and consisted of two parts, demographic detail and statements to be ranked using a Likert Scale (five-point: strongly agree, agree, uncertain, disagree, and strongly disagree). Demographics included gender, teaching grade, and the number of years of science teaching experience at primary level. The second part was thirty statements aimed at unpacking their familiarity with, and understanding about, the implementation of formative assessment. The questionnaire assisted the researcher in developing an understanding of the overall trends regarding teachers' thinking, in particular, why teachers hold their ideas and how they translate their ideas about formative assessment into classroom practice. To obtain a general picture of teachers' thinking about formative assessment, statement design related to the concept, processes, practices and value of formative assessment expressed by researchers such as Black and Wiliam (2003), Popham (2008), Sadler (1989), and Wiliam and Thompson (2008). Statement design also aimed to solicit participants' views, their previous experiences and their teaching strategies, which may influence their behaviour toward the implementation of formative assessment. The questionnaire then was translated into Thai to ensure accessibility.

4.3.3.3 Testing the questionnaire. As the researcher designed the questionnaire, it was appropriate to conduct a pilot test before using it in this study. Pilot tests follow-up to ensure the questionnaire was understandable for participants and generated the types of responses intended. I utilised a convenience sampling technique to recruit participants. In convenience sampling, participants are selected based on time, money, location, availability of sites or respondents (Merriam, 2009). Sixteen participants, including five science educators and 11 primary teachers, received a pilot test questionnaire. All participants selected fulfilled necessary criteria such as convenient sources of data, willingness and availability for the study, and provision of useful information. Participants received invitations to complete the questionnaire over two weeks. After the two weeks, 10 participants, including five science educators and five primary teachers, returned the questionnaire. All participants provided insights into the areas of the questionnaire,

including an understanding of instructions, content and response format. Further, they provided feedback about what they had difficulty making sense of and/or statements they had difficulty answering. The participants of the pilot study who offered feedback provided suggestions about how to make the questionnaire more useable and understandable. Examples of suggestions from the pilot group included using more ‘teacher friendly’ words, and also providing more space for teachers to complete their contact information. Accordingly, receipt of this feedback instigated a few minor modifications with the amended questionnaire returned to all participants of the pilot study to recheck by completing the amended questionnaire offering further suggestions or comments where necessary. The amended questionnaire came back without any modifications.

4.3.3.4 Data collection procedure. Before the study could commence data collection required permission to research from the Secretary-General of the OBEC, Ministry of Education (MOE), Thailand (see Appendix 1) and Monash University Human Research Ethics Committee (see Appendix 2). A permission letter from the MOE, an explanatory statement, and school principal’s consent forms were sent by email to 168 public primary school principals across the country asking them to send the link of the online questionnaire, an explanatory statement (see Appendix 3) and a consent form to the teachers in their school and inform their teachers of the response timeline. I received consent forms from 78 school principals.

If teachers volunteered to complete the questionnaire (see appendix 4), the expectation was that they return the consent form to the researcher and complete the online questionnaire within two weeks. After one week, as minimal responses were received, a reminder email was sent to the 78 school principals to ask them to remind their teachers to complete the questionnaire. As a result, 185 public primary teachers responded.

At the end of the questionnaire, a statement sought teachers willing to participate in the semi-structured interview. Those who were interested provided their contact information,

including their name, school name, school address, personal contact number, and email address.

Figure 4.2 presents a summary of data collection procedures for pilot study of this research.

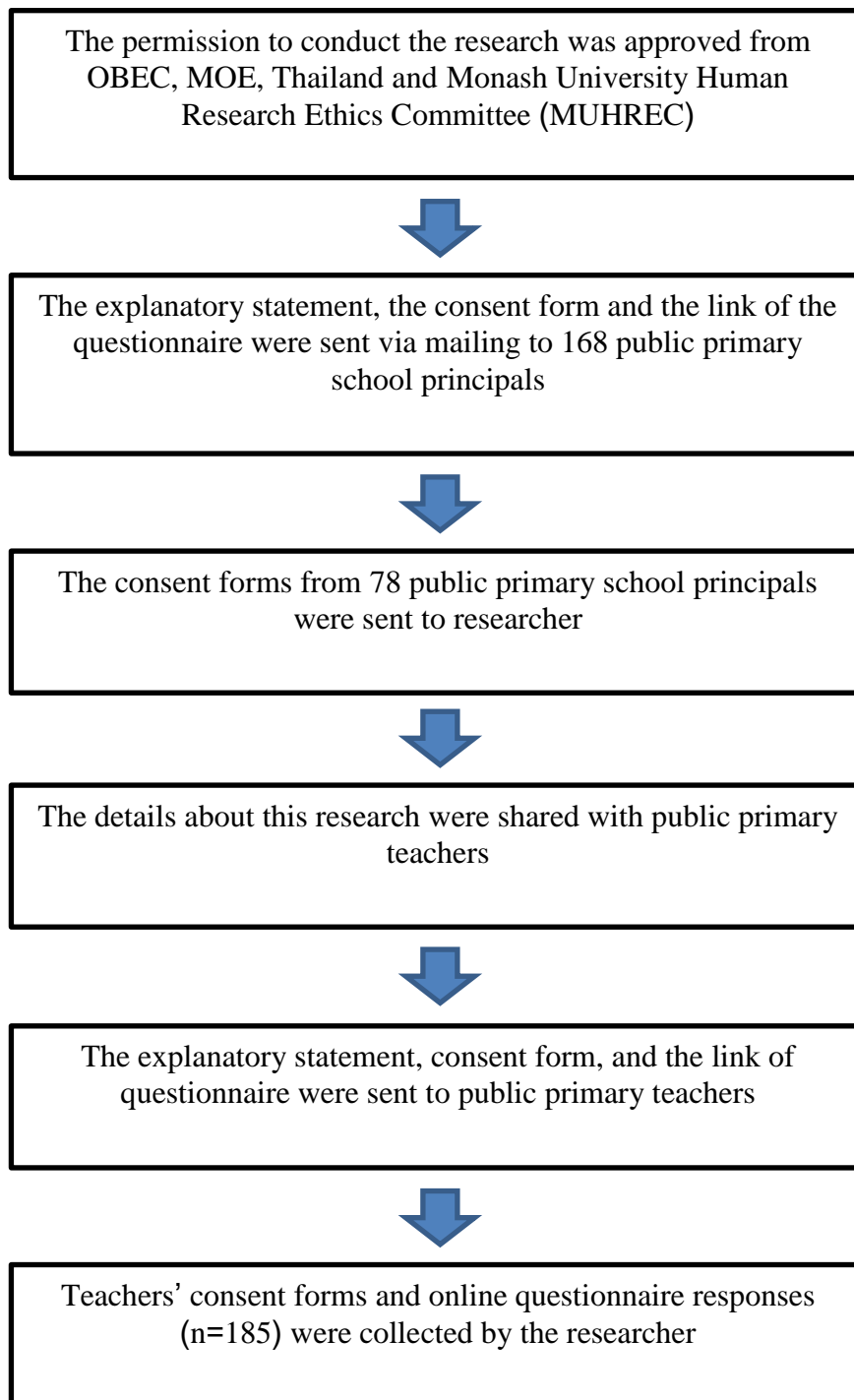


Figure 4.2. A pilot study data collection procedure

4.3.3.5 Data analysis. According to Merriam (2009), data analysis is the process of organising and refining data. Data analysis carried out in conjunction with data collection,

achieves rich and meaningful analysis helping to avoid the problem of unfocused and repetitious data (Merriam, 2009). First, I completed an initial analysis of the data in order to identify key participants and determine how to frame questions for main study of this research. Following Creswell's recommendations, required examining the data from the questionnaire to look at what participants reported in terms of their ideas, experiences and implementation of formative assessment.

An analysis of the demographic profile of the questionnaire respondents took place. Descriptive statistics, including percentage and frequency, were employed. Analysis of questionnaire responses was conducted by coding the various categories of statements on the questionnaire according to the following 5-point Likert scale: Strongly Agree - 5; Agree - 4; uncertain - 3; Disagree - 2; Strongly Disagree - 1. The data were categorised into general trends to obtain an overall picture of teachers' thinking. Over 93% of teachers expressed their level of agreement by choosing the ratings strongly agree and agree with 24 statements related to:

- Their understanding of formative assessment such as formative assessment improves student learning, provides the teacher with evidence of what students have learned in science and helps teachers to identify student's' abilities;
- Implementation of formative assessment such as providing student feedback, assessment criteria, providing students opportunities to assess themselves and their peer, share their learning goals and express their own opinion; and
- Their need to learn more about formative assessment.

The following six statements were particularly interesting as participant's responses varied across the Likert scale.

- When teaching science, I give students written non-grade feedback
- I have had adequate training in formative assessment

- I feel the implementation of formative assessment during science class is time-consuming
- Testing is important when teaching science
- When teaching science, I rely on the result of the paper and pencil test
- I was successful in teaching as a result of teachers who used a lecturing method for science teaching

The questionnaire data analysis provided the basis to develop the qualitative interview questions for main study.

4.3.3.6 Limitation of pilot study. Data from pilot study, obtained through the online-based questionnaire, was self-reported data from teachers. A possible bias may exist within this data set as teachers may have responded intending to please the researcher, such as selecting answers they thought researcher wanted to receive. Additionally, in Thai culture, teachers are expected to be highly knowledgeable, given that it is their responsibility to develop student knowledge and learning abilities (Deveney, 2005). Therefore, teachers do not want to lose ‘face’ if they do not know the answers. These considerations may account for the high level of ‘strongly agree’ and ‘agree’ responses to almost all items in the questionnaire. Selecting such responses may have been designed to demonstrate that they understood the concept of formative assessment.

4.3.4 Main Study

4.3.4.1 Participants. Recruitment of participants for main study drew on the pool of questionnaire participants. There was no questionnaire respondent from the eastern region of Thailand who agreed to participate in main study. However, 86 questionnaire respondents from five regions agreed to participate, the majority of these provided contact details by giving a school email address and school contact number. Only 38 questionnaire respondents provided personal contact information. When considering this information through a Thai cultural lens, it was possible that the majority of teachers lacked confidence in giving their personal contact

details as they may have been unsure about participating in a semi-structured interview. Instead, they provided their school email address and school telephone number. Providing contact details by giving a school email address and school contact number minimises the opportunity for researchers to contact teachers. I was concerned about this as it held potential implications for the data collection, so as a result, I chose interview participants from questionnaire respondents who provided personal contact information.

The interview participants were identified based on the following four criteria:

1. the questionnaire respondents who agreed to participate in the semi-structured interview and provided their personal contact details;
2. the location of participants with participants selected from the provinces that were easily accessible, i.e., convenient for travelling from all regions of Thailand;
3. participants' experiences of science teaching to ensure the cohort of teacher participants represented a range of years in service; and
4. if the responses they had provided in the second part of the questionnaire, focused on their practices and views of formative assessment and if they also responded to the six statements of interest.

Based on the criteria listed above, 15 participants received invitations; however, 2 participants withdrew from the research. I was also concerned about the importance of maintaining the confidentiality and anonymity of participants. Throughout this study, use of pseudonyms Pailin, Tubtim, Petch, Paitoon, Komen, Ploy, Paytai, Mook, Opal, Morrakot, Bussarakham, Thong, and Nin provide a way to de-identify the participants. I present the following summary of the interview participants' characteristics.

Teachers from the northern region

(1) Teacher Pailin

Teacher Pailin (female) completed a Bachelor of Education in Secondary education (Physics). She teaches in a public primary school in an urban area in the northern region of Thailand. She has five years science teaching experience at primary level. Currently, she is a Grade 5 classroom teacher teaching all compulsory subjects, including science. She also teaches only science to Grade 6, and she has approximately 40 students in her classes.

(2) Teacher Tubtim

Teacher Tubtim (female) earned her degree in Secondary Education with an emphasis in Chemistry. She has eight years science teaching experience in this primary school. Currently, she is a Grade 3 classroom teacher teaching all compulsory subjects, including science and teaching only science for Grade 4. She has approximately 45 students in her classes.

(3) Teacher Petch

Teacher Petch (male) completed a Bachelor of Education in Primary education. He has six years teaching experience in primary school. Petch used to teach in a small primary school with class sizes of seven students. Currently, he is a Grade 3 classroom teacher teaching all compulsory subjects, including science, and he has approximately 30 students in his class.

Teachers from the north-eastern region

(4) Teacher Paitoon

Teacher Paitoon (male) earned a Bachelor degree in Education in Health and Physical Education. He has six years science teaching experience in primary schools. At first, his assignment was to teach Physical Education. After a year, there was a vacancy for a science teacher. Then he was requested to teach only science for Grade 5 and 6 alternating each year. He

taught Grade 5 last year. Currently, he teaches science for Grade 6. He has approximately 50 students in his class.

(5) Teacher Komen

Since teacher Komen (male) was young, he was interested in being a teacher. After completing his secondary education, he applied to enrol in a teaching program and received a Bachelor of Education in Primary education. Teacher Komen has 26 years of teaching experience at primary level. At first, his assignment was to teach all compulsory subjects, including science. Due to his exemplary performance in teaching science, his assignment now is to teach only science for Grade 5 and 6. He has approximately 55 students across his classes.

Teachers from the central region

(6) Teacher Ploy

Since she was young, Teacher Ploy (female) had the ambition to become a teacher. She was inspired to be a teacher, as her parents were also teachers. She enrolled in a degree in primary education and has eight years of science teaching experience at the primary level. Currently, she is a Grade 6 classroom teacher and teaches all compulsory subjects, including science. She has approximately 30 students in her class.

(7) Teacher Paytai

Teacher Paytai (male) finished a Bachelor of Arts in Thai language and completed a Graduate Diploma (Teaching Profession) Course of one-year duration. He has been teaching science in primary schools for eight years. He is a Grade 3 classroom teacher teaching all compulsory subjects including science and teaching only science for Grade 4. Currently, there are approximately 25 students per class in his classes.

(8) Teacher Mook

Teacher Mook (female) received a Bachelor of Education in Primary education. She had experienced a passion for learning science since she was young as a former primary science teacher was kind to her. This passion had inspired her to become a teacher. She has 24 years of teaching experience at primary level. Currently, she is a Grade 4 classroom teacher teaching all compulsory subjects, including science and teaching only science for Grade 6. She has approximately 35 students in her classes.

Teachers from the western region

(9) Teacher Opal

Teacher Opal (female) received a Bachelor of Education in Primary education. She has 28 years of experience teaching in primary school. During teaching in her present school, her assignment is to teach all compulsory subjects, including science. Currently, she is a Grade 1 classroom teacher. She has approximately 25 students in her class.

(10) Teacher Morrakot

Teacher Morrakot (female) teaches in a primary school located in a suburb in the western region. At first, she was not that interested in being a teacher, but her parents convinced her to give it a try. According to her parents, being a public school teacher is a secure job. She then enrolled in a Primary Education program. She has two years science teaching experience in primary school. During teaching in her present school, her assignment is to teach all compulsory subjects, including science. Currently, she is a Grade 4 classroom teacher. She has approximately 40 students in her class.

(11) Teacher Bussarakham

Teacher Bussarakham (female) completed a Bachelor degree in Primary Education. She teaches in a primary school located in an urban area in the western region. She has four years of

science teaching experience in primary school. She was inspired to be a primary teacher by her mother, who was also a primary teacher. As her mother shared positive experiences in teaching with her. Currently, she is a Grade 6 classroom teacher teaching all compulsory subjects, including science. She has approximately 30 students in her class.

Teachers from the southern region

(12) Teacher Thong

Teacher Thong (female) completed a Bachelor degree in Secondary Education with a specialisation in teaching general science. The school is located very near to her home. She was a primary student at this school, and some of her colleagues were her teachers. She has five years of science teaching experience in primary school. Currently, she is a Grade 4 teacher teaching all compulsory subjects, including science. She has approximately 30 students in her class.

(13) Teacher Nin

Teacher Nin (female) received a Bachelor of Education in Primary education. She has 29 years teaching experience at primary level. Currently, she is a Grade 6 classroom teacher teaching all compulsory subjects, including science. She has approximately 30 students in her class.

4.3.4.2 Data collection method: Semi-structured interview. Interviewing is one of the most popular data collection methods in qualitative research because it generates rich data that allows insights into how individuals interpret their experiences through what they say and how they say it (Merriam, 2009). According to Patton (2002) and Richards (2014), the essence of an interview approach is to help the researcher find out what is in the interviewee's mind and how they make sense of their world. Therefore, interviewee's thoughts, views, perceptions and perspectives can be elicited through interview. As this research aims to inquire into the complex nature of teachers' thinking, interviews were an appropriate data collection approach.

Interviews range from being highly structured to being unstructured. Structured interviewing refers to situations in which interviewers ask participants a series of pre-determined questions to access participants' perspective (Merriam, 2009). On the other hand, unstructured interviewing allows researchers to ask relevant questions to obtain a better understanding of the phenomena and experiences of participants. There are no pre-determined questions. In this research, semi-structured interviews were an appropriate source of data because this approach not only allowed for the use of pre-determined questions but with the opportunity to ask follow up questions as a way of inviting the participant to provide further information about their thinking. Semi-structured interviews are commonly used in qualitative research because this approach provides such flexibility. It is systematic in the wording and structuring of questions allowing the researcher to generate depth and richness of information, while also allowing the researcher to notice behaviours and non-verbal communication (Wengraf, 2001). Additionally, semi-structured interviews provide the researcher with more flexibility to move to different interview questions depending on the flow of the conversations.

The purposes of using semi-structured interviews as a data collection tool in this phase were to gain insights into Thai teachers' thinking about formative assessment and further explore and clarify the concepts highlighted in the findings of the pilot study questionnaire. Before conducting the interviews, I prepared the guiding questions which were open-ended and developed from the responses gathered from pilot study and also listed sub-questions and possible probing questions which allowed me to clarify if there was something that seemed to be unclear. The use of open-ended questions gave ample opportunity for teachers to provide specific details and crucial perspectives not captured from closed questions. Moreover, the interviews required interactions with the participants allowing them to present their views in their own unique way (Denzin & Lincoln, 1994). Appendix 5 provides examples of interview questions.

4.3.4.3 Data collection procedure. In order to better understand Thai primary teachers' voices and life experiences, the initial research agenda was to establish a good relationship and trust with these teachers. Guba and Lincoln (1985) suggest that building and maintaining trust are an essential task for qualitative researchers. Researchers must be able to adopt a careful approach to participants indicating that the researcher has a willingness to listen to them rather than doing harm (Truglio-Londrigan, Gallagher, Sosanya, & Hendrickson-Slack, 2006). Once the researcher has the trust of their participants, the study will proceed smoothly. The 15 teachers, who agreed to participate in a semi-structured interview and provided their contact details, were contacted by email with email correspondence, explain the role of the researcher along with the purpose of this research. Additionally, the email explained the interview process making it very clear that they had the right to withdraw from the study at any time prior to the data analysis stage together with providing assurances that all the data would be de-identified and remain confidential. This early contact helped the researcher to build relationships and develop a rapport with the participants (Guba & Lincoln, 1985). I aimed to develop trust between myself as the researcher and the participants by carefully explaining my role. I hoped that the teachers would view my position as an outsider, who wanted to collect the data from them rather than someone who had come in to judge their work and their schools.

The researcher contacted those who replied via email, indicating a willingness to participate in the interview by phone. As a result, 13 teachers offered their time for the semi-structured interview. Various dates and times were provided to the participants to find a mutually agreeable time to conduct the interview. Participants selected a date, time and place that suited them. Then I carefully scheduled the interview to avoid overlap among interview participants.

Interviews were conducted from August to mid-September in 2017. The interviews were face-to-face and took place in a quiet area that were convenient to the participant. Each interview lasted approximately 75-90 minutes, depending on participant responses. As Thai is the first

language of the researcher (interviewer) and teacher participants (interviewees), I chose this for all original interviews and conversations. I believe that communicating in Thai with the teachers benefited my study in four key ways:

- It helped teachers to communicate with researcher fluently and effectively;
- It helped teachers to express their views more fluently, clearly and confidently;
- It took less time to explain specific terminology; and
- It also reduced the number of translation complications.

Table 4.2 provides a summary of data collection and the timeframe for main study of this study.

Table 4.2

Summary of Data Collection of main study

Data collection period	Activities	Region
Week 1-2	<ul style="list-style-type: none"> • Contacted and invited the questionnaire participants by email • Contacted by phone participants who wanted to continue to the interview • Confirmed the interview date, time and place with participants 	All regions
Week 3	<ul style="list-style-type: none"> • Semi-structured interviews • Transcribe the interviews • Contacted the participants in the southern region to confirm the interview date, time and place 	Western
Week 4	<ul style="list-style-type: none"> • Semi-structured interviews • Transcribe the interviews • Contacted the participants in the central region to confirm the interview date, time and place 	Southern

Data collection period	Activities	Region
Week 5	<ul style="list-style-type: none"> • Semi-structured interviews • Transcribe the interviews • Contacted the participants in the northern and north-eastern region to confirm the interview date, time and place 	Central
Week 6	<ul style="list-style-type: none"> • Semi-structured interviews • Transcribe the interviews 	Northern and north-eastern

All interviews for main study of the research were audio recorded with the thirteen teachers asked for their permission to record before taping. Audio recording provided a technique for data collection directly from the participants, and it was a useful resource allowing the researcher to revisit the verbatim conversations at any time (Yin, 2009). Moreover, it also ensured that all interview transcriptions maintained the richness and accurateness of what participants had said (Merriam, 2009). Before conducting the official interview, the interview session began with a casual conversation—teachers engaged with the researcher discussing basic information, such as their educational background and personal life stories. As a researcher, I was also asked by teachers to share my personal life stories, my study and my experience of living abroad. This conversation allowed the researcher and teacher to get to know and become familiar with each other. Then Teachers were asked open-ended research questions, plus additional subsets of these questions, and were encouraged to elaborate on each of the questions in an honest and relevant manner providing an opportunity for the researcher to ask follow-up questions based on the response of the participants and explore aspects of the research question more thoroughly.

During the interview, the researcher also wrote notes to record the teachers' key ideas and their non-verbal communication, for example, gestures and actions, along with their answers

to the questions. At the end of the interview, I offered teachers the opportunity to double check the transcription of their interview. Moreover, after finishing each interview, I immediately wrote reflective notes summarising my impressions and interview interpretations.

4.3.4.4 Data analysis: Thematic analysis. Prior to the qualitative data analysis of the audio recorded interview data, Thai transcription occurred. After transcription concluded, the teachers who had signalled their wish to do so previously took up the opportunity to read their interview transcript. As a result, three teachers received transcripts via their individual email addresses. These teachers were then able to read, modify where necessary, and return to the researcher within one week. After five days, the teachers returned all transcriptions with a few minor modifications.

As qualitative approaches are incredibly diverse, complex and nuanced, Braun and Clarke (2006) suggested that researchers should view thematic analysis as a foundational method for qualitative analysis. The purpose of thematic analysis is to identify, analyse and report patterns within data sets (Braun & Clarke, 2006). Thematic analysis provides an illuminating description and rich insights of complex phenomena (Tesch, 1990). In this research, thematic analysis intended to explore the understanding of an issue that reflected the understandings of Thai primary teachers' views toward formative assessment. This research followed six steps of thematic analysis process suggested by Braun and Clarke (2006) as listed below.

1. Familiarising with data;
2. Generating initial code;
3. Searching for themes;
4. Reviewing theme;
5. Defining and naming theme; and
6. Producing the report.

First, I read through the interview transcripts several times to get the general sense of the data and developed a deeper understanding of the information provided by participants.

Second, I analysed the data by coding. In doing the analysis, coding the data was done by hand using different coloured highlighters to mark the presence of ideas in various parts of data. The colours identified similar ideas, facilitating grouping these comments into categories. In, working through this process, it was important to read the interview data carefully noticing any segments where a respondent definitively clarified a position. It was then necessary to identify how participants talked about this position, for example, if the supporting reasons were well-articulated. Such sections of the transcripts provided relevant evidence of teachers' thoughts, their practices, their experiences, their view, their formative assessment training, as well as the factors that influenced their practices, were highlighted. Then, using the colour coded categories, text segments were coded as categories of meaning (e.g. "providing feedback", "providing examples", "asking questions", "using tests", "enhance student learning", "to ensure students have understood" and "to know what students have learnt"). Each interview transcript underwent this process of analysis.

Third, using all the codes, the possibility of initial themes were explored. Themes were defined using text segments, short phrases marking initial thoughts about concepts or categories of meaning. Some codes appeared to be related such as, "providing feedback", "providing examples", "asking questions" and "using test" which became combined into a theme of "teacher assessment technique". When examining the codes such as, "enhance student learning", "to ensure students have understood" and "to know what students have learnt" another theme emerged which became "teacher understanding about the purpose of formative assessment".

Fourth, I reviewed and checked initial themes to confirm their suitability for accurate application to the coded extracts and the entire data set, followed by generating a thematic analysis map.

The fifth step was ongoing analysis to define and refine the specifics of each theme. Each theme identified the essence and the overall story the analysis told to ensure there was not too much overlap between themes. Then, individual themes were generated, clearly defined and named.

After reviewing and refining, the themes were finalised and presented a step that involved final analysis of selected extracts, relating to the analysis to the research question and literature, to produce a scholarly report of the analysis.

According to Braun and Clarke (2006), this data analysis process is not linear merely moving from one phase to the next, instead, moving back and forth as needed throughout the phases as a more recursive process. Therefore, during the entire analysis process, I often had to go back and forth through the steps and go through the data several times.

Following the process of thematic analysis, four key themes originated from the interview data. The themes are as follows:

1. The place of formative assessment;
2. The value of formative assessment;
3. Factors influencing teachers' decision making when implementing formative assessment in science teaching; and
4. Teachers' formative assessment practices in science teaching.

Then the data from each interview was translated from Thai to English in order to support my claims and evidence during the writing process. Each translation was done by me and reviewed by a third party in order to verify the translations. The translation focused on the important ideas that would support telling the research story rather than on translating all aspects of the interviews.

Example of translation:

Thai: การประเมินผลเพื่อการเรียนรู้ การประเมินเพื่อพัฒนาการของเด็ก เราอาจจะมีการให้เด็กทำ
ดูว่าเด็กได้คะแนนตรงนี้เท่าไร อาจจะเป็นแบบทดสอบ ว่าเด็กผ่านตามตัวชี้วัดนี้มั้ย ดูว่าเค้าเข้าใจในสิ่งที่เรา
สอนหรือไม่ ที่เราสื่อสารมากน้อยแค่ไหน เวลาเราสอนเราก็สังเกตจากหน้าของเค้า ว่าเค้าตั้งใจแค่ไหน ว่าเค้า
จะคุยหรือไม่ ถ้าเค้าสนใจในสิ่งที่เราสอนเค้าจะหยุดนิ่ง

English translation: Formative assessment is used to assess the development of students.
We give them a task and see how many scores they get. A task can be a quiz to see whether
students can achieve the indicator or not. See how they understand the lesson and understand
what we teach. During the class, we observe their faces to see how they are paying attention, and
if they are talking to other students. If they are interested in the lesson, they will stop doing
anything.

4.3.4.5 Limitation of main study. There were several limitations of main study that
may have influenced the findings. Firstly, it was difficult to interview Thai teachers because this
is not a common practice in Thai culture. Thai teachers are not familiar with participating in an
interview. They are not confident, and they are worried that they may answer the questions
incorrectly. In addition, a possible limitation is teachers' attitudes toward research. Teacher
participants signified the research as a process to judge the level of their knowledge and teaching
quality. As discussed in Chapter 3, Thai teachers perceive themselves as a good source of
knowledge and as a 'righteous guru'. They do not want to lose 'face' if they do not know the
answers. As a result, most teachers were reluctant to participate in a semi-structured interview.

The self-reported nature of the interviews was another limitation as the participants might
have difficulty remembering and recalling the details of their classrooms or their practices.

Lastly, a limitation that may have influenced the results is data confidentiality. Even
though all interview participants had reassurances about data confidentiality, they remained

unconvinced that the conversation and their answers during the interview were confidential. Participants asked the researcher many times to ensure their confidentiality. They were concerned that their school principal, their colleges and the readers of this thesis might identify their name, school name and the region of their school and this recognition would affect their career resulting in many interview participants preferring interviews held outside the school.

4.4 Quality Criteria and Ethical Considerations

In any qualitative research study, credibility, transferability, dependability, and conformability are the four criteria of naturalistic inquiry that assist in ensuring the quality of the research (Guba & Lincoln, 1985).

Triangulation and member checking were used in this study to meet the credibility criteria. Triangulation is “the process of corroborating evidence from different individual, types of data, or method of data collection in descriptions and themes in qualitative research” (Creswell, 2014, p. 29). Triangulation is a well-known strategy used to compare and cross-check the collected data (Merriam, 2009). As all knowledge is subjective, triangulation plays a key role in reducing bias (Hatch, 2002). According to Denzin and Lincoln (1994) and Merriam (2009), there are four types of triangulation used to validated the data: (1) multiple methods, (2) multiple sources, (3) multiple investigators, and (4) multiple theories. This study employed multiple sources of triangulation. This type of triangulation involves collecting data from people of different backgrounds to gain multiple perspectives on data and increase the depth and quality of the results. To ensure the credibility of the research, data on teachers’ thinking was collected with more than one source using semi-structured interview. Collecting data from different participants allows the researcher to find the commonalities across all data sources. Besides that, it allows the researcher to compare and verify the data.

Member checking was employed to ensure the accuracy, reliability and authenticity of the data provided by the participants. The researcher offered teacher participants the opportunity

to check the transcript of their interview to ensure that the interpretation was correct, to check the summaries to identify whether or not the interview data analysis reflected their perceptions. If any discrepancies appeared, I discussed those with the participants and made changes where necessary according to their suggestions. In order to ensure the validity of the responses and as part of the member check process, the researcher occasionally restated or summarised the response of a participant to ensure that a clear understanding of terminology was in place so as not to create a random variation from the intention of the question or context of the answer. This practice sought to maintain the focus of the interview and the relevance and accuracy of all recorded responses.

In terms of transferability, Merriam (2009) stated the importance of qualitative research findings or significance having application to other or broader areas. Hatch (2002) mentioned that knowledge is subjective, so it would not be possible to ensure that the findings of this study are appropriate and applicable to the context of other studies. This research design may have limited applications when implemented in other settings. However, Guba and Lincoln (1985) suggested that researchers can provide a thick description, such as time and contexts, to help readers to understand how the findings might be transferable to other situations.

As described earlier, this research used triangulation of multiple data sources to establish dependability. According to Guba and Lincoln (1985), to ensure the dependability of the research, researchers can provide sufficient details and documentation of the methods employed in the study so that the study can be scrutinised and replicated. Thus, I described the research steps taken from the beginning of this research to the development and reporting of the findings. Another technique used to improve the dependability of the research is an inquiry audit (Guba & Lincoln, 1985). In this research, Monash University milestone panel members who are lecturer researchers of the Faculty of Education played the role of inquiry auditors. Milestone panel members are responsible for supporting, facilitating, and tracking the decisions made and steps

taken in the study. This included the appropriateness of my inquiry decisions and methodology, and ascertaining whether the findings were grounded in the data by tracing back through transcripts.

Regarding conformability, this study used an audit trail. According to Merriam (2009), an audit trail describes in detail how data were collected, how categories were derived, and how decision making occurs. Audit trails refer to the process of going back and checking the original sources in transcripts, documents, journals, field notes to ensure that the influence of the researcher's judgment was minimised (Guba & Lincoln, 1985). In this study, all raw data have been kept, including questionnaire results, interview audiotapes, record memos on the process of questionnaire development, conducting the research, and analysis and interpretation of data. While analysing the data, I checked the raw data to ensure the study's findings were the result of the experiences of the participants rather than the preferences of the researcher. The audit process was another technique used to develop conformability for this study (Guba & Lincoln, 1985). The milestone panel members also played the role of external auditors to examine whether inferences based on the data were logical, looking carefully at analytic techniques to ensure these were well-considered, employing appropriate category labels while maintaining high quality interpretations, with categories used effectively.

Ethical considerations in research generally relate to the recruitment of participants, data collection and the way data is used and communicated (Babbie, 2011). Key considerations for the researchers are ensuring voluntary participation, anonymity and confidentiality (Merriam, 2009). Prior to data collection, the researcher sought ethical approval for this study from the Monash University Human Research Ethics Committee. The completion by all participants of consent forms and the use of pseudonyms to maintain the confidentiality and anonymity of participants were important features of this research process. In line with ethics standards, all recording and reporting data will be stored securely for five years. After this time deletion and

destruction of all digitised data and hard copies occur in line with the processes prescribed by Monash University.

4.5 Summary

This chapter has explained the methodology used for this research to explore Thai public primary teachers' thinking about formative assessment, why they hold these ideas and how they transfer their knowledge into their practice in the classroom. There were two phases of data collection. A pilot study gathered data through the administration of an online-based questionnaire with 185 public primary teachers across the country. Data analysis used descriptive analysis to examine the general trend of teachers' understanding of formative assessment and the extent and frequency with which teachers utilised formative assessment strategies. A main study conducted a semi-structured interview with 13 teachers who agreed to participate after completing the questionnaire. The purpose of this phase was to provide further and more detailed information about teacher thinking and practice concerning formative assessment and why teachers hold particular ideas.

The following three chapters present the findings of the analysis of the qualitative data obtained from the semi-structured interviews. The chapters draw from the information gained from 13 teachers as they shared their perceptions about the place and value of formative assessment, the potential factors influencing their thinking and decisions to implement formative assessment in their science classrooms, and the practices they associated with formative assessment.

Chapter 5: Thai Primary Teachers' Thinking about the Place and Value of Formative Assessment in Science

5.1 Introduction

As stated in Chapter 1, this study aims to explore and understand how Thai primary teachers think about formative assessment to support science teaching and learning. Research Question 1 design aimed to gain a better understanding of teachers' personal knowledge about formative assessment exploring teacher understandings through questions designed to examine their thinking about what formative assessment meant to them, what they understood by the term formative assessment when formative assessment took place in their science classroom and what their values were around the implementation of formative assessment.

This chapter explores the findings to learn more about what Thai teachers think about the place and value of formative assessment to support science teaching and learning. While the findings revealed that Thai teachers understood formative assessment in a variety of ways, there were three key themes:

1. Frequency of use—a one-time event (simple) to an ongoing part of teaching practice (more complex);
2. Reasons for valuing formative assessment; and
3. Recognising the potential of formative assessment to inform teaching practice.

I explore each of these themes in detail below.

5.2 A Continuum Construct of Understanding

When exploring the relationship between teachers' understandings and practices regarding formative assessment in the science classroom, the findings indicated that formative assessment was understood and enacted by Thai primary teachers in a variety of ways and there

were no consistent similarities from teacher to teacher. However, while responses indicated difference, the analysis of the data revealed a possible continuum of understanding. Teachers' thinking about formative assessment appeared to move from a very technical approach, often a one-time event, to that where teachers recognised formative assessment as an ongoing part of their practice, which required them to attend to a range of considerations as they worked to support students to construct understanding across stages of learning. There were no clear boundaries around or between these understandings; they simply increased in complexity. Therefore, it is not the intention of the analysis to position teachers at particular points of understanding but instead to use a continuum as a construct to interpret the different ways formative assessment appeared to be understood and enacted by Thai primary teachers.

5.3 Frequency of Use—A One-Time Event (simple) to an Ongoing Part of Teaching Practice (more complex)

The teachers in this study used formative assessment in their science classroom at different times. Some teachers described formative assessment as an overall evaluation of students' academic achievement, where formative assessment was used to evaluate student attainment of the learning objectives at the end of a major instructional period, such as a chapter or a semester. While other teachers used formative assessment more frequently.

When teachers responded to what they thought about when they heard the term 'formative assessment', Morrakot, Opal, Thong, and Paitoon expressed an understanding that they implemented formative assessment in their classroom as the final stage of a teaching sequence. For example, Paitoon implemented formative assessment "at the end of class when a chapter was completed to check how much of the content had been acquired by the students and whether the learning objective has been met". Similarly, Morrakot stated that she conducted formative assessment at "the end point of learning". She further explained using the following example: "the final test that all students need to do". While Thong stated that,

Usually, teachers use formative assessment at the end of the class, or when finishing teaching the chapter, or sometimes they use it at the end of a semester to evaluate student learning, skill, academic achievement and how much knowledge students gain.

Opal reported using formative assessment practices to provide a score when students completed a test at the end of a lesson. She said, “formative assessment might occur when students complete a test at the end of a lesson or when a chapter is complete. Teachers check for understanding after the lesson has been taught”.

These four teachers' comments reported formative assessment as a one-time event usually occurring at the completion of teaching. Furthermore, these four teachers used formative assessment for specifying how well their students knew the overall content. It is noteworthy that this interpretation of formative assessment is contrary to the definition that is commonly used in the literature (e.g. formative assessment is multiple ongoing processes, formative assessment is an integral part of teaching and learning, formative assessment happens throughout instruction, formative assessment provides information about student learning for subsequent instruction to support student learning).

Three other teachers—Nin, Paytai and Ploy—reported that formative assessment occurred during teaching and learning sequences in three key stages. For Nin, these three stages were defined by (i) initial questioning before commencing an activity, (ii) questioning positioned within the activity, and (iii) discussion at the end of the activity. Nin's reflection below clearly identified these stages:

I ask questions before I let students do the activities because I want to make sure that they know what to do and know what to pay attention to... I ask questions again during the activities, discussion and at the end of activity until I ensure that their understandings are correct... I assess them to ensure that they know from the beginning, they do not miss anything along the way... when they show that they are still confused, I explain and give an example to them... I do not want to wait to assess students understanding only at the end of the lesson; it is too late to help students if they have misunderstood.

This response suggested that Nin considered formative assessment practices as happening before, during and at the end of a lesson. The comments also provided evidence of Nin applying formative assessment in each stage more than once as she mentioned that she would ask questions until she ensured that students understood. Assessing students in this ongoing way appeared to help her determine how well students were doing, and this ensured that she provided students with support at their point of need. There was evidence that Nin thought about formative assessment as a way of supporting students to construct understanding. Nin's description of formative assessment implied that it was ongoing, flexible, and frequent.

Paytai's practices of formative assessment occurred in stages that aligned with Nin, yet his practices of formative assessment were different. Paytai gave an example of how he implemented formative assessment in a lesson about the solar system. Before commencing an activity, he asked questions related to the learning objective of the activity to ensure that students knew what to do. Then, Paytai allowed students to build a model representing the solar system. He did not give students any specific instructions, but rather let them explore how to create the model by themselves. He observed, asked questions and listened to students as they built the model. He said, "these strategies allow me to see whether students have understood the content... As predicted, many students misunderstood and thought that every star had the same size, and the solar system was rounded". At the end of the lesson, Paytai allowed students to present their model, and he often gave a short lecture afterwards to enable students to determine their misunderstandings and alternative conceptions. Then he asked questions that enabled students to think and compare their understandings during and after doing the activity. Paytai further explained that "I want them to learn from a mistake. I believe it is better than I tell them this is wrong, this is right. They will not listen to me".

These comments provide evidence that Paytai applied formative assessment using various strategies during an ongoing lesson. Like Nin, his view of formative assessment focused

on supporting students to construct their own knowledge, however, his actions indicated that he used the information he obtained from formative assessment in different ways. While Nin provided support to students at their point of need, Paytai did not tell students that they had misunderstood nor did he provide immediate support; instead, he provided correct information at the end of the lesson. It was the student's responsibility to compare their own work with this information and critically evaluate, analyse, and construct their own knowledge. Using such information enabled him to assess students in an ongoing way, and this helped him to elicit student conceptual change. This response suggested that his personal belief in learning influenced his formative assessment practices.

Ploy explained that she also followed three steps when teaching science. Firstly, she started the lesson with what she referred to as the preparation step. In this step, she intended to prepare all students to be ready to learn. She mentioned that, "I ask them to be quiet, put their science textbook on the table. Then I tell them what they are going to learn today. What they need to achieve and the goal of learning for today". Ploy explained that she then taught the relevant science content in the teaching step, which would often involve the students doing an activity. She finished the lesson with a conclusion during which she would summarise what she taught and assess students' understanding. Ploy mentioned that it was suggested to her by her university lecturer to teach students using these three steps.

When asked about formative assessment, Ploy described many assessment techniques such as questioning, observation, and 'pre' and 'post' tests. It appeared that Ploy used these techniques many times and that, as before, she intended to check students' understanding. In the introduction step, she reported asking questions to link a new topic with the previous lesson, "I ask them questions and ask them to tell me what they have learnt from the previous class to check whether they still remember previous content". Further, Ploy said she sometimes asked her students to do a pre-test at the beginning of a new topic. In the teaching step, she explained

that while students were doing science activities, she used observation techniques to assess students. At the end of the lesson, as part of the concluding step, she asked questions to invite students to summarise what they had learnt and used a test to double check students' understanding of the overall content. These comments indicated that Ploy talked about formative assessment as an ongoing part of her current teaching practice. It appeared that she associated formative assessment with a way of determining student understanding. She had clear learning intentions for the practices she used; an approach influenced by the teaching advice she received at university.

The six other teachers in this study characterised formative assessment as a continuous process. Petch and Bussarakham used the phrase “an ongoing process”. Likewise, Tubtim, Pailin, Mook, and Komen expressed a similar understanding of formative assessment as a “day-to-day classroom-assessment process”, which happened every day during teaching and learning sequences allowing teachers the opportunity to assess student learning. Mook's response demonstrates this thinking:

Formative assessment can happen when teachers gather the information about students learning, teachers provide feedback to students, students respond to the feedback, then it is back to teachers to gather the information about students learning again. Sometimes it [formative assessment process] incidentally happens during the class... I just observe what they say, or as they play with friends in the playground, then I know their misunderstanding of the content... sometimes during general conversation when my students and I talk about other things. I suddenly assess them through our conversation.

Mook's statement implies that she saw formative assessment as a cycle which involved both teacher and students. These comments suggest that Mook used formative assessment to assess student understanding multiple times and in different contexts (e.g. in the classroom, outside of the classroom, formally and informally) using various tools and strategies. Mook's thinking about formative assessment implied that assessment seemed to be a natural part of the

teaching and learning process and could even occur unexpectedly, i.e., when not intended. Her comments also indicated that she recognised and enacted a range of opportunities for assessing students understanding.

Bussarakham described a similar understanding of the characteristics of formative assessment, although her perspective on the purpose of formative assessment was different. She said, “if it is used to respond to student learning, know where they are, what they know during the learning in order to support that learning, help them to achieve the goal, it is formative assessment”. Bussarakham’s comments implied that she understood formative assessment as a way to close the gap between where students currently were and where students needed to be at the end of the lesson. Therefore, it did not matter when the practices occurred or what the associated teaching practices were; the purpose was more important. Formative assessment went beyond determining what actions were necessary and when such action should happen.

Key Finding 5.1

The Thai primary teachers considered and enacted formative assessment in their science classrooms along a continuum of understanding moving from a one-time event (simple) to that which was an everyday, ongoing part of their teaching practice (more complex).

5.4 Reasons for Valuing Formative Assessment

In this study, data analysis revealed that most of the Thai teacher participants indicated they valued formative assessment, but for two different reasons.

1. Formative assessment provided information about a level of achievement for use as an indicator of student learning and an incentive for student improvement.
2. Formative assessment provided information about student learning needs which could be used by the teacher to support student learning.

The value teachers placed on formative assessment depended upon their beliefs about the importance of the information this assessment provided. Some saw formative assessment as a

way of identifying what students had learnt at the end of a teaching sequence. They valued this information because they interpreted it as a score of achievement, which they could then use as an incentive for students to improve. Others saw formative assessment as providing information about specific learning needs and valued this information because they could use it to support student learning in an ongoing way.

The frequency of use, as described in the previous section, was often an indicator of the value teachers placed on formative assessment.

5.4.1 Formative assessment—Information about a level of achievement that can become an incentive for student learning. When teachers reported using formative assessment as a one-off event, e.g. at the end of a teaching sequence, their purpose was often to determine where students lacked understanding and to identify the students who had not yet met science standards. These teachers valued formative assessment because it provided a way of gathering information about achievement, or lack of achievement, that they could then use to encourage student motivation. When formative assessment appeared to be understood and reported to be used in this way, little to no description was provided about any follow-up teaching designed to attend to student learning.

Of the thirteen teachers interviewed, two teachers, Paitoon and Opal, described formative assessment as a way to judge a level of student academic achievement. Given this purpose, the associated multiple choice tests as formative assessment tools. They appeared to believe that formative assessment enabled them to elicit how students understood the content, and they reportedly used this information to provide achievement scores to students. They valued this as part of the learning process because they described using achievement scores as a way to motivate their students to learn science. Paitoon mentioned that,

If students get nine points from the total score of ten, they must have learnt well and understood the content. If they get a low score, I ask them “do you feel embarrassment?

Others get a higher score than you”, and I tell them to pay more attention to the lesson. They will study harder to get a higher score next time. They want to have high scores as their friends. They do not want to lose face.

Paitoon reported interpreting a low score as an undesirable outcome and that he used low scores and negative statements to motivate his students to increase their effort to meet learning expectations. As a result, he reported that his students showed a strong commitment to receiving high scores. As part of Thai collectivism culture, Thai students avoid losing ‘face’ in the class. Getting low scores could generate a sense of losing ‘face’ which creates uncomfortable and unpleasant feelings for students, as discussed in Chapter 3. Moreover, Paitoon’s comments reflect a competitive aspect of Thai education, where Thai students work within a culture where high scores serve as both a reward for hard work and are an important requirement for gaining a place in a good university. Paitoon’s comments also suggested that he used scores to motivate his students to do better. He did not express an intention to use this information to engage them in further thinking about the topic.

While Opal described formative assessment as a way to score achievement and motivate students, her approach was different:

If I say there is a score for this class, for example, I will give five scores for those who pay attention during the class, then all of the students show up, and they will learn. For those who do not listen to me, the scores will be deducted for five scores. Then all of my students will pay attention to me because they are afraid to get low scores while others have high scores.

Opal appeared to use formative assessment as a way to motivate students by providing scores which were used as penalties and rewards to promote preferred behaviour.

The comments from Paitoon and Opal suggest they saw the purpose of formative assessment as being more summative in nature, used at the end of a lesson to capture a level of student achievement or participation which they could translate into a score. Within the Thai

culture, these teachers used these scores to motivate students to improve, and for this reason, the teachers valued the information that formative assessment provided to them. This purpose also appeared to determine the types of strategies these teachers associated with formative assessment.

5.4.2 Formative assessment—Information about student learning needs which can support student learning. When teachers reported they frequently used formative assessment approaches in their teaching, their purpose was often to gain information about their students to learn more about what students already know, what they learnt during the class and what they were struggling to understand. These teachers then responded to this information in ways designed to support the development of student learning.

Petch reported using the information gathered from formative assessment to support students. He mentioned that,

When I was teaching in the previous school, I knew each student's strengths and weakness by assessing their learning. For example, one of my students had difficulty in reading. Then I told him to practice and focus more on reading. Every morning before we did the morning school activity, he had to meet me and practice reading with me. After one semester, his reading ability was improved, and his learning also improved.

These comments suggest that Petch believed that reading skills were an essential element that had a direct impact on this student's learning and that he believed when students were able to read, they could learn effectively and were able to develop their own understanding and knowledge. Not only did Petch reportedly use the information gathered from formative assessment to support students in terms of science content, but he also reported having helped students who had difficulties by assisting them in learning how to improve their literacy skills. He said this could lead to long-term changes in the learning of a student. This thinking also suggested that Petch understood learning as not just memorising information but also involved

literacy and a need to develop the knowledge and skills to understand, analyse and evaluate information, make meaning, express thoughts and, present ideas and opinions.

Mook described formative assessment practices that provided her with an opportunity to monitor how students were able to build a deeper understanding of what they had learnt as they applied thinking in different ways and different situations.

I often assess my students' knowledge by giving them a new situation and see whether they can apply the knowledge they have learnt to a different situation or not. They cannot do it for the first time, but later on, when they do it often, they can do it.

Through such practices, Mook appeared to want to improve students' abilities in the processes of inquiry, problem-solving and higher order thinking skills. Mook mentioned that the more she saw students improve their understanding of science, the more she was motivated to implement formative assessment.

Mook and Petch indicated they valued formative assessment for reasons that went beyond merely motivating students or understanding content. For these two teachers, formative assessment seemed to be a way of determining how well students were able to apply this knowledge in new situations.

Komen appeared to value formative assessment as a powerful tool which helped him to understand what science concepts students were struggling to understand as captured in the quote below.

I assess students, and I know what they know about the concept I am going to teach... I assess them again, and then I know that they are confused between dissolving and melting concept as in our everyday spoken language [Thai language] we often mix these two terminologies. Students understand that the process of ice melting is a dissolving process. So now I know that they need more help explanation and examples about these concepts. I teach them step by step to help them to have a clear understanding... I assess them again; now, they can differentiate between the two concepts.

As Komen talked about the progression of each student's learning, moving from the unknown to known, it seemed that he believed formative assessment helped students to improve their learning. Moreover, these findings also suggest that Komen implemented formative assessment many times during his teaching, and this aligned with his understanding that formative assessment took place frequently in his classroom:

I often share with my students all the learning objectives, then assess them and give them feedback, suggestions and let them know where they are in the learning process... I ask them to think about my feedback and ask them to reflect themselves. [I] ask them to think about what they have learnt today, what they think they have done well and what they think they need to improve, what the mistake... they said "we have finished the second learning objective, and we have two more objectives to go", "I think I have done well on doing an experiment and I need to practice more on how to write conclusion".

The interview indicated that when Komen provided students in his class with opportunities to engage in 'self-reflection', he reported they worked to: identify and recognise what they know about their learning, identify and understand their own strengths and weaknesses as they work through the feedback process, know what they have achieved, know what they did well, and what they needed to work harder on to achieve the learning goal. These comments provided evidence that collected information from formative assessment became a learning opportunity for students as they could use this information to improve their academic performance.

While all the teachers in this study indicated that they saw formative assessment as useful, they appeared to value formative assessment because of the information they sought to gain. Therefore, while they all appeared to value formative assessment, their purpose for using it was often quite different. While they were all working to improve student learning, i.e., to achieve a learning goal, they reported using formative assessment in different ways to support the learning process. Some teachers appeared to value the information they gained because it

enabled them to assign a level of achievement (simple) while others sought to gain information they could use to meet learning needs and enhance learning (quite complex). How they understood the purpose determined the types of strategies they associated with formative assessment.

Key Finding 5.2

The Thai primary teachers understood the value of formative assessment as limited to assigning a summative level of achievement (simple) through to a highly valued way of increasing the effectiveness of learning, including the developing of learning skills such as problem solving, literacy, and self-reflection (more complex).

5.5 Recognising the Potential of Formative Assessment to Inform Teaching Practice

The frequency of use of formative assessment was also an indicator of the degree of influence formative assessment had on teaching practice. When teachers used formative assessment at the end of a teaching sequence, the purpose was often to determine how well students knew science content. These teachers reported that they typically used formative assessment as a 'one of event' and did not use information from this approach to improve and consider making changes to personal teaching practice. This thinking framed teaching and learning in particular ways. When formative assessment was only used once, usually at the end of a teaching sequence, the information had limited influence because teaching was often very technical in nature, designed to deliver information and assess student success. On the other hand, when teachers frequently used formative assessment, teaching and learning were positioned as an ongoing, interactive process. Teachers highly valued collecting ongoing information because they used the information to adjust instructional activities in order to support student learning. When teachers used formative assessment information in this way, the influence was more significant because these teachers were able to improve their teaching based on evidence, they made changes and improvements that benefited student learning.

Of the thirteen teachers, four teachers, Morrakot, Opal, Thong, and Paitoon did not mention how formative assessment helped them in planning their teaching. Their comments did not provide any evidence that they used information from formative assessment to improve their teaching practice. Instead, when they recognised that many students lacked understanding in a particular area, they would re-teach the content with the same teaching strategies. Their comments indicated a view that the relationship between teaching and learning appeared to be transactional. Teachers taught the content then assessed students' levels of understanding.

On the other hand, nine teachers described that formative assessment was highly valued because it informed their teaching. For example, Nin expressed that she used information from formative assessment to “make decisions about what to do next in the class, design teaching plan and determine the most effective teaching strategies to support learning”. Similarly, Petch stated that he would “determine whether students had understood the lesson... plan future lessons and providing academic support to students by using information from formative assessment”. For these teachers, it appeared their thinking about formative assessment reflected an understanding of a complex relationship between teaching and learning. Such complexity is evident in the way Ploy talked about how the information gained from formative assessment supported her design of a future lesson:

I tell them the purposes of the pre-test and the reasons why I want them to do this test. The result of this test will provide me information on their prior knowledge, what they know and do not know about this topic and information to develop the lesson plan for them. I also tell them the aim of the lesson and what they are expected to learn when finishing the lesson. When they know and understand the reasons, they concentrate on doing a pre-test.

Her comments indicated that she was clear about the purpose of the assessment task. Her aims for using a pre-test were to elicit students' prior knowledge and use the collected information for planning her future teaching. These comments suggest that she paid attention to

students' prior knowledge, which she viewed as important in learning new concepts and in the construction of new knowledge. Given this clarity of intention, Ploy was able to convey this purpose and the learning expectation to her students. This information allowed the students to be more aware of the purpose of learning.

Additionally, three teachers, Tubtim, Ploy, and Paytai, talked about the importance of reflection on practice, and as a result, they were working on using reflection as a way to improve their teaching. They stated that they assessed their teaching when students appeared to show that they had a misunderstanding.

I use that information to make a decision for my teaching. For example, when I know my students understand the lesson, I know what to do next, I continue teaching. On the other hand, when I know that my students do not understand or they are bored during the class, I have to think about what I should do next. Giving them a break, asking them questions to check which part they do not understand or change teaching technique. Sometimes I realise that I should speak slowly, give more clear explanation... it becomes my habit when I do this often. (Tubtim)

When I know that my students do not understand the topic I teach, I ask myself, is it because of my teaching method? I may need to change teaching method, for example, I change to use simple language to explain the content, prepare and use the pictures, games to help them develop their understanding... it makes me be a teacher who thinks very carefully. (Ploy)

It allows me to assess my teaching practices... If students do not understand what I teach, I ask and assess myself, "what is the missing thing in my teaching?" Next time, I will prepare more, I will plan the lesson more carefully... later on, it become my routine. I always ask myself. (Paytai)

When these teachers became aware that students lacked understanding in a particular area, they reported that they responded by adjusting their teaching. Tubtim thought about the action she should take to help student learning while Ploy and Paytai said they tried to find the reason why this situation happened and worked to determine what to do next. Such thinking

about what and why of teaching and learning suggests that these three teachers were thinking deeply about their teaching. Each saw that reflecting on their teaching enabled them to recognise problems which happened in their own teaching context. They appeared to recognise a strong relationship between the information collected through formative assessment and the professional judgements they needed, to consider alternative approaches and make changes to their teaching practice. Their comments also provided evidence that such considerations reflected a complex understanding of what it takes to be a teacher. However, these teachers did not appear to be aware of and did not notice the potential that such changes in thinking and practice had as part of their own professional growth.

Nevertheless, the data did indicate that some of the teachers were able to develop an awareness and understanding of their teaching practices. They not only appeared to see the value of using formative assessment to inform their teaching, but they also seemed to recognise learning needs and determine the effectiveness of teaching. It was evident that these teachers undoubtedly saw that formative assessment contributed to their professional growth. Petch expressed an example of this thinking:

First time I taught my students about how plants respond to stimuli, I asked them to predict how Venus flytrap responds to stimuli. All of my students were silent. Then I pushed them to predict again. The same responses received from them. Then I taught that there might be something wrong in my teaching, they might not know the plant or they did not understand my question... I asked their idea about Venus flytrap. Not surprisingly, they did not have any knowledge about it. Then I know where they are and what I should do to make them reach another point [learning goal]... it helps me to keep in mind to assess student knowledge when I teach other topics so I can support them.

It is clear from Petch's statement that formative assessment seemed to help him to support students to identify the gaps in their development to meet the learning goals. As a consequence, he reported that he was able to offer support along the way. The experience of making decisions appeared to benefit Petch because it enhanced his capacity to clarify and

consider alternative practices which aimed to produce increases in student achievement. This thinking also indicated that he was aware of and focused on the role of effective teaching to enhance learning.

Additionally, Komen's comments indicated that he recognised that he grew professionally in his career and he could improve the quality of his teaching, which in turn contributed to students learning. He mentioned that,

I know what content or topic my students do not understand from this practice [formative assessment]... I also know which terminology they are confused about and where they need clear explanation. Then I use the information as a guideline to plan the next lesson to cover all issues. For example, if they do not understand the terminology, I will prepare an example, or I will explain it very carefully to students before allowing them to do activity... if this teaching cannot help students to understand the terminology, I learn from this mistake, I enjoy it, and try to think of another way. I have the feeling that I also learn something from this practice.

Komen used information from formative assessment to identify the difficulties his students experienced, and he then adjusted his teaching to match his students' needs. Moreover, the experience of practising formative assessment informed Komen more about himself and his role as a learner. He mentioned that he learnt and gained an understanding of his students and instructional methods through practical experiences. As a result, he said he was able to assess his own practice more effectively by analysing situations and determining appropriate practice suggesting that his professional ability was growing and he had more in-depth pedagogical knowledge gained through reflection on his practice.

For some teachers, the frequency of use of formative assessment was also an indicator of the degree of influence formative assessment had on teaching practice. Some teachers appeared to believe that formative assessment was essentially about student achievement and that teaching was about providing the information that students needed to cover the content reflecting a very

transactional view of teaching. Other teachers appeared to recognise the importance of using the information from formative assessment to change their teaching to meet student learning needs. Though this was often a challenging process, some of these teachers recognised that such change helped them to develop as teachers. For these teachers, their thinking about formative assessment reflected an understanding that there was a complex relationship between teaching and learning.

Key Finding 5.3

The Thai primary teachers understood the role of formative assessment in similar ways to how they understood the relationship between teaching and learning. If they understood teaching and learning as transactional, then the role of formative assessment was limited and produced no change in teaching practices. However, the more teachers recognised an interdependent relationship between teaching and learning; formative assessment appeared to play an increasingly important role, often leading to changes in teaching practices and professional growth.

5.6 Summary

The aim of this chapter was to gain a better understanding of teachers' thinking about the place and value of formative assessment. Formative assessment in Thai primary science classrooms represents a continuum of understanding moving from a one-time event to an eventually becoming an ongoing part of daily teaching practice. The data analysis revealed that the Thai teachers thinking about formative assessment varied as evident in concerns around the technical aspects of practice to the many complex considerations of the nature of professional work, classroom culture, context, and developing alternative ways of teaching to support student learning. The reasons for valuing formative assessment in science education were varied, sometimes limited to merely identifying student achievement levels through to seeing formative assessment as a way to access rich information about student learning which was an important part of teaching with the potential to enhance student learning, change teaching practices and support teacher professional growth.

The next chapter uses the findings to explain why Thai primary teachers think in particular ways about formative assessment in the context of science teaching and learning. I identify and discuss key factors directly influencing teacher thinking. These factors created conditions that contributed to and constrained teachers' decision making about the implementation of formative assessment in their science lessons.

Chapter 6: Potential Factors Influencing Thai Primary Teachers' Thinking about Formative Assessment in Science

6.1 Introduction

This chapter addresses Research Question 2 and aims to understand why Thai primary teachers think in particular ways about formative assessment in the context of science teaching and learning. The findings revealed three key factors that directly influenced Thai primary teachers' thinking:

1. Teacher-related factors;
2. Student-related factors; and
3. School-related factors

These factors created conditions that contributed to and constrained teachers' decision making about implementing formative assessment. A detailed exploration of these areas of influence will follow.

6.2 Teacher-Related Factors

It was clear from the data that Thai primary teachers believed formative assessment involved teachers and students. The data revealed that both parties appear to exert some influence over the process, potentially hindering or facilitating the implementation of associated practices. The data indicated that a teacher's willingness to employ formative assessment as part of their teaching practice, appeared to be influenced by three key personal factors:

- Teacher knowledge about formative assessment;
- Science content knowledge; and
- Understandings about the role of a teacher.

6.2.1 Teacher knowledge about formative assessment. In this study, the use and frequency of use of formative assessment appeared to be strongly related to how teachers perceived their own level of knowledge about formative assessment. Generally, the teachers involved in this study believed that it was important to understand why formative assessment might assist student learning and they felt they needed a collection of formative assessment strategies that were relevant to their teaching context. Many of the teachers stated that their initial teacher education course did not provide such knowledge, and some participants talked about accessing such information from other sources.

Many teachers in this study commented they felt unsure about the meaning of formative assessment and commented they had learnt very little useful information about assessment, including formative assessment, from their initial teacher education courses. Komen said, “at that time I had learnt about developing exam questions. I am not sure whether I had learnt about formative assessment or not. I might have learnt, but I did not know it was formative assessment”. Some teachers commented that course information focused on specific assessment techniques. Ploy explained that she had learnt how to “develop effective questions, the test items and grading methods”. Five other teachers commented that their assessment and evaluation coursework had defined associated terms and introduced some techniques connected with formative and summative assessment. These techniques were not specific to science education. This focus was evident in Bussarakham’s response, “I learnt how to implement the effective questioning technique and performance assessment and develop a standardised test and rubric score”. However, the teachers felt that such strategies were often of little use when they started teaching because these approaches did not address the specific challenges they faced in their classrooms. Petch specified “... We [student teachers] were taught the same thing, but we were assigned to teach in different classroom environments. Dealing with school culture and students’ behaviour is very challenging”. Such comments indicated that teachers believed they needed

more relevant information to attend to the real challenges they now face in their teaching.

According to the teachers' descriptions, the approaches used in their initial teacher education courses seemed to be 'one-size-fits-all', and teachers believed this type of approach did little to develop their ability to apply assessment practices for a range of purposes and in a range of teaching contexts including science education.

Some teachers identified that the most influential sources of information about formative assessment included professional reading, extensive teaching experience, and learning from other teachers in the same school. Mook, Nin, Komen, Thong and Opal specifically cited these sources as influential. Thong shared her experiences of obtaining information about formative assessment from the senior teacher via word of mouth. She said, "a senior teacher told me about formative assessment and suggested I use it in my classroom". Teachers learnt about formative assessment in different ways and as a result, appeared to hold strong beliefs about the value and depth of knowledge they had developed. When teachers felt their personal knowledge about formative assessment was not strong, they appeared to avoid using formative assessment regularly, if at all, in their classroom teaching.

Holding knowledge about the benefits of formative assessment and knowing a range of relevant strategies influenced a teacher's personal sense of adequacy with formative assessment, appearing to influence how and when they incorporated this approach in their teaching.

6.2.2 Science content knowledge. The level of science content knowledge held by teachers had an impact on their decisions to use formative assessment in their teaching. Teachers in this study believed that it was necessary to have strong knowledge in all areas of science to identify students' knowledge and take action to improve student's understanding. The level of confidence a teacher had in their personal science content knowledge appeared to impact their use of formative assessment.

Paytai completed a Bachelor of Arts in the Thai language. He mentioned that, “it is not that bad teaching science in primary level”, however, he was concerned that some topics could be difficult for him, especially Biology. He explained further, “I was not able to explain the relationship between water and the undeveloped seeds based on specific terms or explanations in Biology. Thus, I decided to give students the content so that we can move on to the next lesson”. Paytai's comments suggested a lack of confidence in his science content knowledge in Biology, which made it difficult for him to engage students with key ideas and assist students in constructing understandings about this particular topic. As a result, he returned to a more traditional approach where teaching was about delivering content. Such comments may indicate that a lack of science content knowledge possibly somehow connected to a teacher's need to control teaching sequences, particularly when working with unfamiliar topics. Traditional teacher-centred approaches provide such a sense of control, whereas formative assessment, being more student-centred, potentially introduces more challenges for teachers' content knowledge.

Although Morrakot had a degree in primary education and had learnt the content in science, she still lacked confidence in her Physics content knowledge. She said, “Physics content is the most difficult for me. For some concepts, such as friction force and electricity, I only know the definition... I feel it's difficult to explain the concept to students”. Morrakot mentioned that her lack of Physics content knowledge influenced her questioning practice. When she taught a science topic related to Physics, she did not ask students questions to assess student understanding or allow students to ask her questions. Morrakot was worried and afraid that she could not “give correct answers to students” when her students had misunderstood. Morrakot's responses indicated that she avoided formative assessment, such as question and answer strategies. Student questions were unpredictable, and she feared losing face and respect with her students if she was unable to provide correct explanations. Thus, she tended to adopt teaching strategies which allowed her to maintain control over decisions about exploring conceptual

knowledge and introducing new information in the classroom. These approaches did not include formative assessment practices.

The perceived levels of science content knowledge had an impact on teacher confidence in teaching science. When teachers lacked confidence in their science content knowledge, this appeared to influence the decisions they made about using formative assessment practices. Limited content knowledge appeared to influence a teacher's need to increase control around how and when they introduced and explored information, often meaning that formative assessment practices were less likely to be evident in these classrooms.

6.2.3 Understandings about the role of the teacher. The data from the interviews indicated that Thai teachers use of formative assessment in science teaching was related to how they perceived their role as a teacher. Teachers' comments described how they viewed themselves as teachers, their purpose, and what they felt mattered regarding teaching and learning. These beliefs appeared to determine whether they valued formative assessment in their teaching.

In the interview, Mook mentioned her role as a teacher was like being a 'second parent' in the classroom. She usually called her students '*Loook*' which means 'my children' to build a relationship with them and "to reduce the gap between teacher and students". She treated her students like her own children, presented a strong sense of caring, and acted as a good role model. Her self-perception of a teacher as a 'second parent' influenced Mook's teaching practices and the value she placed on formative assessment in her classroom. She claimed that when students admire her or have a close relationship with her, they trust, obey, and listen to her. She mentioned that many of her students seemed to develop a good attitude for learning science. Additionally, her "students were not afraid to share their ideas, what they need to learn, they would talk... they were not shy or nervous in answering the question". She claimed that she could assess students' understanding of science by using question and answer strategies and

helped them to improve learning. As most students seemed eager to offer their answers, “they did not feel disappointed when their answers were wrong”. With her sense of responsibility as a ‘second parent’, Mook wanted to ensure that her students were engaged in learning as well as support their learning along the way by guiding them as if the students were her own children. Mook created the conditions in which students felt safe to take risks and explore their thinking. In addition, she stated that the more she saw students enhance their knowledge of science, the more driven she was to carry out these practices.

Mook gave a further example that was consistent with her self-perception. Just as parents want to provide a positive and nurturing environment to support their children’s learning, Mook also wanted to enhance learning by providing only positive written feedback to students. Examples of such comments included “good job,” “very good,” “be specific,” “explain more,” “recheck again” and “make it clear.” When questioned further about the reasons, Mook mentioned that positive feedback was better than negative feedback to motivate students learning. She said, “I do not want them to feel bad... I believe that providing negative information may hurt students' self-esteem and effect on student motivation and decrease students' interest in academic tasks”. Thus, she was sensitive to and avoided writing words such as useless or terrible. She said, “it is better to do as a parent in providing feedback to children”. Therefore, the language Mook used in feedback was an important way in which she made students aware that their learning needs mattered. Mook recognised that formative assessment strategies provided her with valuable information about her students and provided opportunities for her students to interact in ways which she encouraged. Formative assessment sat comfortably with her sense of professional identity and the conditions she wanted to create to support her students.

Bussarakham and Nin viewed themselves as facilitators working to support student learning. These two teachers assessed student learning, and when their students appeared to show

that they had an alternative conception in science, they provided opportunities for students to reconsider their existing knowledge. The teachers planned their next lesson to help students understand the concept. They were aware of all learning expectations and helped students to evaluate their own work. The following excerpt illustrates how Bussarakham understood her role in formative assessment and how formative assessment related to her work as a teacher.

I will help them and give them activities, ideas, things or information to think by themselves. I want them to construct their own knowledge and change their minds instead of giving them information. Learning science is not about memorising. I encourage them to think about what they have done in class on the other day or knowledge that they have already learnt. Then help them to make connections and change their own minds. The students need to be supported and guided in order to learn. Without this support and direction, the learning will not succeed.

Bussarakham's comments illustrate that she believed her role as a teacher was to assist students in working towards making sense of knowledge. As she saw this as her purpose as a Thai primary science teacher, she wanted to help her students discover things, make connections, and so she offered support and advice when needed. These comments suggested she recognised that her role as a teacher was to facilitate learning for her students, so they were able to work towards conceptual change. Bussarakham's sense of what it means to be a teacher appeared to shape her teaching, and formative assessment supported her teaching approach.

Thong saw herself as a knowledge transferrer and mentioned that she did not believe that formative assessment was suitable, given her teaching style and her students. She stated in her interview that,

I do not think it will work for me and my students... I prefer to teach them to be able to remember the term or concept in science and assess whether they remember them or not. When I was a student teacher, I was taught this way and I think it works... Even though I know there are many other ways to assess student understanding, I prefer using multiple

choice test, so my students will be familiar with the test then they know what to do at the end of year.

The interview also suggested that her experiences had convinced her that the best way to teach students was through explaining information. Her experiences also shaped her role as a teacher. Thong felt unable to free herself from the traditional teaching practices taught to her. Thus, she taught in a way that was familiar to her which was more teacher-centred than student-centred. Furthermore, she explained that the end-of-year test drove her teaching and assessment decisions. Therefore, her assessment focused on students' ability to memorise the concepts she had presented during lectures rather than on students' understanding of the concept.

Participants' understandings about the role of the teacher influenced how they viewed their purpose and what they believed mattered about teaching and learning defining their self-perception as a teacher with this thinking emerging as a significant factor influencing the ways teachers implemented formative assessment practices in science classrooms. Those who saw themselves as a 'second parent', or 'facilitator' were more likely to implement formative assessment in their classroom to support the process of student learning. Those who saw themselves as 'a knowledge transferer' were more likely to focus on traditional teaching practices and steered away from implement formative assessment in their classroom.

Key Finding 6.1

A number of teacher-related factors influenced teacher thinking about formative assessment and determined the likelihood they would implement formative assessment practices in their science classroom. These factors included: a personal sense of adequacy with formative assessment which was primarily influenced by the level of personal knowledge each teacher held about the purpose of formative assessment and how to implement associated practices in the classroom; teacher confidence with personal science content knowledge; and, personal understanding about the role of the teacher, which determined each individual teacher's sense of purpose, how they worked to develop student learning and the practices they used in their classroom.

6.3 Student-Related Factors

This section presents student-related factors which influenced teacher thinking and willingness to employ formative assessment in their teaching practice. The data analysis revealed two key student-related factors:

- Student learning behaviour; and
- Family support

6.3.1 Student learning behaviour. The findings indicated that student learning behaviour appeared to have an impact on how teachers in this study saw the value of formative assessment in science teaching. Teachers mentioned the challenges they experienced as they worked to apply formative assessment with students who were passive learners. Some teachers mentioned conflict between principles of formative assessment and cultural expectations of Thai student behaviour, which was very teacher dependent. There was also a lack of risk taking among students. Their use of formative assessment appeared to be determined by these challenges.

Thong and Tubtim described how students often remained silent and passively waited for teacher guidance. For both teachers, these learning behaviours reduced their enthusiasm to implement formative assessment. During science class, Thong asked students to give an example of the essential factors for photosynthesis, but her students did not respond and kept quiet. Thong mentioned that her students waited to be “spoon-fed... do not want to speak out... wait for me to tell the answer”. Tubtim explained similar passive student behaviour, “my students do not try to think themselves... Just wait, do not do anything... do not say anything and answer my questions”. Teachers’ comments in the interviews indicated that when they asked questions during classes to determine if the students had learnt and understood a science concept, students often did not respond. Thong said, “I feel like I am alone in the class, no response, and no answers from students... I do not know if they understand the concept I teach... questioning

does not work in my class". Many of the teachers reflected such comments feeling their students were passive and relied heavily on the teacher to provide information rather than actively participating in the process of learning. The challenge of this passive student behaviour made it difficult for teachers to see value in formative assessment. These learning behaviours discouraged teachers from implementing formative assessment strategies in their science teaching.

Another student behaviour that appeared to influence teacher use of formative assessment was a lack of student interest in peer-assessment. Opal and Paitoon mentioned that the majority of students were not interested in discussions or assessing their peers' work during science class time. Opal explained that her students "avoid making conflicts and problems with their friends. My students did not want to hurt their friends or damage their friendships. Students felt that if they gave honest feedback, they would make their friends feel ashamed". The students' reluctance to assess their peers' work should be understood through a cultural lens. As stated in Chapter 3, the nature of Thai culture highly values community and the importance of establishing harmonious relationships. Therefore, friendships are seen as important. When teachers implemented peer-assessment, they observed that students, in general, did not engage in discussions and did not provide feedback to their peers. It may be that students felt such experiences were likely to produce conflict, catching them between the cultural focus of harmony and how to meet teacher expectations of peer feedback. This thinking appeared to influence student behaviour, making formative assessment practices such as peer-assessment challenging for Thai teachers in their classroom teaching.

Students were also reluctant to engage in formative assessment practices because they risked making mistakes; many students viewed this as frightening. Pailin mentioned that although she asked students a simple question to elicit basic science knowledge, such as, "what shape is the earth?", even while some students in her class knew the answer they did not respond.

“They are afraid that their friends will laugh at them when they make mistakes... avoid losing face in front of other students”. As a result, students sat silently in the classroom. However, Pailin took this situation as a challenge, and she motivated students to participate in a question and answer session. She said, “I write the question on the blackboard and tell them I will give extra five points to students who can answer”. Although Pailin believed that providing an incentive often motivated students to participate actively in sharing their ideas, she mentioned that students did not always engage in learning. She explained further, “I change to use other assessment techniques, for example, tests and reports instead”. As students are involved in the formative assessment process, teachers invite them to share their understandings and express what they think and how they are making sense of information. However, student activities as part of this process appeared as high-risk behaviour for Thai students who traditionally never reveal what they do not know publicly. Therefore, when teachers' attempts to engage students in such experiences are not successful, such outcomes may influence teachers' decisions about the use of formative assessment practices, such as questioning in science teaching. As a result, teachers may be less likely to implement formative assessment.

The data suggested that teachers faced challenges using formative assessment practices in science teaching because of student learning behaviours. Often these behaviours were driven by cultural influences which had shaped the role students play in the learning process, their thinking about appropriate behaviour, and their willingness to take risks as learners.

6.3.2 Family support. Data indicated an interrelatedness between the family support given to students and teachers use of formative assessment in science. Teachers believed that students from lower socioeconomic backgrounds needed more support with wellbeing and cognitive abilities. Some teachers mentioned that they were facing pressure from the high expectations held by parents. These challenges empowered teachers to make decisions about their teaching and formative assessment practices.

Three teachers raised family issues: Ploy, Pailin and Komen. Ploy suggested that in the last school year, she taught only science for Grade 5 and 6. Some of the students in her class came from a low socioeconomic background, and the parents of these children did not support their learning. Students did not want to learn, lacked motivation for learning, and did not understand the value of learning. Some students went to school because there was no one at home to take care of them.

As a teacher, I spent 10 to 15 minutes at the beginning of class, teaching them how to be a good person, good behaviour, and telling them about the importance of education. So I had only 30 to 35 minutes to teach science content.

Ploy's interview also indicated that she viewed herself as a teacher who had multiple responsibilities to her students. She saw her role as a teacher to not only help students develop their knowledge but also assist students in developing self-motivation and preparing students to be good people in Thai society. Ploy further explained that in the last school year, much of her teaching time attended to all of these responsibilities. As a result, she did not regularly assess student learning in science in her class.

Pailin and Komen revealed that unlike Ploy, they experienced pressure from students' parents who wanted to see their children succeed. Pailin and Komen taught in a primary school located in an urban area, and the majority of students in their school came from upper-middle and high socioeconomic status families. Pailin mentioned that her students' parents held the belief that education was important. As a consequence, they encouraged their children to attend tutorial classes, particularly for science and mathematics, to obtain high scores in their examinations.

I know that more than half of the students in my class understand our science lessons. It is because they have learnt from the tutoring class... Their parents want their children to do many lesson exercises....They also want teachers to teach advanced science content.

If I do not teach advanced content, the parents will call or send me a message asking for reasons. They check what I teach in the class from their children.

Pailin was confident that the majority of students had already learnt and understood the content she taught. Evidence from the data indicated that Pailin tended to teach students advanced science content using traditional lecturing as a result of pressure from students' parents. These parents believed that success, based largely on academic performance, brings pride to students and families. Moreover, parents expected teachers to contribute directly to maximising the opportunity for their children to achieve this success. As a result, an intention to assist students in gaining high scores and grades in science drove Pailin's teaching, leading her to adopt traditional teaching practices where highly valued summative assessment tended to dominate. Therefore, it would seem that cultural expectations likely shaped Pailin's approaches to teaching. Parental pressure influenced her use of formative assessment in her teaching.

For Komen, the parents held similar beliefs about education; however, they supported their children differently. The parents of the students in Komen's classroom paid attention to their child's learning progress by sending messages and/or asking Komen in person about topics, lessons, or any scientific skills that their child needed to improve. Komen explained further that,

The parents wanted to help and support student in learning... at first, it is too much pressure but on the other way round it is my job to help student achieve the learning goal... assessing students learning also help me to understand my students' strengths and weaknesses.

This comment suggests that these expectations influenced Komen's decision making. He decided to employ formative assessment in his classroom in order to know which topic or scientific skills students needed to improve. He mentioned further that, "we both know and work toward the same goal and share responsibility in order to support student learning". This provided the opportunity for Komen and his students' parents to work cooperatively to support student learning.

The data suggested that socioeconomic status and parental expectations influenced teachers' decisions about the value of formative assessment and how they would implement such approaches in their classroom teaching. If students displayed a poor attitude towards learning, often a behaviour teacher associated with students from a low socioeconomic background, this made it less likely that a teacher would adopt formative assessment in their science classroom. In situations where parents valued a high score as an aspect of learning achievement, teachers tended to work in traditional ways to transfer knowledge and subsequently gave little attention to formative assessment. More frequently, teachers implemented formative assessment practices in science classrooms where the students' parents recognised the importance of children developing scientific skills and knowledge.

Key Finding 6.2

A number of student-related factors influenced teacher thinking about formative assessment and determined the likelihood of them implementing formative assessment practices in the science classroom. These factors included student learning behaviours, their socioeconomic background, and parental expectations for student achievement and the degree of support parents were willing to provide for teachers to enhance student learning.

6.4 School-Related Factors

School-related factors are directly related to the teaching context and appeared to have an impact on the decisions teachers made about adopting formative assessment as part of their teaching practice in the Thai classroom. The data analysis revealed three school-related factors:

- Limited time;
- Class size; and
- Pressure from the school leadership

6.4.1 Limited time. Teachers believed that formative assessment in science teaching was difficult due to time limitations. This challenge influenced teachers' decision making about their teaching and formative assessment practices.

A majority of teachers in this study raised the issue of time constraints. Examples of this concern are evident in Pailin's, Paitoon's, Opal's, Paytai's, and Morrakot's responses. Pailin mentioned,

I usually assess students' understanding at the end of the lesson... it would be better if I had more time to implement it before and during the class. In reality, there are many factors that affect our teaching. This idea would happen only in the ideal classroom.

Pailin suggested merit in implementing formative assessment before and during the lesson rather than when the lesson finished. As her interview continued, it became clear that her actions in practice differed as she checked her students' understanding only after she had taught the lesson. She felt unable to practise assessment in any other way than using summative approaches due to the range of competing pressures and requirements on her as a teacher. For this reason, Pailin did not see this practice as a reality in a Thai classroom.

Paitoon mentioned the expectation of teaching a designated amount of science content within a year, within a limited time when he was working to cover all content. Paitoon believed that the 50-minute classroom period did not provide enough time for him to teach and assess students' learning during the class. Paitoon said,

There is not enough time to spend on one topic and to cover all science content... It takes much time to prepare and develop different ways to assess student learning... with such a time limitation, I do not think I can apply many assessment techniques in my classroom. I cannot do that. If I do, I will have three chapters behind... If I assess student understanding during the class, I have to spend extra time in teaching them all science content.

This comment revealed that pressures of time constraints meant that Paitoon was reactive rather than proactive in his planning and implementation of lessons and assessment. Moreover, these comments indicated that Paitoon believed formative assessment was extra work that required a great deal of time and effort in an already limited timeframe for teaching science. Paitoon believed he needed time to prioritise curriculum coverage. Therefore, Paitoon attempted to spend his time teaching science content and did not include assessment techniques to elicit student understanding. With curriculum as a priority, he did not indicate a willingness to conduct formative assessment, and he tended to teach students science content using traditional lecturing.

Opal mentioned that her number of science classes per week often reduced due to events, such as National holidays, Buddhist holidays, sporting activities, various competitive events, and all-day teacher meetings. She said, "I need to cover all content in science. I want my students to understand the basic knowledge of the subject" so when facing these demands there appeared to be a shortage of time for her to conduct formative assessment practices. These time constraints influenced Opal's decisions about teaching practices and ultimately, the formative assessment practices she used. She said, "Because of time limitations, I prefer to use the traditional approach as it works for me". Opal explained further that,

My students are too young, so I need to tell them what to do, it would be easier for my students to understand the content and to know what they have done... I cannot let them do all science activities by themselves and learn nothing... in term of assessment, I do not need to do assessment often. It should be fine to assess them once in a while because I teach all science content they need to know.

Opal's perception of time limitations led her to teach science concepts using lecturing as this gave her a sense of control over the limited teaching time available to her. Moreover, her interview indicated she believed learning science took place by listening to lectures where students were able to receive all knowledge from her and therefore, assessing student learning

seemed to be unnecessary. Her statements also indicated she believed that implementing formative assessment should occur at the end of a chapter.

Paytai and Morrakot believed that there was a range of non-teaching duties which limited their time to use formative assessment in their science teaching. Examples of non-teaching duties emerging from the data included: preparing the parade in an important event such as school sporting events; various competitive events; organising an exhibition on Buddhist religious days; working as a cashier at the school cooperative store; preparing the documents for the Committee on Standard and Quality Assessment to assess the school's quality, and working as a sports coach. Paytai shared his experiences with non-teaching duties. He said,

So I do not have time to prepare a lesson, material for science activities and sometimes I do not even have time to think about questions to ask students in the class. When I meet students, I only teach the content. Assess student learning? I do not implement any assessment techniques when I do not have time... These other duties take me away from my teaching.

Paytai's statements indicated that time spent on extra tasks impacted his teaching performance and took him away from planning for science teaching as well as preparing formative assessment techniques. Often teachers required time to plan formative assessment tasks before class. Lack of preparation time caused by non-teaching duties may reduce teacher confidence and increase the level of risk associated with losing a sense of control in teaching. As a result, teachers seemed to steer away from the implementation of formative assessment.

Morrakot also shared a similar sentiment: "I spent my time working on this kind of works. Then I did not have enough time to check my students' science homework and give them feedback... These are not my main responsibilities, but I have to do them". These comments suggested that Morrakot could not ignore these non-teaching duties, and she seemed to see these duties as priority tasks. Observations noted that in the Thai educational system, teachers' work is varied. Teachers are not only teaching in the classroom, but they are also required to do other

duties such as cleaning, coaching, and being a clerk. Teachers viewed themselves as having multiple responsibilities within their school. Additionally, as part of Thai culture discussed in Chapter 3, respect for elders and those in higher social positions is significantly important. School teachers are required to show their respect for the school principal, head of the department or other senior academics. Non-teaching duties usually are assigned from those who have a higher position in the school. As a result, teachers seemed to view extra duties as having to be done in order to avoid the conflict between them and those in higher positions at their school.

Limited time for teaching appeared to influence the decisions teachers made about using formative assessment in their teaching. The tension between time constraints and an overcrowded curriculum appeared to influence a teacher's need to cover all science content rather than include formative assessment in their teaching. Non-teaching duties appeared to limit teachers' time to prepare formative assessment tasks and resulted in teachers lacking the confidence to implement this approach.

6.4.2 Class size. Teachers believed it was difficult to use formative assessment in large classes. Teachers' use of formative assessment in their science teaching appeared to be determined by the number of students in the class.

The majority of teachers raised concern about the number of students in a class. An example of this finding was evident in the interviews with Morrakot and Petch. Morrakot said,

I do not believe that formative assessment can work well in my classrooms... My problem is I have about 40 students in each class. If I let everyone in my class answer my questions, or check all my students work or assess all of my students' understanding. I think I would not be able to finish my teaching.

For Morrakot, the number of students in her class led her to lack belief in formative assessment practice. She highlighted formative assessment practice as an ideal practice that only exists in an ideal classroom, and it was not a realistic practice in her class.

When Petch was teaching science in a small school with only seven students in his class, he observed each student doing science activities and provided feedback and support to individual students. He explained further that the small number of students in the class allowed time to assess each student's strengths and weaknesses largely influencing his ability to provide such individual feedback. However, in his current school, with approximately 35 students in the classroom, it was difficult for him to observe each student. "In my current classroom... I do not provide individual student feedback". These comments suggested that a large class size presented difficulties for Petch to implement formative assessment because he believed such an approach required him to provide relevant feedback and support to meet each student's different learning needs. A large number of students in the classroom increased this demand. In this situation, larger student numbers and limited time made such approaches difficult and stressful for him.

The data suggested that class size was a challenging factor that could have an impact on teacher decision making and efforts to incorporate formative approaches to assessment in science teaching.

6.4.3 Pressure from the school leadership. Teachers mentioned that pressure from the school principal, particularly in relation to external test results, made it difficult for them to focus on adoption of formative assessment in science classrooms.

Tubtim shared her experiences of the high expectations of her school principal and senior academic assistant about student science exam scores. She said,

In every examination, including ONET examination, I have to ensure that my students' science achievement will be excellent. If my students get a low score or I can not achieve

the academic school target, I may have to meet the principal or a senior academic assistant to explain the reasons. This makes me focus on providing the content to student... I met a senior academic assistant once. She thought that it was because of my poor quality of teaching. It is very challenging and stressful.

Tubtim's comments suggested that high expectations affected her teaching. She was more concerned about her students' passing or failing the test than their learning of science. She also mentioned her struggles with needing to meet their requirements and top-down expectations. Her interview indicated that her senior academic assistant established a link between high scores and quality of teaching. In her school, a high score was an indication of students' learning, and it frequently measured how well teachers performed. A researcher could construe from this information that her school seemed to require teachers to use summative assessment to report students' achievement resulting in formative assessment being an uncommon assessment practice. Consistent with this belief, Tubtim paid more attention to transferring science knowledge to students and shifted all of the focus toward high stakes assessment, rather than integrating formative modes of assessment.

Ploy mentioned that her school principal also required her to ensure the school ONET score in science was among the top ranking in the educational service area. She said, "the principal wants to see the good results. He does not care about the processes... he believes that scores are valid measures of how much students know about the content. Teaching is very stressful..." Ploy further explained that the ONET score would promote competition among schools, and it was used as an indicator to evaluate the quality of teaching.

Significantly the national examination, or ONET test, plays a vital role in the Thai education system with all Grade 6 students in the country completing this exam. Several organisations use ONET test scores to evaluate the quality of students, teaching and schools. In Ploy's situation, the school principal's expectations and requirements appeared to be driven by accountability demands that focus on achieving a high score in high-stakes examinations. These

demands put pressure on teachers and influenced teacher thinking and decision making about the use of formative assessment in science teaching. Although Ploy mentioned that she often used formative assessment, there was evidence of possible tendencies that she would shift her focus at some point from teaching and assessing students to construct the knowledge to transmissive teaching focused on passing the test and on the delivery of facts, principles, and concepts in science.

Paitoon shared a slightly different experience. He explained that he was required to finish teaching all science content at least two weeks before the ONET examination period.

At least two weeks before the ONET examination period, I need to provide a tutorial class for Grade 6 students. I need to finish all content earlier than the schedule... I do not think about assessing student learning because time for covering all science content is still not enough.

In this situation, Paitoon did not have enough teaching time, and the best solution for him in terms of covering all science content was using traditional teaching strategies. Moreover, these comments indicated that Paitoon focused on meeting the accountability demands of the school and high stakes exam. The pressure he felt to prepare students for ONET affected his use of formative assessment. As a result, Paitoon tended to cover the content, use test-driven activity and taught students test techniques to get a higher score from this exam rather than focused on assessing student knowledge to improve their learning. His comments were consistent with this understanding that formative assessment would be implemented when the chapter finished and his belief that scores motivated students in learning science.

The nature of high stakes testing and the perception that test scores are important influenced teacher instructional decisions and practices, which resulted in an emphasis on summative assessment and rather than linking formative assessment, teaching and learning practices.

Key Finding 6.3

Several school-related factors influenced how teachers thought about formative assessment and determined the likelihood they would implement formative assessment practices in their science classroom. These factors included: limited time for teaching; large class sizes; and pressure from school leadership, particularly in relation to achieving high results on external tests.

6.5 Summary

This chapter aimed to identify the factors influencing Thai primary teachers' thinking about formative assessment in science. Through an analysis of the data, many potential factors influenced teachers' thinking related to the implementation of formative assessment in Thai science classroom. The experiences and challenges they faced with regard to formative assessment varied among the participants of this study and were a result of numerous factors, such as:

- *Teacher-related factors*, e.g., teacher knowledge about formative assessment gained through a teacher education program, science content knowledge, and teacher role in teaching;
- *Student-related factors*, e.g., culture expectation of student learning behaviour and student family support; and
- *School-related factors*, e.g., limited time, class size, and pressure from the school leadership.

These factors determined the likelihood that teachers would implement formative assessment practices in their science classroom. For some teachers, these factors appeared to support their implementation of formative assessment. On the other hand, these factors often appeared to be challenging factors for some teachers and generally, teachers more likely to lean toward summative approaches to assessment.

The next chapter presents practices described by the participating Thai primary teachers when asked about formative assessment and their intentions for science teaching and learning.

Chapter 7: Formative Assessment Practices as described by Thai Primary Teachers

7.1 Introduction

This chapter addresses Research Question 3, which aims to explore what practices Thai primary teachers describe when asked formative assessment. The findings revealed that the Thai primary teachers participating in this study described various formative assessment practices. The way they discussed these practices revealed they held particular intentions for science teaching and learning. The analysis revealed that Thai primary teachers used certain practices to achieve three main goals:

1. Eliciting evidence of student learning;
2. Providing feedback to students; and
3. Making adjustments to subsequent instruction.

The particular approaches teachers talked about and their descriptions of how these were used, revealed insights about science teaching and learning in Thai primary classrooms.

7.2 Eliciting Evidence of Student Learning

It was clear from the data that when Thai primary teachers described how they worked to elicit evidence of student understanding particular practices repeatedly emerged. These practices included:

- Questioning;
- Observations;
- Self- and peer-assessments; and,
- Testing.

The ways the teachers used these practices revealed insights about the nature of science teaching and learning in Thai primary classrooms.

7.2.1 Questioning. In this study, questioning was frequently used by Thai teachers to elicit evidence of student understanding. The data revealed that questioning was used in different ways and with different results in the science classroom.

Sometimes teachers used questioning to encourage students to engage in deep thinking, providing insight into each student's level of understanding. Of the thirteen teachers interviewed, two teachers, Komen and Bussarakham, prepared questions before teaching science. Komen claimed that, "asking good questions provides students with an opportunity for deeper thinking in science and provides me with significant insight into the degree and depth of students understanding". These teachers both prepared many types of questions, such as open-ended questions, probing questions, and questions beginning with prompts (e.g. what, why, how, and compare and contrast). Both teachers listed these questions before the lesson. Bussarakham mentioned, "I prepare many types of questions... before teaching by composing specific questions that I will ask students and think about possible student responses... my questions make science relevant to students' daily life". Komen said, "I need to organise questions in a logical sequence, to guide students to think, step by step. Asking better questions allows an opportunity for deeper thinking and provides me with significant insight into the degree and depth of understanding". These statements indicate an intention to use questioning not only to collect information about students' ability to recall information but also to engage, challenge, encourage deep understanding, and develop students thinking skills. These comments indicate that for these teachers, this level of thinking mattered in primary science.

Three teachers, Bussarakham, Komen and Mook, mentioned they often asked questions before beginning teaching; however, each teacher held different intentions for the questions they asked. Bussarakham claimed that she used open-ended questions to elicit students' prior

knowledge. She said, “students’ prior knowledge and experiences influence their thinking. Each student might understand what I say in slightly different ways... if I know their prior knowledge, I can help them to engage and connect new knowledge to their prior knowledge”. Bussarakham shared an example where she taught a lesson about the digestive system. She assessed students’ prior knowledge by asking, “What have we learnt about the human body?” Bussarakham expected students to know that many different organs in the human body work together and the name the organs in the digestive system. Following questioning, Bussarakham recorded students’ ideas and analysed the responses. If the majority of students lacked sufficient understanding of this topic, she provided a short lecture explaining the concept. These comments suggested Bussarakham had clear intentions for using questioning and also held clear expectations about the specific knowledge her primary students should be able to demonstrate. She used questioning to explore areas of confusion in relation to students prior learning. She then worked to provide clarification in her science teaching.

Taking a different approach, Komen explained that he used questioning to gather students’ alternate conceptions of the topic he taught, intending to invite a range of answers, and he valued diversity. He encouraged his students to share their thinking and knowledge about the topic they were going to learn. He claimed that he asked open-ended questions because there are many possible answers in science. He encouraged students to think more deeply and critically by asking "What are your reasons for thinking that is so?" In one example, he asked students to share what they thought and knew about the properties of gases and their answers were written on the blackboard. Komen said, “At this stage, I know some of their alternative conceptions such as gases do not have mass or weight because we cannot touch gas... students do the activities to find out the properties of gases, discuss the result and summarise the concept they have learnt”. Following these activities, students compared their ideas on the blackboard and the knowledge about the properties of gases they had learnt. Komen said, “Alternative concepts may prevent

students from learning scientific concepts. They may reject the new scientific concepts I teach... but accurate preconceptions can enhance student learning because it acts as an anchor for the new knowledge”. Komen attended to students’ alternative conceptions by using questioning to identify where students might make mistakes and where they might struggle. He believed this was important to assist students with their science learning. He used this information to help students by providing experiences that were contrary to what they would expect. Komen’s comments indicate that he believed it was important for students to hold an adequate understanding of fundamental concepts in science, and this was important for future science learning.

Mook reportedly used questioning to gather information about students’ learning preferences and their individual needs. Mook claimed that her students learn better when she used teaching materials that matched their needs. Moreover, she recognised that different students had different preferences, and their preferences changed for different topics. She gave an example, “for the topic of rocks, students prefer a real example because they want to touch the surface and weigh the rocks. However, students prefer to see the animation of how food is digested in the human body”. Thus, she often asked students about their preferences before teaching a new topic. She claimed that her students felt comfortable to tell her what they needed and what they wanted to learn. Examples of the types of questions she asked included, “What are you interested in about this topic?”, “Do you prefer watching a video or seeing pictures related to the topic?” and, “What do you want to learn for the next class?” She often prepared numerous resources, for example, pictures, videos, real examples and models because she “wanted to engage each student to achieve their personal best”. Mook reportedly used questioning to acknowledge and respond to students’ learning preferences. She believed this was a meaningful way to support their learning in primary science. Mook indicated that she modified her instruction to accommodate student needs.

In this study, Paytai claimed that he innovated a questioning technique called ‘a reverse question’:

When I gave a lesson on the food chain, I gave an example of how worms eat producer organisms like leaves on the trees to survive. Then I asked students to give examples of what kind of producer that worms can eat and justify their reasons.

Paytai used ‘a reverse question’ to help him assess whether students understood science content. He said, “If students understand the content, they will be able to answer my question and say “grass” since it is classified as one of the producer organisms”. He did not think it was important that every student answer with the same response as they may think there was only one correct answer. These comments suggest that Paytai used this questioning technique because he wanted to determine if students understood science ideas and were also able to apply their science knowledge.

Thai teachers described different types of questions and different ways of using questioning. However, cultural factors largely influenced the likelihood that students would respond to their questions. Traditional expectations about the respectful relationship required between students and teachers as well as the importance of harmony and relationships were seen as significant for many students, which means that many are reluctant to share their thinking. Some Thai teachers mentioned that to encourage their students to respond actively, they had to create very supportive conditions in the classroom.

Bussarakham mentioned that at the beginning of the school year, none of her students answered her questions. They were afraid of being judged by their friends. She created some opportunities for students to practice speaking freely and openly.

I often told them that “I am happy to listen to any answers. Do not feel bad if you do not know the answer; your friends may not know it either. When you answer the question, it is not only for you but also for your friends to learn too”. I said the same sentences in

almost every classes. When they answered, I said, “thank you for your answer” and asked for any other ideas if the answer was wrong.

Bussarakham’s tried to create a comfortable environment for her students so that they would feel safe to answer her questions and be active learners. To do this, she showed appreciation and respected students’ answers. In time, she said her students took her advice and began to answer, expressing their ideas, answers, and problems without feeling embarrassed.

For other teachers, the support and encouragement they provided were not only about assisting students in feeling comfortable to respond to questions but also to ensure that the students provided a correct answer. Morrakot explained, “I ask questions in the class but not often because most of my students keep silent and do not answer to my questions”. She claimed that when she asked questions, she engaged and motivated students to respond to her questions by guiding their answers. She said, “I think students need to be guided to answer the right question... it helps them discover knowledge for themselves”.

Opal considered the age of the students as influencing their capacity to respond to questions. “My students are too young; they need a clue and help to answer the question”. Opal said, “If a student can select correct answers, it means that he or she understands the lesson... they can remember the right information and will select the right answer in exam”. Both Morrakot and Opal reported that they often asked leading questions that prompted students to answer in particular ways. Morrakot said she asked focused questions followed by answer choices offering students a chance to guess the right answer, for example, “What is the essential thing plants need for photosynthesis, sugar or water?”. She sometimes wrote answers on the blackboard and asked students to make a choice. “When they see the two choices, some of them immediately say the correct answer. I think they need to be guided, then they have learnt”. Additionally, she sometimes asked questions providing some of an incomplete answer, so the students had to fill in the missing information, such as the last syllable of an answer, “Can you

tell me, the process by which green plants use sunlight to synthesise nutrients from carbon dioxide and water? It's called Photosynthe_”, in response, students who knew the answer said ‘sis’ to make the word ‘photosynthesis’. Similarly, Opal reportedly often prompted student thinking by providing the first letter of an answer. Students then used this clue to find the answer. Opal asked grade one students during science teaching, “What is the main function of ears? The answer begins with ‘L’”. If students still answered incorrectly, she would give them “the second letter, writing it on the blackboard”. For teachers such as Morrakot and Opal, it was important that students felt comfortable to answer questions, but it was also imperative that the student provided correct answers. In science, this demonstrated that they had learnt the content. Morrakot and Opal claimed that questioning elicited evidence of student learning; the examples they provided focused on students’ recall of scientific knowledge. The questions they asked seemed to intend to help students select the right answer providing some interesting information about the learning that was valued by these teachers in primary science.

Other teachers did not see student silence as a concern in primary science with these teachers tending to assume such silence was an indicator of student understanding. Tubtim reportedly asked questions to gather information about student learning. The examples she provided indicated that she framed questions in particular ways which may have influenced the type of responses she received from her students. Her questions seemed to require students to comment on their learning in relation to her teaching. For example, “Do you understand what I teach?” “Who has any questions?” “Are you with me?” “Do you need me to repeat?” These questions may have placed a responsibility on the student to say if further teaching was necessary. Tubtim said, “my students often answer ‘I understand’ or ‘I do not have any question’”. Tubtim talked about these responses as an indication of student understanding because the students did not express any learning needs; neither did they ask questions to indicate they did not understand. Perhaps this type of student response may be the result of

cultural expectations where students feel a duty to their teachers because teachers are highly respected and considered to be an authoritative and knowledgeable person who give students knowledge. These questions may create a moral debt, where students feel they must answer in ways which are respectful, obedient, humble and non-assertive. If students did express particular needs, this might indicate that the teaching was ineffective; such behaviour could demonstrate a display of personal disloyalty. In primary science in the Thai classroom, cultural expectations may make it difficult for students to answer teacher questions, and they may choose to remain silent. A Thai primary teacher may see silence as an indication of student understanding when this may not be the case. This thinking may have consequences for student learning.

The data suggests that while Thai teachers intended to use questioning to elicit student understanding, an intention that aligns with the Western practice of formative assessment and how teachers used questioning was often very different. Some used questioning to ensure that student learning was on track and to develop students' thinking skills further. If this was the intention, then teachers were more likely to use questioning which required students to go beyond recall of information. Questioning also elicited students' alternate conceptions, reviewed previous lesson content, and determined students' learning preferences. Other teachers used questioning to focus on students' recall of information and placed high importance on students providing a correct answer because this was an indicator of student understanding. In all cases, culture not only influenced if students would respond to questions but also how they would respond. Students often remained silent. Though this did not concern some teachers, others described how they wanted students to be active learners and how they worked to create supportive and safe conditions in the classroom to encourage students to share their thinking.

7.2.2 Observation. The teachers acknowledged that student observation revealed information about students' understandings. By observing their students, they could, in a short amount of time, determine student learning.

Three teachers, Pailin, Morrakot, and Paitoon, described how they observed student behaviours during class time, claiming that observation practices provided them with information about student learning and helped them to assess whether students understood the content. They observed students by walking around to each student while the student was working on an activity, and they watched as the student performed a task, such as reading a book or working on science activities. The teachers said they noticed some students sat quietly after the class had started and paid attention to the teacher while they observed other students falling asleep, talking to their friends, or doing homework from other subjects. When questioned further about the information they collected from such observations, their comments indicated they reached similar conclusions. Morrakot mentioned that, “it becomes obvious that students who understand what I teach will listen to me, know what to do in science activities and can give a right answer to the lesson exercises”. Students engaged in learning and making sense of the content were noticeably enthusiastic, able to follow activities instructions and behaved well during class.

Additionally, Paitoon said he observed how students paid attention to him during the class, and he used this information to make a judgement about their subsequent learning using what he described as “common sense”. He was confident that his common sense was accurate. He said, “as a teacher, I know who understands, who does not. It was my feeling, common sense... Good and high performing students respect and really depend on me... whatever I teach, of course, they will understand”. Paitoon made decisions about student learning based on what he expected to see students doing during the class.

Two other teachers, Paytai and Tubtim, said they carefully observed students’ expressions by looking at their facial expressions. Teachers mentioned a variety of student expressions they used as evidence of student understanding, such as “clear eyes” and their “understanding face”. Paytai looked for their ‘clear eyes’ claiming that he could identify a

student with ‘clear eyes’ because they “act like they are watching a cartoon. They smile with sparkling eyes”. Paytai identified students with ‘clear eyes’ as those who were interested in and enthusiastic in the lesson. When he looked at them, “they do not avoid making eye contact, they behave like an empty glass that is ready to be filled with water [knowledge]”. Tubtim reportedly looked for students with an ‘understanding face’, he explained that “students with an understanding face sit quietly at their desks, look at me with sometimes nod their head and take notes. They show a happy face, a smiley face”. The teachers claimed that observing student expressions was less time-consuming and a suitable way to determine learning. Tubtim said, “I can assess my students’ understanding quickly ... it works for me as my students always keep quiet in the class”. Both teachers also claimed that they used student expressions as evidence of student understanding, such as a student expressing happiness, paying attention to the teacher, looking at the teacher during the class, and making eye contact. Paytai and Tubtim saw such students as engaged and understanding the content.

Only one teacher, Komen, did not agree that observation provided information about what students had learnt. Komen believed that “observation is subjective; it depends on teacher experiences and interpretations... observation can only provide information about student behaviours. Teacher cannot assess and know what students think and learn”. He explained further,

One bright student in my class always keeps quiet. He has never participated in sharing ideas. He behaves well, listens to me and pays attention in class. When I observe him, I know only his behaviour, but I do not know what he thinks. On the other hand, an unengaged student in my class, he is also a bright student. He often gets a high score for the exam, but his behaviour is not good. He does other stuff, talks with their friends, or sleeps in my class.

Komen did not appear to believe that it was possible to validly assess student understanding through observation, as observation did not provide adequate insights about student thinking and learning.

It was clear that teachers expected students to act in a certain way during a class, and these expectations influenced and shaped what teachers were observing when they were trying to elicit information about student understanding. As previously discussed in Chapter 3, the behaviours teachers chose to observe were heavily influenced by the Thai culture as these behaviours were often characteristic of the traditional learning style of Thai students. Teachers responded positively to culturally appropriate student behaviours, and these were the behaviours teachers used as indicators that students were developing conceptual understanding in science. Teachers' observations and interpretations of student behaviour appeared to be largely driven by cultural norms and expectations.

7.2.3 Self- and peer-assessment. Self- and peer-assessment were evident, but not common practices for the majority of Thai primary teachers in this study. Teachers provided diverse reasons for not integrating these approaches in their science teaching including; students not wanting to engage in discussions or provide feedback to their peers, students not able to make fair judgments often favouring their friends, and that peer-assessment was considered a time-consuming process which limited the time available to teachers to cover content. However, the data revealed that some teachers claimed they did self- and peer-assessment in their science teaching.

Two teachers, Tubtim and Paytai, reported they provided the opportunity for students to assess themselves; however, their comments indicated they implemented self-assessment practices in different ways. In Tubtim's classroom self-assessment was linked to the science textbook used in her school. She mentioned that in the last school year, her students had an opportunity to do self-assessment because there was a self-assessment part of the science

textbook. Her students assessed themselves after completing each science activity. She said, “students checked which scientific skills they had completed. There was a definition of each scientific skill in the textbook. They just read and tick in the box. They could do it by themselves”. When questioned further about her role in this practice, Tubtim said, “I told my students to read carefully about the definition of each scientific skill. It was their work. Everything was in the book... It is an extra exercise they can do by themselves”. However, this changed when her students used a different science textbook from another publisher. There was no self-assessment part in the new textbook, and so her students no longer did self-assessment.

Tubtim’s comments indicated that she understood self-assessment as something extra to her teaching. It was a student task, something they were responsible for doing by themselves; the teacher was not involved in this process. Self-assessment was not an integral part of her teaching practice; it did not happen unless it was in the textbook.

Paytai reported he created some opportunities for students to do self-assessment after presenting their work. “I want students to criticise their own work, develop higher thinking skills and capacity for independent learning”. He asked three questions, “What is the strength of your work? What is the weakness of your work? What will you do to improve your work?” All students had to write an answer to each question in their notebook. He further explained that,

Students’ achievement improves when students are required to think about their own learning, articulate what they understand, and what they need to improve. They learn from their mistakes and avoid making the same mistakes... These skills can be used for further learning. Students will become aware of areas that they need to be improved.

Paytai’s comments indicated that he considered self-assessment contributed to student learning. He appeared to use questions to encourage students to think about the quality of their work, make judgments, identify strengths and weaknesses, and gaps in their understanding and capabilities.

Peer-assessment in Mook and Thong's classrooms happened in different ways. Mook mentioned how she allowed her students to observe and assess their peers' performance in a range of areas, such as cooperation and materials preparation, but not about the quality or accuracy of work. Mook mentioned that the purpose of her practice was to prepare students for undertaking responsibility and developing important skills for real-life contexts such as communication and teamwork abilities. She wanted to prepare students to be more open-minded and accepting of feedback to improve themselves and their learning. It may have been possible that Mook culturally linked her learning intentions to a perception of her teaching role as being a 'second parent' with responsibility for developing students' intellectual, wellbeing and life skills as discussed in Chapter 3. Mook said she shared the assessment criteria and the processes of assessment with her students before doing a group activity. She gave an example of criteria such as "prepare the material from home; carry out activities according to the assigned roles; appropriate use science equipment; read the instructions before doing an activity; follow the instructions; transport all materials and equipment safely; and, clean the table before leaving". At the end of the teaching, Mook allowed her students to share the results from the peer-assessment practices and give suggestions to other students in their group. Mook used peer-assessment to elicit student thinking.

Although Thong revealed that her students sometimes did peer-assessment through a gallery walk, her purpose for using peer-assessment was to have students practice providing feedback and she "did not expect student to respond to the feedback". Thong said she asked students to assess their peers' work by writing feedback or comments on a sticky note and placing it on their peers' work. However, she did not appear to describe any assessment criteria or give students' instructions for how to provide feedback to best support each other. Thong also shared examples of feedback students gave to their peers such as, "beautiful colour", "beautiful drawing", "good", "put the arrow in the wrong place", "spelling wrong", "increase the font size"

and “the model was not similar to mine”. Consequently, peer-assessment was a chance for students to provide feedback, with comments being mostly focussed on the appearance of the work rather than content. Skills around providing critical and constructive feedback did not seem to be a focus of Thong’s teaching. Moreover, her students did not appear to have the opportunity to use the feedback provided to develop their learning or improve their work.

The data suggests that while Thai teachers intended to use self and peer assessment to elicit student understanding, an intention that aligns with the Western practice of formative assessment, these practices were often used very differently. When teachers understood self- and peer-assessment as a way for students to assess their own work and provide a constructive and critical appraisal of peers’ work, then both self- and peer-assessment demonstrate careful design. Some teacher’s used self- and peer-assessment as tasks for students to do by themselves and did not use this strategy to help students develop evaluative and feedback skills. Students were not always supported to learn how to use the feedback they had received from their peers to enhance their learning and/or improve their work.

7.2.4 Testing. Another practice the teachers used to elicit student understanding was testing. Teachers mentioned that they used various types of tests, for example, multiple-choice, matching, labelling, and verbal tests at different times and often for different purposes. Thai primary teachers also used testing at different stages of a learning sequence. Many appeared to associate testing with the end of a teaching sequence, a practice which from a Western perspective would be more aligned with summative assessment than formative assessment.

Petch reported that he used different test formats when he finished teaching each area of content. He used testing to assess student understanding. To better support, a range of student learning abilities, particularly weak students, Petch used matching and labelling tests. For students who had reading and writing difficulties, another technique called “storytelling” was used. Petch verbally asked questions to students who had difficulty learning with those students

required to respond to him verbally. Petch's statements appeared to show that he understood the term 'verbal test' as 'storytelling'. Moreover, he was positive about the 'storytelling' technique as this technique gave him a chance to "know more deeply what students think by listening to students' explanations and reasons". He stated that, "students who have reading and writing difficulties are still able to tell me what they have learnt. They can tell me what causes day and night and the relationship between the Earth, the Sun and the Moon". These comments indicated his belief that students may have an area of strength and the intellectual ability to learn science in different ways. He appeared to use testing to support students' individual learning needs.

Komen talked about developing and using multiple-choice tests when he introduced a new topic to identify any confusion or misunderstandings students may hold about the content. After he finished teaching a topic, he said he used tests to ensure that students understood the content. Komen described a pre-test which he used because "students are unable to differentiate the meaning of 'melt' and 'dissolve'". He claimed that he used this information to inform his teaching and to ensure he spent more time on areas that confused students aligning with a Western view of formative assessment, a multiple-choice test used for formative purposes, i.e. as a diagnostic tool to examine students' current level of conceptual understanding and identify areas which students did not understand in order to inform future approaches to teaching and learning. Komen went on to explain that after he finished teaching this topic, he conducted a post-test with his students. He developed a different set of questions for the post-test that were similar to the pre-test content. He claimed that pre and post-tests provided him with evidence of students' progress in learning as his students selected the right answer in the post-test. The post-test, as described by Komen, aligns more with summative assessment in a Western context.

The other four teachers tended to use multiple-choice tests at the end of instruction only if teaching finished earlier than expected. Paitoon stated, "I did not often use multiple choice test to assess students during the class. I used it when I really had plenty of time". Additionally, these

teachers mentioned a similar purpose for using tests. Thong said, “the test was a good indicator to reflect what students know and how much knowledge they had learnt”. These comments suggested that teachers used multiple-choice tests in ways which aligned with how summative assessment is often used in a Western context, i.e., to measure or to assess the impact of the teaching. In using multiple-choice tests, the teachers’ intention aligned with their practices and understanding of the place and value of formative assessment, as mentioned in Chapter 5.

The data suggested that the teachers implemented many types of test in their science classrooms. Teachers used tests for formative purposes when they wanted to assess students understanding and to modify their practice so that it would be more effective. Tests were also used for summative purposes when teachers wanted to determine what students had learnt and to measure students learning progress.

Key Finding 7.1

Thai teachers intended to use particular practices to elicit student understanding, an intention that aligns with the Western practice of formative assessment, yet teachers used practices in different ways and for different purposes. Embedded formative assessment practices took many forms in Thai science classrooms, and these varied from teacher to teacher. The most frequently used strategies for eliciting evidence of student understanding included: questioning; observation; self- and peer-assessment; and testing. What Thai teachers paid attention to when using these practices sometimes indicated that science learning in Thai primary classrooms was sometimes about giving correct answers and recall of information or critical thinking and decision making that went further than just knowing the content.

7.3 Providing Feedback to Students

It was clear from the data that when Thai primary teachers described how they worked to provide feedback to students’ particular practices in science class began to emerge repeatedly.

These included:

- Written and non-verbal feedback; and

- Verbal feedback.

The particular approaches teachers talked about and their descriptions of how these were used, revealed insights about science teaching and learning in Thai primary classrooms.

7.3.1 Written and non-verbal feedback. Data suggested that the majority of teachers provided written comments on student science homework assignments. Teachers mentioned they regularly put a circle, a tick, or a question mark highlighting right and wrong answers on homework assignments. Two teachers responded to students during science teaching by using sign language (making a cross mark, OK, and using thumb signal to respond to students' answer). They mentioned that giving written and/or non-verbal feedback was effective with their students, but the degree of follow up was often determined by the value or priority that the teacher placed on providing such information. The intent was that the feedback given by teachers would cause students to reflect on their understandings.

Nin and Morrakot provided examples of the written comments they provided to their students. They often put a circle or cross marks on incorrect answers when students made a mistake, placed a tick when students gave a correct answer and put a question mark when they thought the answer was not clear enough or needed students to clarify the answer. Morrakot did not provide follow up, but if students wanted to know more about why their answers were incorrect, they had to come and ask her. She said, "I do not have time to explain individually. I have a lot of work to do". In contrast, Nin claimed that she often implemented follow up with students to ensure they were able to correct their answer and genuinely understand the content. By doing follow up, "students have to think again and find the correct answer and write it down with red colour pen". Furthermore, she believed that follow up helped "students to search for meaning and developed conceptual understanding."

Bussarakham and Mook said they provided non-verbal feedback because they wanted to encourage students to participate by answering questions. They did not want students to feel

embarrassed when they made a mistake. Bussarakhum often used a thumbs-up signal to indicate satisfaction and approval of students' answers when they were correct and gave thumbs-down when students made a mistake. She claimed that providing non-verbal feedback was "an easy and efficient way to respond to students thinking in a short amount of time". Mook reported she responded to students' answers by making a cross sign with her arms to respond to incorrect answers and giving a symbol for OK by using her forefinger and thumb to satisfactory answers. Mook said, "I tell them that we are doing a quiz game just like a TV show. If they want to answer the question, they have to raise their hand... I respond to their answer by doing OK or cross mark". Mook reported that her students had fun with this practice, and this resulted in a better classroom environment.

Teachers' statements suggested that their use of written and non-verbal responses during science teaching intended to provide students with feedback. Some teachers used their feedback to highlight to students if answers were right or wrong. The data indicated that sometimes students were provided with information to help them reflect on their learning. Feedback did not always provide information about what area(s) required improvement or how students could improve and clarify learning in relation to outcomes. It was seen as a student's responsibility to reconstruct and internalise their knowledge by themselves as they were not always supported to do so with help from the teacher. The teachers expected the students to ask a teacher to explain the reason why their answer was incorrect.

7.3.2 Verbal feedback. Another type of feedback mentioned by the teachers was verbal feedback. The data from the interviews indicated three types of verbal feedback: saying a score, giving numerical grades, and giving general feedback. They claimed that when given their verbal feedback motivated students to learn science.

Komen and Nin reportedly used verbal feedback in their science classrooms to motivate students to think critically, improve self-confidence and increase learning enthusiasm. Komen

mentioned that he responded to student answers by using a score from one to five as an indicator of relevance or value of an idea instead of saying that the student's answer is right or wrong.

Komen said,

I ask open-ended questions, so there are many possible answers. If their answer is wrong, I will say zero points. If their answer is nearly correct, I will say two points. Then they think and try to answer again. They will get five points when they answer correctly.

Nin described giving numerical grades to students as representations of the quality of the answers.

Students will get grade four when he or she says a completely correct answer. Grade three is for a nearly correct answer which it needs to be corrected in some words. Grade two is for a partially correct answer. I give grade one for a nearly incorrect answer, and I give grade zero for an incorrect answer.

Both teachers mentioned that this approach motivated their students to talk and share their ideas and answers in science. Students became comfortable as they appreciated there were no right or wrong answers. The teacher's choice of response often indicated an intention to increase students' self-confidence. However, in terms of improving students' critical thinking skills, verbal feedback did not always encourage students to search for meaning or develop conceptual understanding, critical thinking, or inquiry skills. The feedback given to students did not always enable students to recognise their strengths or identify areas they need to enhance. Often the reported feedback appeared to encourage students to match their answers with the teacher's expectation.

Opal, a Grade 1 teacher, believed that "Grade 1 students are too young to comprehend/interpret and respond to feedback". Thus, she reported that she only provided general feedback to motivate them in learning in science. Examples of verbal feedback provided by Opal included "good job", "excellent", "you have done very well", "well-done everyone", "awesome", "you need to practice more" and "careful how you begin your sentences." Opal's

feedback did not appear to invite students to further actively engage with particular ideas. Some of the examples she provided did identify ways they could improve their learning and achievement.

The analysis showed that teachers reportedly used verbal feedback. Some used verbal feedback for a range of purposes which included to provide a score or grade to motivate and encourage students to learn. However, some described feedback that seemed general and which may not help guide students about what to focus on and where to go next. It is interesting to note that it was evident from the interview data that generally, teachers avoided responding to students' answers by saying the word 'wrong' if their answers were incorrect. It appeared that they did this to avoid placing students in an embarrassing or shameful situation. Instead, they provided positive responses in a relaxed classroom environment building a fun atmosphere. Thai culture highly values community and the importance of establishing harmonious relationships. Therefore, positive responses would be considered an appropriate way to handle such interactions for teachers and students.

Key Finding 7.2

Thai primary teachers implemented feedback strategies in their science classroom in different ways and for different purposes. These strategies included written, non-verbal, and verbal feedback. It appears that feedback, as reported by the Thai teachers, did not always provide students with the guidance they may need to enhance their science learning. Teachers often used feedback to encourage science or focus on highlighting correct and incorrect answers.

7.4 Making Adjustments to Subsequent Instruction

It was clear from the data that Thai primary teachers used a variety of assessment practices. How they used these practices often depended on the teacher's intention or the values teachers associated with formative assessment, as discussed in Chapter 5. The three main intentions were to elicit evidence of student understanding, provide feedback or to make adjustments to subsequent instruction. This section presents examples of how teachers in this

study used information gained from particular practices to design or guide the planning of subsequent teaching instruction.

Nin reported that she used information gathered from her questioning of students to assess the effectiveness of her teaching strategies and make adjustments to her teaching, as mentioned in Chapter 5. She said she asked herself, “What happens if students do not concentrate on the lesson, or the language I use or questions are too complicated?”. Nin reported that she immediately rephrased the questions, asked the questions differently, or broke the main question down into sub-questions. For the next lesson, she reported that she would “think carefully about planning the lesson, use simpler language or ask simpler questions, and would provide many examples or make use of visual aids or multimedia to promote understanding”. If students lacked engagement, she said she would try to engage them with a “wow activity” [exciting activity] before teaching. An example of ‘wow activity’ she shared was teaching geological disasters topic using a sand volcano. She reported preparing a sand volcano and engaging students by showing the eruption of a sand volcano in front of the class. After that, she reported asking the students to think about the effect of this disaster on human beings and the environment in the local area. She claimed that her students had fun and tried to think about the effects of erupting lava from a volcano. Nin’s statement indicated that she used the information from questioning to determine the most effective teaching strategies to support learning and made a decision to modify her instruction to find a better way to engage students in learning.

Petch shared an example of how he planned his teaching based on the information received from the storytelling technique. By using the location of the Sun from the storytelling technique, Petch realised that weak students did not understand the concept of directions. Before teaching the next lesson, he said that he discussed with the students what they had learnt about this topic, then he clearly explained, demonstrated and used an animation video to help students understand how to define cardinal directions based on the Sun. He reported that he assessed

student understanding before continuing to teach the following content. He said he asked students who did not understand to demonstrate how they would find the directions by using the location of the Sun. He mentioned that “I need to ensure that all students understand otherwise teaching the next lesson will be difficult. Students need this knowledge to learn the next concept”. Such statements indicated that Petch used this assessment information to inform and support his teaching enabling him to work to assist students in understanding content better. His practices aligned with his understanding of the value of the information gained from formative assessment to inform his teaching as presented in Chapter 5.

Morrakot and Opal explained they sometimes recognised that many students lacked understanding in a particular area or answered the same question incorrectly several times. When this happened, they would re-teach the content or sometimes teach differently by lowering the degree of difficulty for the whole classroom once again. Morrakot mentioned that when she went to re-teach the same topic, she only provided “a summary of the topic, I do not explain in detail”. While Opal said, “I teach the same topic again. I teach only the content where they made a mistake, I think it is important, and students should know”. These teachers confidently claimed that re-teaching helped their students to understand the content better, making, assessment activities after re-teaching unnecessary. These statements indicated that some teachers did not use the information to change their teaching approach to assist students in reconstructing their knowledge. This re-teaching practice, as mentioned by Morrakot and Opal, aligned with their understanding of the place and value of formative assessment practices, as mentioned in Chapter 5.

Key Finding 7.3

Some Thai primary teachers used information derived from assessment strategies to inform their future teaching to support students learning in several ways. Some teachers prepared activities to engage students, while some provided more examples and explanations to help students reconstruct knowledge. However, some teachers engaged in re-teaching by using the same or similar strategies intending to transfer the correct scientific information to students.

7.5 Summary

This chapter aimed to identify the practices Thai primary teachers associated with formative assessment and what these practices revealed about Thai primary approaches to science teaching and learning. Through an analysis of the data, it became evident that three intentions drove the teachers' use of assessment practices:

- *Eliciting evidence of student learning*, e.g., questioning, observation, self- and peer-assessment, and use of test;
- *Providing feedback to students*, e.g., written and non-verbal feedback, and verbal feedback; and
- *Making adjustments to subsequence instruction.*

While these intentions often appeared to align with the use of formative assessment in a Western context, teachers adopted particular practices in ways that were sometimes very different. The results they reported ranged from deeper student learning to more effective memorisation of content. The use of particular practices and the outcomes that resulted appeared to be often influenced by Thai cultural norms and expectations. The cultural context influenced teachers' interpretation of evidence collected from assessment practices, and generally, teachers showed a strong sense of care when providing feedback to students.

The next chapter discusses the findings of this study as presented in Chapters 5, 6 and 7 respectively by comparing, contrasting and exploring the connections between the key findings and the existing body of literature as outlined in Chapters 2 and 3.

Chapter 8: Discussion

8.1 Introduction

The purpose of this chapter is to make meaning of the key findings presented in Chapters 5 to 7 and present a critical analysis by comparing, contrasting and exploring the connection between these findings and the existing body of research literature as well as the cultural influences related to the implementation of formative assessment in Thai primary science classrooms. Four sections form this chapter's structure.

The first section presents a discussion regarding Research Question 1: *What do Thai primary teachers' think about the place and value of formative assessment to support science teaching and learning?* This section discusses Thai primary teachers' understandings of the frequency of use and value of formative assessment by comparing their thoughts with the existing literature.

The second section presents a discussion regarding Research Question 2: *Why do Thai primary teachers hold these ideas about formative assessment?* This section discusses the range of factors influencing teacher thinking and addresses why Thai primary teachers have different understandings of formative assessment; it also discusses how Thai culture shapes the roles of Thai teachers and students and subsequently influences assessment practices. Further, this section discusses how the school context influences and contributes to teachers' decision making about whether to adopt formative assessment practices in the science classroom.

The third section presents a discussion regarding Research Question 3: *What practices do Thai primary teachers describe when asked about formative assessment and what do these reveal about science teaching and learning in Thai primary classrooms?* This section discusses the assessment practices Thai primary teachers use in their classrooms as a result of cultural influences. Further, it considers how to empower teachers to change the culture of assessment in

their science classrooms by effectively combining principles of formative assessment with elements of Thai culture.

The fourth section presents the implications for practice of the findings in terms of how this study could contribute to future policy development and support from relevant stakeholders in Thai education.

8.2 Research Question 1: What do Thai Primary Teachers' Think about the Place and Value of Formative Assessment to Support Science Teaching and Learning?

As the findings presented in Chapter 5 illustrated when asked about their understandings of formative assessment, Thai primary teachers articulated and clarified their ideas and thinking in various ways. Analysis of the data indicated that Thai primary teachers hold a variety of understandings about formative assessment concerning the frequency of use (KF 5.1), the value of formative assessment to support student learning in science (KF 5.2), and the potential value of formative assessment to inform their teaching practices (KF 5.3). Chapter 5 also highlights that the participating teachers' responses were not consistent from teacher to teacher. All of these teachers were at a different place in terms of their understandings of formative assessment. Indeed, their understandings are best described as a continuum moving from basic insights to those having greater complexity in their interpretations.

In making sense of this data, the remainder of this section explores how these findings contribute to the existing body of literature by providing evidence illustrating the similarities and differences between Thai primary teachers' conceptions of formative assessment and what the relevant literature describes.

8.2.1 Making sense of teacher thinking about formative assessment. As mentioned earlier, Thai primary teachers' understandings about formative assessment indicate it exists along a continuum. This section discusses the findings related to the frequency of use of

formative assessment, which ranges from a one-time event to recognition of formative assessment as an ongoing part of practice. This section will also consider teachers' understandings of the value of formative assessment varying from simple use to identify student achievement right through to having it play a rich and important role with the potential to enhance student learning, change teaching practices, and support professional growth.

8.2.1.1 Teachers frequency of use of formative assessment. Four teachers - Opal, Morrakot, Thong and Paitoon—responded that formative assessment occurred as part of their teaching as a one-time event, such as completing a chapter or at the end of a semester to specify how well students knew the overall content. Research (see: Hosp, 2012; Hosp & Ardoin, 2008; Shephard, 2000; Stiggins, 2017) suggests that formative assessments should be more than a one-time event with teachers utilising formative assessment to support students' progress toward their learning goal(s). However, when described as a one-time assessment, formative assessment could be viewed as more summative in nature, suggesting that the teacher's primary purpose for this assessment was more summative rather than formative even though they labelled it as formative assessment. These comments indicated no clear distinction between formative assessment and summative assessment for these teachers, which highlights that these understandings of formative assessment are not well aligned with commonly espoused definitions in seminal formative assessment literature (e.g., Atkin & Coffey, 2001; Bell & Cowie, 2001; Black & Wiliam, 2009; Popham 2008).

However, some teachers in this study, for example, Bussarakham and Komen, understood teaching and learning science as being focused on paying attention to students' prior knowledge or alternative conceptions and helping students to construct knowledge. For these teachers, formative assessment characterised by its ongoing, dynamic, and progressive nature occurred more regularly in their science classrooms. They understood that formative assessment could happen at any time in their teaching and as such, incorporated it as an everyday event and

flexible process. These teachers' view of formative assessment aligned with some formative assessment characteristics that are also commonly referred to by scholars such as Bell and Cowie (2001); Black and Wiliam (2009); and Popham (2008). Formative assessment practices appeared to be intertwined in their teaching as supported by the work of Darling-Hammond (1994), who indicates that assessment must become part of both the teaching and learning processes.

8.2.1.2 Teachers' understanding the value of formative assessment. This study also found that the frequency of use of formative assessment and how teachers understood the relationship between teaching and learning linked to how they valued the role of formative assessment in their teaching and the degree of influence formative assessment had on their teaching practice.

By conceptualising formative assessment as more like summative assessment, four teachers appeared to underestimate the potential value of formative assessment. For example, formative assessment for Opal remained traditional and frequently required students to provide correct answers that matched the textbook solutions. Moreover, select participants understood formative assessment as a way to evaluate how much scientific knowledge students had absorbed, to give students a score for their achievement, and to motivate students. These teachers did not use formative assessment to help students develop scientific knowledge or skills or to help students view learning as a search for meaning. Holding such restricted beliefs about the purpose and value of formative assessment leads to the limited application of formative assessment in these teachers' classrooms, and further, any information gathered was rarely used to inform teaching. The purpose and value of formative assessment mentioned by these four teachers do not resonate with conceptions of formative assessment as suggested by the literature (e.g., Bell & Cowie, 2001; Black & Wiliam, 1998; McMillan, 2014).

The other nine teachers (Nin, Paytai, Ploy, Petch, Tubtim, Pilin, Mook, Bussarakham, and Komen) recognised an interdependent relationship between teaching and learning. These

same nine teachers also had a clear understanding of what they wanted students to learn, how they could help and support students learning progression to move from what they do not know to what they can know, and provided information about what actions should occur in order to help the students to construct knowledge and reach a learning goal. These teachers understood formative assessment as a vehicle to monitor students' progress to help them identify their weaknesses and strengths and assist them in acquiring knowledge and learning skills. These teachers used information collected through formative assessment to make adjustments to their subsequent teaching, provide subsequent learning activities to improve student learning, and help students overcome alternative conceptions as well as reconstruct and internalise their knowledge. The conceptions of formative assessment provided aligned with some formative assessment characteristics commonly referred to by scholars such as Ali and Iqbal (2013); Amua-Sekyi (2016); Black and Wiliam (2009); and Bell & Cowie (2001). Further, they claimed that through careful critical reflection on their teaching, they were able to plan more effectively for the next lesson. On this point, I argue that for these teachers, including formative assessment in their teaching contributed to a deeper understanding of their teaching practices (Ash & Levitt, 2003) and professional growth.

In summary, Thai primary teachers' thinking about the nature of formative assessment was not consistent among the teachers who participated in this study. As discussed, the term formative assessment meant different things to different teachers. There was no common concept or description of formative assessment shared by all Thai primary teachers in this study. These findings are congruent with research shared in Chapter 2 which suggests that teachers develop a depth of understanding about new teaching strategies through their existing knowledge, personal values, and experiences which consequently often differed from teacher to teacher as well as within contexts (Connelly & Clandinin, 1985; Elbaz, 1983; Johnston, 1992; Tsang, 2004). The

next section discusses the potential factors that influence Thai primary teachers thinking about formative assessment.

8.3 Research Question 2: Why do Thai Primary Teachers Hold these Ideas about Formative Assessment?

This study captured numerous factors that influenced teacher thinking about formative assessment and determined the likelihood that they would implement formative assessment practices in their science classroom. These factors included: teacher-related factors, e.g., teachers personal sense of adequacy with formative assessment, science content knowledge, and their role as a teacher (KF 6.1); student-related factors, e.g., student learning behaviour, the socioeconomic background of students, and parental expectations for student achievement and their degree of support (KF 6.2); and school-related factors, e.g., limited time for teaching, large class sizes, and pressure from school leadership (KF 6.3).

In making sense of this data, the remainder of this section explores how these findings fit within the existing body of literature and discuss the impact of these factors on teachers thinking about formative assessment and their decision to implement this approach in the science classroom.

8.3.1 Making sense of factors influencing teacher thinking about formative assessment. It was evident in this study that, despite being in the same profession, Thai primary teachers held varying levels of knowledge and understanding about formative assessment with many factors influencing their thinking and decision making to implement formative assessment. This study captured the key themes influencing teacher thinking: teacher knowledge; Thai culture aspects; and school context. This section discusses the key themes.

8.3.1.1 Teacher knowledge. The interview data presented in Chapter 6 indicated that teachers in this study had a range of learning experiences connected with formative assessment as part of their initial teacher education programs. While most teachers in this study had learnt

about the theory and practices of assessment, some were not sure whether or not they had encountered the notion of formative assessment. Some teachers, who were aware of formative assessment, seemed to have generalised (e.g. not specific to science education) knowledge of the principles underpinning this approach to assessment. The findings suggest at the likelihood that Thai initial teacher education (ITE) programs vary in their offerings, emphasis and coverage of different assessment approaches and curricula.

The teachers interviewed articulated that they received formal training about assessment mostly focused on measurement techniques such as developing test items and grading methods with some teachers, for example, Bussarakham, saying they learnt a few techniques for formative assessment, such as effective questioning techniques and performance assessment. The findings suggest that assessment courses in ITE programs seemed to focus on more traditional summative assessment methods. The findings in the current study confirm findings from a study by Townsend (2007) and a report from OECD/UNESCO (2016) that identifies that the design of assessment courses in ITE programs in Thailand teach pre-service teachers about the role and purpose of educational evaluation, test design and implementation, curriculum and test analysis, validity and reliability, and score interpretation and evaluation. Thus, the content of the curriculum was insufficient to help teachers understand formative assessment as research has shown that the types of assessments focused on in Thai ITE programs assess only knowledge targets and objectives and do not sufficiently measure reasoning or performance-based targets (Stiggins, 2005).

Based on the interview data, indications are that ITE programs introducing the theory and practice of formative assessment in Thailand seem to be inconsistent and insufficient. Consequently, many teachers enter classrooms with a variety of understanding of the theory underpinning formative assessment and a sense of uncertainty regarding the distinction between formative and summative assessment. The findings support what has been discussed in the

literature that teachers enter the profession bringing their own existing experiences and understandings of what ITE taught them about assessment (de Vries & Beijaard, 1999; Kagan, 1992; McGhie-Richmond, Jordan & Underwood, 2002; Stofflett & Stoddart, 1994). The lack of undergraduate education in regards to assessment philosophy and practice arose as an influential factor in terms of how teachers in this study understand and decide to implement formative assessment. As a result, teachers lack the basic knowledge and skills in classroom assessment and revert to traditional grading practices that tend to replicate what they experienced as students and pre-service teachers (Frary, Cross, & Weber, 1993; Guskey & Bailey, 2001; Truog & Friedman, 1996).

I should acknowledge, however, that ITE programs were not the only source of knowledge for the Thai primary teachers in this study. Some teachers were motivated and enthusiastic about acquiring more knowledge about formative assessment through their own independent learning. For example, approaches such as professional reading and participating in communities of practice made up part of their individual efforts to support their own ongoing professional development and learning once again highlighting the notion that learning is an individual experience; personal and unique to each teacher. This experience offers some interpretation of how and why teacher knowledge about formative assessment differs.

This study found that teachers' content knowledge seemed to have an impact on decisions to implement formative assessment practices. For example, when Paytai worked with unfamiliar topics, he lacked confidence in identifying students' science conceptualisations. Consequently, he returned to a more traditional approach where teaching was about delivering content and could not integrate formative assessment into his teaching. This finding reflected what Matese (2005) said about teachers' science content knowledge and formative assessment. He claimed that teachers' content knowledge is vital for formative assessment because it influences teachers' abilities to support students to understand key concepts. Moreover, the

evidence from this study supports the claim from the study by Magnusson, Krajcik, & Borko (1999) who suggested that the absence of one sort of knowledge for teaching affected the use of other types of knowledge. It is thus no surprise that teachers who lacked science content knowledge might not be confident using formative assessment and may be more likely to use assessment as a tool for accountability.

8.3.1.2 Thai culture aspects. As discussed in Chapter 3, teaching and learning often have a basis in cultural expectations and understandings (Hofstede, Hofstede, & Minkov, 2010; Ohmae, 1995; Gu, 2010). Teachers and students from different cultures have different methods or patterns of teaching and learning, thinking, and behaviour. Adoption of formative assessment practices, which is a Western teaching ideology that sometimes sits in opposition to certain aspects of Thai cultural values and norms, could cause tension for Thai teachers and students.

Components of Thai culture, particularly aspects of hierarchy and collectivism, strongly influenced Thai teachers' understandings of what it means to be a teacher, what values subsequently inform teaching and learning, and the role and behaviour of students in classrooms (Hofstede, 1986; Komin, 1991). These components could contribute to the traditional, more exam-oriented assessment culture commonly observed in Thai classrooms.

8.3.1.2.1 Role of teacher and their teaching strategies. The interview responses from teachers (e.g., Opal, Morrakot, Thong and Paitoon) about their understandings of the nature of formative assessment appeared to reflect their understandings of their role in teaching as transferrers of knowledge and supported their traditional understandings of teaching and learning where science knowledge is viewed as transferrable from one person to another and thus, best taught by lecturing. This finding is similar to the report by Thamraksa (2003) who claimed that the way Thai teachers see themselves as "righteous gurus" (p. 62) who possess knowledge for transfer to their students means they continue to lecture in their classrooms. As discussed in Chapter 3, aspects of Thai culture strongly influence the role of the teacher as transferrer of

knowledge in Thai school settings (Kantamara, Hallinger, & Jatiket, 2006; Podhisita, 1998). In Thai teachers' minds, there is a hierarchy that differentiates the higher status of teachers from the lower status of students (Podhisita, 1998). In this sense, inequality in Thai classrooms leads to teacher-centred practices and controlled teaching methods (Podhisita, 1998; Tiranasar, 2002; Kantamara et al., 2006) such as lecturing, rote learning and the application of traditional assessment methods (e.g. summative assessment). This finding supports the work of Berry (2010) who found that teachers whose attitude towards teaching and learning is dominated by a teacher-centred view are less likely to adopt formative assessment practices in their classroom.

In Thai teaching culture, teachers teach and were taught using practices based mainly on teacher-centred approaches. As a result, teachers are familiar with this pattern of teaching. This finding also links to studies by Kagan (1992) and Stofflett and Stoddart (1994), which highlights that the development of a teacher's practice comes from their experiences as students as well as their observations of other teachers and their lecturers in their ITE program. The traditional teaching that Thai teachers receive from their own education influences them to become teachers with a strong connection to teacher-centred approaches.

In order to implement formative assessment effectively, Cizek (2010) suggested that teachers should shift their roles from transferrer of knowledge to facilitator. The mismatch between the traditional role of transferrer to the role of facilitator utilising formative assessment approaches may be challenging for Thai teachers resulting in a lack of confidence with implementing these ideas. A teacher who is comfortable with their traditional role as a Thai teacher with obedient students may struggle and feel uncomfortable with this shift in role. In this study, Morrakot avoided losing 'face' with her students due to not knowing the answer to a student's question by not allowing students to ask questions in her classroom. Instead, she lectured to her students as a way of transferring science knowledge to her students. Communication in her classroom tended to be one-way (teacher to students). Holding an identity

as an authority figure can lead to a teacher's tendency towards using rote learning, traditional instructional strategies or lecturing, and avoiding the implementation of formative assessment so that he/she feels that their position of power remains strong. This finding supports the study of Tiranasar (2002) that this cultural value is the main obstacle to changing the traditional role of transferrer to the new role of facilitator.

Throughout Thai history, Thai teachers have been considered as both teacher and ‘second parent’ (Deveney, 2005; Komin, 1990; Thamraksa, 2003). Combining this with elements of the hierarchical social system creates a sense of control for teachers in the classroom. This ingrained cultural norm could make Thai teachers believe that the sources of knowledge reside within them and that they should directly transfer this knowledge to students. With respect to this research, Mook presented herself as a teacher and ‘second parent’ in a way that did not entirely align with the notion of a teacher in Thai culture as just discussed. Mook wanted to assist her students in building positive attitudes towards learning science and used more encouraging words to make students feel confident to express their ideas. She carefully built a relationship to develop a shared sense of trust and community within her classroom. When Mook asked questions, most of her students seemed eager to offer their answers and share their ideas. This sense of community between Mook and her students might manifest as a precondition for formative assessment practices in Mook’s classroom.

8.3.1.2.2 Role of student in learning. As discussed in Chapter 3, Thai students are taught and expected to behave in certain ways so that they show respect for their teachers. Hence, they are passive, obedient, dependent, harmonious, and non-confrontational. These attributes of students are viewed by Thai teachers as pleasant and desirable though having said this, these characteristics also appear to be mediating factors and obstacles preventing some Thai students from being thought of, and behaving as, independent learners. These cultural expectations strongly influence Thai students’ behaviour and perception of themselves as passive

learners who rely heavily on teachers to give them knowledge rather than participate in a self-learning culture (Hofstede, 1986). Additionally, these prevailing characteristics of student learning behaviour are barriers to the use of formative assessment practices. Formative assessment is a student-centred educational process by nature. Students are encouraged to discover intellectual direction for themselves by actively engaging in their own learning. Successful learning of formative assessment derives from the establishment of two-way communication between student and teacher. Discrepancies between cultural values and principles of formative assessment could hinder teachers' implementation of formative assessment practices. Pailin, for example, reported that she moved away from formative assessment to more summative assessment practices because her students were relying on her to provide content knowledge, expecting her to take responsibility for their learning (Apfelthaler, Hansen, Ong, & Tapachai, 2006; Renshaw & Power, 2003), and were very reluctant to respond when she asked questions to assess their understanding. These challenges were consistent with the common factors that influence formative assessment suggested in the literature which seem to indicate that Asian students tend to be more dependent learners (Ballard & Clanchy, 1991; Chan, 1999; Chen & Starosta, 1997; Deveney 2005; Hing, 2013; Murphy, 1987; Nguyen, 2008; Thanh, 2013; Woodrow & Sham, 2001).

Moreover, the differences between learning behaviours of Thai students and principles of formative assessment will likely result in significant conflicts and frustration for the Thai students as formative assessment requires students to take an active role in their learning. For example, Opal and Paitoon reported that peer-assessment was unfavourable for their students because peer-assessment often requires students to undertake verbal interchanges. Particularly in Thailand where collectivism is the basis for cultural and behaviour orientation, maintaining harmony and avoiding confrontation is viewed as positive behaviour. Thus, Opal and Paitoon's students avoided conflict with their friends instead preferring to establish and maintain

harmonious relationships. These findings were consistent with studies by Nguyen (2008) and Thanh (2013) conducted with Vietnamese students. These studies found that, in general, students were not interested in face-to-face discussions and assessing their peers' work because students were afraid of hurting their friends or damaging friendships if they shared their honest opinions. Another problem that has the potential to make peer-assessment unfavourable in Thai culture classrooms is that students do not respect peer feedback. Teachers are perceived to be the only person who is professional and experienced enough to provide feedback (Yang, Badger, & Yu, 2006); thus a teacher's comments are more valued than a peer's (Chen, May, Klenowski, & Kettle, 2014; Ng, 2014; Tepsuriwong & Bunsom, 2013).

8.3.1.2.3 Exam-oriented culture. Teachers in this study highlighted their inevitably experienced tensions between their view of the role of formative assessment and the accepted culture of school-based practice when working within a high-stakes climate. For example, Tubtim's interview reflected that she had a clear understanding of the interdependent relationship between teaching and learning in science which focused on student's construction of knowledge and she had a clear purpose for formative assessment. Moreover, she recognised a strong relationship between the information collected through formative assessment and the professional judgement needed to consider alternative approaches and make changes to her teaching practice. When Tubtim entered the profession, she worked in a school where they measured the success of learning by a highly valued grade or number. She felt the tension between the need to address student's learning needs and the pressures to address existing school culture norms and school administration requirements, which tended to ensure that students acquired knowledge. This finding reflected an explanation provided by other research which described experiences where the implementation of formative assessment creates tension in the traditional grading practices of teachers (Gioka, 2009; Harlen, 2005; Lamprianou & Christie, 2009; McClam & Sevier, 2010; Wiliam, Lee, Harrison & Black, 2004). Moreover, this finding

supports a claim by Adamson (2011) that the nature of high stake exams identified as distorting the use of formative assessment and breaking the link between assessment, teaching and learning. It is, thus, no surprise that Tubtim's assessment practices became focussed on teaching her students' study habits to help them develop test taking skills to pass the test.

Tubtim's interview also reflected that traditional assessment practices are likely to dominate in science classrooms (Abell & Volkmann, 2006; Brickhouse, 2006; DeBoer, 2002; Delandshere, 2002). Her school did not require her to assess student's depth of understanding and knowledge in science instead she was only required to measure student's acquisition of scientific facts and ensure that students would achieve a high score on mandatory exams. Traditionally, in the exam-oriented education system, teachers' assessment practices are expected to conform to the national standards and are regularly inspected by government agencies (Brown, Kennedy, Fok, Chan & Yu, 2009). The teachers' role in the assessment process is providing a grade for each student, indicating that they passed or failed, and then recording and summing up this information in the student's school report. Thus, the school required teachers to administer the exam papers and report a letter grade to the administration through progress reports rather than requiring teachers to reinforce higher order thinking and inquiry skills or adopt formative assessment practices to improve students' ongoing knowledge construction.

This finding tends to align with findings from a study conducted by Li (2009) which suggested that in Asian countries, cultural factors focused on the achievement of a high score in accountability-focused testing drives the school expectations and requirements. High scores and grades serve as a means to determine students' competency, students' future college admission and future employment (NRC, 2001; Marshall, 2006). As in the Thai context, parents and society are likely to see examinations as a trusted mechanism to achieve social ambitions. The case of Pailin illustrates this clearly. Parents of students in Pailin's class believe that success is based

largely on academic performance, and they expected the teacher to contribute directly to maximising the opportunity for their children to achieve this success. Success in Asian societies is viewed as socially-oriented and brings prestige to the family and others (Yu, 1996; Yu & Yang, 1994). Furthermore, grades manifest as a measure of the outcomes of an accountability system indicating a schools' performance and a teacher's performance with grades used to make decisions about the effectiveness of a teacher as well. Specifically, school administrators use grades to make judgments about a teachers' performance in the subject area that they teach and to check on teachers making sure that they are accountable for what is occurring in their classrooms.

8.3.1.3 School context. When teachers talked about their concerns with implementing formative assessment in a science classroom, their comments revealed insights about tensions between covering the curriculum and implementing formative assessment practices, which take time and repeated efforts (Buck & Trauth-Nare, 2009). For some teachers, for example, Morrakot and Petch, there is the impact of the number of students in their classes, which leads to a lack of motivation to use formative assessment in their classrooms. This finding supports the suggestion of Pham (2014) that large class sizes do interfere with the efforts of Asian teachers to implement educational innovations, such as collaborative teaching or formative assessment. As formative assessment focuses on improving individual student learning based on relevant feedback from different students' needs, having a large number of students per classroom would make it more difficult for the teacher to implement formative assessment as it requires teachers to spend more time with individuals in order to provide feedback.

In summary, teachers in this study shaped their thinking and understanding of formative assessment along with their knowledge of formative assessment from initial teacher education programs and individual learning, cultural values, their personal values about the teaching profession, and their school context. Although some teachers appeared to have a basic

understanding of constructivist pedagogy and agreed that formative assessment was an effective tool to understand student learning, they still decided not to implement formative assessment in their classroom. These findings suggested that there was no simple link between teachers' thinking about formative assessment and their assessment practices. In the following section, the practices teachers describe when asked about formative assessment are explored.

8.4 Research Question 3: What Practices do Thai Primary Teachers Describe when asked about Formative Assessment and What do these Reveal about Science Teaching and Learning in Thai Primary Classrooms?

This study revealed that Thai primary teachers described practices associated with their approach to formative assessment which often indicated they held particular intentions for science teaching and learning. While these intentions often seemed to align with the use of formative assessment in a Western context, the Thai teachers used specific practices in ways that were sometimes very different from Western understandings. Three intentions drove teachers use of assessment practices by eliciting evidence of student learning (KF 7.1); providing feedback to students (KF 7.2); and making adjustments to subsequent instruction (KF 7.3).

The remainder of this section discusses how these findings fit into the existing literature and consider the practices of formative assessment as described by Thai primary teachers.

8.4.1 Making sense of Thai primary teacher implementation of formative assessment. As mentioned in Chapter 2, teachers' thinking substantially influences and determines their behaviours and teaching practices. Teachers' thinking provides teachers with a platform for understanding their practice, making sense of new ideas, making decisions about teaching and learning, and influences the way in which they create the appropriate conditions to support their students' learning. However, during their careers, teachers face many challenges that could influence their thinking. This section discusses the findings related to Thai primary teachers assessment practices which are driven by Thai cultural expectations. Further, it

considers how teachers made room for formative assessment by balancing and maintaining the aspects of classroom culture and the principles of formative assessment.

8.4.1.1 *Formative assessment practices are strongly driven by Thai cultural factors.* In this study, teachers, for example, Opal, Morrakot, Thong and Paitoon, had strong ideas and feelings about the role of the teacher as being a transferrer of knowledge which aligned well with the traditional status of teachers as accepted in Thai culture. This view, coupled with the teachers' lack of knowledge, education and experience with formative assessment, may have been an obstacle to the adoption of such an approach. These teachers held views of assessment that are largely focussed on summative assessment and marking for right and wrong answers. For example, Opal and Morrakot assess students' understanding by asking leading questions that prompted students to answer correctly as exemplified in the study by Yin and Buck (2015), where the teacher sought predetermined correct answers without providing an opportunity for classroom discussion generated by follow-up questions to enhance student thinking. In addition, Paitoon underestimated the complexity of gathering evidence of students' learning using formative assessment practices. He paid little attention to eliciting and analysing evidence of students' learning; instead, he used his 'common sense' to assess what students had understood, perhaps due to Paitoon's inability to elicit his students' learning. Thus he had to determine this for himself via observation and make judgements about students' learning and progress. The data indicated that teachers, like Paitoon, assessed students' learning as a way to maintain control over student thinking and therefore struggled with the implementation of a highly student-centred approach such as formative assessment. These teachers did not allow students to take ownership of their learning which made applying formative assessment challenging.

The emphasis on social harmony recognised within Thai society leads to Thai people engaging in relaxed interactions, joyful behaviour and enjoyment of a pleasant atmosphere. Additionally, Thai teachers perceived as role models for students and practice politeness and

treat students with good manners. All these values and expectations are directly related to teachers' thinking and teaching practice. The analysis of data from this study suggested that the teachers attempted to find ways they could express calmness, respect students' emotions, and respond positively to students' behaviours to support students' learning in science. Such actions inspired a peaceful atmosphere in the whole classroom. Teachers always tried their best to reduce aspects of practice that discouraged student participation. According to the data analysis, three teachers - Nin, Komen, and Mook - provided feedback to students by creating a situation that encouraged students to have fun and feel like they were on a TV game show. Teachers considered teaching practices as fun and claimed that students began to be interested because their feedback did not make students feel upset or ashamed when they made a mistake. These fun practices viewed as useful activities benefited students learning of science. The main objective of this activity was to increase the sense of harmony and encourage student participation in the classroom. Providing feedback in this fun and collaborative way was considered relevant to the collectivist approach underpinning Thai society because providing critical individual feedback is a risk that could place a student in an embarrassing or shameful situation. Having said this, considering this activity from a Western viewpoint you could assert that this activity did not provide constructive feedback to students and did not assist students in filling a gap between what is understood and what is aimed to be understood (Hattie & Timperley, 2007). In a Thai context, this was not the point of this activity; the point was for teachers to shift their role from the traditional Thai understanding of teacher and have a more informal experience with their students in the classroom. Doing this was an attempt to narrow the gap between the teacher's status (high power) and the students status (low power) to encourage two-way communication between teachers and students. In this example, implementing a formative assessment practice, in a way appropriate for the Thai context, allowing teachers to elicit student thinking and provide feedback while carefully challenging the traditional teacher-student relationship and sharing an enjoyable learning experience. The element of mutual pleasure is also a key part of Thai culture.

8.4.1.2 Making room for formative assessment by building a sense of trust. Findings from this study indicated that not all of the teachers heartily embraced the hierarchal cultural values but instead were keen to show some equality and flexibility in their relationship with students and thus, tried to pay more attention to their learning needs. The findings indicated that teachers in this study had suspended their role as a transferrer of knowledge and moved to more of a facilitator role. They were beginning to recognise an interdependent relationship between teaching and learning. Further, this suggested that assessment practices were more about building a sense of trust so that students would speak up in class and be more open to feedback. The teachers worked hard to establish and maintain trust with their students viewing this as an enabler for the implementation of formative assessment. This finding supports the work of Carless (2009), and McEntarffer (2012) who identified that trust has a significant impact on the implementation of formative assessment practices.

Building a sense of trust in, for example, Mook and Bussarakham's classrooms emerged during the interview when discussing how they handle silence in their classrooms. They noticed that their students avoided answering questions because they were afraid of being judged by their friends. They responded to students' characteristics and preferences by creating a safe classroom environment that made their students feel comfortable about participating in public questioning and encouraged their students to learn this process of supporting each other's learning through discussion and feedback. They created opportunities for students to use their voices in reflections about their thinking and empowered them to participate in learning rather than passively accepting knowledge. Mook used more encouraging words to motivate students to express their ideas while Bussarakham showed her appreciation for and respected all answers that came from her students. In Bussarakham's classroom, she treated students' mistakes as opportunities to learn rather than moments of embarrassment. She established a classroom culture of trust and openness. One could assert that Bussarakham's practices were unusual in Thai culture,

particularly in the ways she was always supportive, open-minded and flexible in class. Thus, students in Bussarakham's class seemed comfortable working and sharing their ideas in front of their peers. Bussarakham was able to use her students' responses as evidence of their learning and to support the development of her teaching practice.

A classroom environment where teachers' build trust enables students to feel a sense of freedom and enthusiasm. Students feel free to make decisions that reflect their interests and to take risks in sharing their ideas. Students in such a classroom environment actively learn, which is different from the traditional cultural expectations of student behaviours. The findings in this study indicated that a classroom environment founded on trust set the stage for implementing formative assessment processes as students feeling free to speak up is vital for formative assessment. As discussed in Chapter 3, this desirable characteristic (students speaking up) seems to be inconsistent with Thai cultural expectations.

Evidence from the research found signs of change in practices of some Thai teachers, which contrasted with the traditional expectation of teachers' role and were consistent with many common descriptions of formative assessment. These changes included: inviting and providing opportunities for students to be involved in learning and assessment processes rather than being passive in their learning; and encouraging students to have a voice and welcoming all students' answers, ideas and thinking.

In summary, teachers' practices of formative assessment were highly variable. Implementation of formative assessment in science classrooms is a multifaceted and complex process influenced by a number of factors such as teachers' knowledge, characteristics of culturally acceptable student-teacher relationships, and school and classroom environments, which remain dominated by teacher-centred practices. It may be difficult for some teachers to shift from the role of a transferrer and move toward the role of facilitator providing space for students to sharing their thinking and ideas and part of the learning and teaching process.

However, some teachers (e.g., Mook and Bussarakham) began to navigate the contradictions and tensions and were developing practices that were encompassing of both the cultural expectations and more commonly accepted notions of formative assessment. They established and maintained trust with students as a precursor to formative assessment. They were able to link some aspects of formative assessment to teaching activities in their classroom. Their practice included elements of formative assessment, such as providing opportunities for students to be involved in learning and encouraging students to have a voice, sharing their ideas and thinking. It could be said that some teachers in this study were not only still working to adopt formative assessment as understood in the commonly cited literature, but they were also trying to translate these pedagogies into more traditional Thai classroom practices being mindful of Thai cultural norms.

8.5 Implications and Recommendations for Stakeholders

In the Thai education system, policymakers make all major decisions regarding policy implementation. School teachers are last in the chain of command but expected to implement the policies, rules, and regulations dispensed from the Ministry of Education. Having such a heavily centralised, vertical, bureaucratic Thai education system means that school teachers often serve as implementers who are accountable for results rather than professionals who are responsible for contextualising the policy. Little attention is paid to teachers' understanding and thoughts when adopting the new policy. By exploring Thai primary teachers' thinking about formative assessment, this study was able to present information about where Thai primary teachers' understanding of formative assessment lies, which is a gap in the literature in the area of formative assessment in Thai context. When the researcher asked teachers in this study to describe formative assessment as well as their understanding of formative assessment, their responses revealed significant insights about their ways of learning, their need for support about formative assessment, and the hidden constraints and opportunities that the teachers faced and

experienced. Additionally, this study was able to capture that Thai primary teachers do not have substantial knowledge for the effective implementation of formative assessment and so struggle to implement formative assessment in a meaningful way.

With this knowledge, various stakeholders in Thailand, such as Thai policymakers, teacher educators, PD developers, and school leadership teams will be able to reflect on their contributions to policy and consider new areas of engagement to better support Thai primary teachers while considering their understandings of formative assessment. This knowledge is an essential element that stakeholders can use when determining what supports should be in place to help each teacher develop a more consistent understanding of formative assessment and skills that can be applied to improve implementation in the future. Moreover, the knowledge provides insights that might potentially improve ITE programs, PD programs, and sustained teacher learning programs to meet the existing knowledge, current needs, thinking and interests of Thai teachers.

8.5.1 Policy-makers. The concepts of formative assessment addressed in the educational policy intend to encourage the adoption of this approach throughout the Thai educational system. However, assessment policy and guidelines announced by the government seemed to be unclear and therefore, did not adequately support teachers to understand the definition and direction of formative assessment as discussed in Chapter 3 also leading to the development of various understandings of formative assessment for Thai teachers that become barriers for effectively moving Thai teachers towards implementing formative assessment practices. This research suggested that there is a need for clarification of a definition formative assessment and clarity for the direction in the curriculum.

Some key cultural aspects found in these findings could inform the significant barriers in the implementation of formative assessment. Thai policymakers must be aware of and understand the cultural influences that have an impact on and can even be an obstacle to the

implementation of formative assessment in the Thai context and seek ways to negotiate or overcome them. Reforms must be grounded in educational traditions and philosophies as well as in the situated experiences of teachers. Formative assessment approaches should be considered through a lens of Thai culture to design the most effective way to formatively assess students' understanding that aligns with the Thai cultural context. It is not appropriate or productive to change Thai teachers' practice to adopt formative assessment practices from Western classrooms. Moreover, this study also suggested that teachers should be involved in the design, implementation, and continuation of any formative assessment program. Giving teachers voice and ownership will encourage the development and acceptance of a meaningful evaluation tool and process (Fullan, 1982; Johnson, 1997; Mielke & Frontier, 2012).

The results of this study reveal that in Thai classrooms, teachers must cope with several constraints. Four major factors influenced teachers' classroom practices including a broad range of science content that students need to know, limited instructional time, many school activities, and heavy teacher workloads as exemplified in the work of three participating teachers: Morrakot, Pailin, and Ploy. These teachers tended to use the lecture-based, teacher-centred instructional approaches, which provided a sense of control. According to findings from teachers in this study, formative assessment principles should take these constraints into account. This research, therefore, proposes amending the science content standards to take account of these factors. Policymakers may need to consider reducing content coverage, school activities, and teacher workloads as well as mandating the expansion of instructional time. Reducing curriculum content will free up time within the classroom for the integration of more formative assessment practices.

8.5.2 Teacher educators. This research captured teachers' sense of inadequacy with the knowledge and practical experience they acquired from their ITE programs in relation to formative assessment practices in science. This study suggests that Thai teacher educators need

to reconsider current ITE programs to ensure that assessment courses assist teachers in developing in-depth knowledge and pedagogical skills related to formative assessment that is fit for purpose in science education. ITE programs play an essential role to support and develop knowledge and effective practices of formative assessment for teachers (Caire, Ameida, & Viera, 2012). The program should provide teachers with sufficient knowledge, up-to-date current assessment techniques and teaching experiences for competently adopting formative assessment approaches. Teachers are more likely to implement formative assessment when they experience formative assessment consistently and effectively during teacher education programs. In other words, those teachers who have a deeper understanding of formative assessment feel more confident practising this approach through their teaching methods. When learning about formative assessment is scattered or not valued, it may appear to be unhelpful for promoting student learning.

8.5.3 Professional developers. Holding such different understandings of formative assessment and having different ways of approaching independent learning suggested that Thai primary teachers need access to substantial knowledge and training about formative assessment and support to develop such knowledge throughout their teaching career. These findings are similar to results from research in science classrooms in Thailand, where Pravalpruk (1999) suggested that teachers need training in order to develop their role as facilitators and assessors of student learning. Further, Pravalpruk's research also suggested that professional development designed to support teachers with their new role to incorporate assessment as part of teaching is urgently needed. Importantly teachers should have opportunities to learn about formative assessment and develop the skills required to enact formative assessment practices in classrooms. Thus, it is crucial for Thai primary teachers to engage in ongoing, collaborative and meaningful professional learning around formative assessment throughout their careers. Armour and Makopoulou (2012) suggested that the effectiveness of PD and sustained teacher learning

programs must meet the existing knowledge and current needs of the teachers. PD programs should facilitate discussion and debate necessary to establish and discover valid knowledge of teachers and support teachers to see the potential to transfer the theoretical knowledge of formative assessment from PD into a classroom context and contribute to student learning. Additionally, PD programs should be built on teachers' ideas and experiences and designed to provide teachers with knowledge and experiences that enable them to implement formative assessment strategy in their activities efficiently. These will assist teachers in developing and implementing more effective formative assessment practices in their classroom. A teacher who has a deeper understanding and value of formative assessment will feel more confident to implement this approach.

8.5.4 School leadership teams. The results of this study also have implications for school leadership teams. Evidence from the research found that formally structured formative assessment was needed to support its sustainability in Thai schools a finding that concurs with Firth, Elford, Leeming, and Crabbe (2008) who explained that a teaching approach, which focuses only on individual skills would gradually disappear without workplace policy in place. Thus, the maintenance of formative assessment is the responsibility of both the school culture broadly and teachers in their individual classrooms.

Integrating formative assessment into daily classroom practice would require a substantial shift in teachers' knowledge and skills, a process that would be enhanced by a supportive school environment and infrastructures (Schneider & Randel, 2010). As discussed above, the school culture and hierarchal workplaces in Thai education have an impact on the uptake of formative assessment practices by teachers. Those with power or in a superior position in the hierarchy in schools make decisions that acutely affects those in an inferior position as they must execute the directions. School readiness to support teachers in implementing formative assessment would depend very much on school principals. Thus, to prepare teachers to

implement formative assessment in science education effectively, school principals and administrators hold critical roles. School principals and administrators should work to ensure that teachers are supported and provided opportunities to acquire the knowledge and skills necessary to overcome the boundaries of the system and implement formative assessment as part of teaching and learning science. The knowledge and attitude of school principals and administrators are significant as it can support or limit teachers' implementation of formative assessment. This study brings attention to the notion that teacher leaders need to actively engage with the foundational knowledge of formative assessment, e.g., articulating learning goals, eliciting evidence, feedback, and student involvement in order to help teachers with effectively embedding ideas of formative assessment in science education

Some teachers identified learning from other teachers in the same school, professional reading, and extensive teaching experience as the most influential sources of information about formative assessment. This study suggested that schools should provide a place in a supportive atmosphere for teachers to create a network for professional conversations and sharing ideas about teaching. It would help Thai teachers to reflect on their practice and professionalism and become constructive participants in an environment of teaching and learning (Doecke, Parr, & North, 2008; Parr, 2010). Additionally, these practices would allow teachers to work closely and collaboratively when they feel supported and encouraged. This task might start with forming a community of practice (Wenger, 1998) of teachers who feel qualified as an expert in formative assessment and other teachers in the same school to exchange knowledge, thoughts, experiences, and feedback and then expand this to other groups of teachers.

Moreover, communities of practice are a valuable space to improve teachers' science content knowledge. As this research indicated, primary teachers in Thailand faced difficulties with explaining science content and providing real-life examples. Any difficulty in understanding science content may make it challenging to organise and structure the content

appropriately, which would impact on a teacher's ability to design an effective lesson including appropriate assessment practices leading teachers to regress to transmitting knowledge for memorisation. A community of teachers who teach science in the same school should adopt an approach that enables teachers to overcome their fear and share their knowledge, skills, and resources.

This study also proposes teamwork between teachers and parents as a robust school-community partnership is significantly important as parental support is one of the factors that contributed to some teachers either lack of motivation or encouragement to employ formative assessment in the classroom. The school and its community can team up and share understandings, thoughts and ideas in several ways. One way is to create an effective school community association that serves as a suitable forum for parents and teachers to discuss and resolve problems of common concern.

8.6 Summary

All participants expressed their thinking about the nature of formative assessment, but these were not consistent among the teachers. There was no common conceptualisation or explanation of formative assessment shared by all Thai primary teachers.

How teachers in this study shape their thinking and understanding of formative assessment is a complex process interconnected to the Thai cultural context, their personal values about the teaching profession, their understandings of teaching and learning, and their knowledge of formative assessment from ITE programs and individual learning. The stories the participating teachers have told revealed a variety of tensions and dilemmas arising from varied teaching experiences and settings.

Thai cultural norms and values, particularly the notion of the traditional role of teachers and teaching and the role of students, are potent factors that affect the implementation of formative assessment. The principle and methods underpinning traditional teaching exemplify a

logical extension of the social hierarchy. Classroom dynamics in Thailand typically do not promote active participation with students discouraged from asking questions during class due to the accepted roles of students as passive learners and teachers as authoritative knowledge transferers. Allowing students' to actively participate in their learning is not common in Thai classrooms with interactions usually reduced to one-way communication between teacher and students. Moreover, Thai educational objectives are to transmit knowledge explicitly from teacher to student, focusing heavily on memorising, not constructing understandings.

However, it does not mean that the implementation of formative assessment is impossible or incompatible with the Thai classroom context. Evidence from this research found that some Thai teachers seemed to understand the nature of formative assessment alongside Thai culture values. They were trying to deal with mismatches and conflicts and developed solutions to solve the disparities between the two systems. They showed the ability to adapt culture values in order to take on formative assessment which indicated a shift in their teaching practices. Teachers, who are keen to change from teacher-centred practices, usually create a positive classroom environment, building trust with students, and implementing formative assessment. The important factors that encourage the implementation of formative assessment in the Thai school context included students' positive responses and their sense of freedom and enthusiasm.

In order to support the sustainability of formative assessment in the Thai context, the relevant stakeholders should be involved. Teachers need official support and external motivations from policymakers, teacher educators, professional developers, school principals and students' parent to adopt formative assessment. Policymakers, teacher educators, professional development providers, school principals, and students' parents play essential roles in creating the culture and resources to enable implementation of effective formative assessment allowing teachers to continually use formative assessment with their students without it depending on teachers' personalities and navigation of cultural barriers.

The following chapter presents the final conclusions of the study. It provides a summary of the study as a whole with the main points of the findings drawn out and the limitations of the study discussed. To conclude, I offer suggestions for future research in the field, and finally, I present my personal learnings.

Chapter 9: Conclusion

9.1 Introduction

The previous chapter discussed the research findings in relation to the research questions and literature around teacher thinking and formative assessment bringing together the results and discussion to draw conclusions on Thai primary teachers' thinking about formative assessment.

This chapter is organised into six sections. The first section presents an overview of research. The following section revisits the research questions, then restates the major findings which provide insights into Thai primary teachers' thinking about formative assessment. The third section addresses the possible limitations of the study, while the fourth section indicates some recommendations and directions for possible areas for future research. The fifth section considers what I have learnt and gained during the journey of completing this doctoral thesis and finally chapter ends with concluding remarks.

9.2 Overview of the Research

Since Black and Wiliam's (1998) analysis and synthesis of the educational benefits of assessment practices after pulling together the work of 250 studies that link assessment and learning, the education sector widely understands the concept of formative assessment as an effective technique for improving teaching and learning. Formative assessment happens during instruction, when a teacher gathers on-the-spot evidence of student learning, interprets student learning, and makes real-time instructional adjustments. Over time, and many research studies, it has become evident that formative assessment design promotes and supports student learning; thus, formative assessment has begun to receive attention from academics and educators across the world. In recent decades, many countries challenged the value of formative assessment including Thailand, the context of this research, where after the passing of National Education Act of 1999 the Basic Education Core curriculum 2008 mentioned elements of formative

assessment. However, implementing formative assessment practices still presents a challenge for many Thai primary teachers. Previous research has reported that many teachers, particularly primary teachers, are not confident in implementing formative assessment (Hondrich et al., 2016). Many factors influence teachers' thinking and decision making to implement formative assessment (e.g., Berry, 2010; Leong 2014; Otero & Nathan, 2008). Studies conducted in Asian classrooms suggested that one of the most influential factors preventing teachers from employing formative assessment is cultural expectations and requirements (Divaharan & Atputhasamy, 2002; Thanh, 2013; Yin & Buck, 2015).

There is deepening interest in how formative assessment can be developed in practice and a lot of research available on the role of formative assessment in education. However, little literature is available about teachers' thinking regarding their own understanding of formative assessment and subsequently, their implementation of this approach. Understanding teacher thinking about the role and value of formative assessment in their instructional practice will provide insights into the impact of formative assessment on daily instructional practice, improving teacher's professional knowledge and teaching practices. In this research, I considered teacher thinking as a critical component to experiencing the successful implementation of formative assessment because thinking guides attitudes and practices. Scholarly work in the field of teacher thinking has confirmed that teacher thinking has an impact on student learning and further, indicates that the quality of what teachers know and can do has the most significant influence on student learning (Darling-Hammond, 2000; Muijs, 2000; Wenglinsky, 2000).

This qualitative research, conducted in two phases, provided a rich understanding of Thai primary teachers thinking about formative assessment in science classrooms. An online-based questionnaire formed the basis for data collection in pilot study, using the collected data to identify interview participants and to guide the framing of the questions for semi-structured interviews in main study. Thirteen teachers from five different geographic regions of Thailand

volunteered to be participants. (There were no teachers from Eastern region willing to take part in this phase.) Interviews focused on teachers' individual knowledge, understanding, and the value teachers placed on the role of formative assessment in their science classrooms. The interviews also explored potential factors that influenced teachers' thinking and decision making to employ formative assessment (or not) in their science classroom practices. Moreover, teachers' practices of formative assessment were explored, in particular, what their practices revealed about their intentions for science teaching and learning. The key findings and data analysis are summarised in the next section.

9.3 A Summary of the Key Findings

This section brings together the findings with respect to the research aims to draw possible conclusions and provide answers to the three research questions, which are:

1. What do Thai primary teachers' think about the place and value of formative assessment to support science teaching and learning?
2. Why do Thai primary teachers hold these ideas about formative assessment?
3. What practices do Thai primary teachers describe when asked about formative assessment and what do these reveal about science teaching and learning in Thai primary classrooms?

In response to the first research question, the findings showed that the teachers' understanding of formative assessment existed along a continuum moving from fundamental insights to insights of greater complexity. The analysis of the interview data showed that four teachers, Morrakot, Opal, Thong, and Paitoon, understood the nature of formative assessment as being more similar to definitions of summative assessment, which was not well aligned with commonly espoused definitions in seminal literature about formative assessment. These four teachers described a limited application of formative assessment.

On the other hand, nine teachers indicated quite sophisticated understandings of formative assessment stating that formative assessment might take place at any time in their teaching as a more integrated, flexible, and everyday event. These teachers reported that formative assessment was used in their classrooms as a technique to monitor students' progress in order to help them identify their weaknesses and strengths and enable them to develop knowledge and learning skills. These teachers used information collected through formative assessment to make adjustments to their subsequent teaching. They provided learning activities to improve student learning based on their analysis of the data collected after formative assessment and helped students reconstruct and internalise their knowledge. These teachers viewed formative assessment as more aligned to definitions commonly referred to by the scholars.

In response to the second research question, the findings showed that key factors influenced the teacher's thinking about and the decision to implement formative assessment such as knowledge of formative assessment practices and experiences of formative assessment from teacher training programs. The teachers' stories of their experiences indicated that assessment courses offered by initial teacher education programs in Thailand differed in their coverage of different assessment curricula and their emphasis on different assessment approaches. Consequently, many teachers entered the profession with a limited understanding of formative assessment. Inadequate knowledge of formative assessment influenced teachers' confidence and their ability to design classroom activities that effectively use formative assessment practices.

One of the issues that emerged from teachers' interviews related to their ability to assess and identify students' science understanding. Findings of this study show that these difficulties mainly connected with teachers' science content knowledge. Teachers who lack science content knowledge seemed reluctant to teach science (Abell & Roth, 1992; Akerson, 2004; Mulholland

& Wallace, 2005) and as a result turned to more traditional teaching and assessment strategies, often avoiding formative assessment.

Another factor serving as a disincentive to implement formative assessment practices were Thai cultural expectations and requirements. These cultural components influence Thai primary teachers' perception of what it means to be a teacher, what values subsequently inform teaching and learning, and the role and behaviour of students in society. Key cultural factors challenged the identity of Thai primary teachers and have highlighted a need for a shift from the traditional Thai teacher transferring knowledge with hierarchical inequality to a more responsive teacher facilitating learning and allowing students to present and share their ideas, a vital part of formative assessment practices. This perception has affected the degree of change in the teaching practice of teachers resulting in obstacles to the implementation of formative assessment, which is a student-centred educational process by nature. Furthermore, the traditional culture of grade and score-focused assessment also presented a challenge for the implementation of formative assessment practices. The exam-oriented education system uses high scores and qualifications as a means of determining the competence of students. School administrators and parental expectations are driven by this exam-oriented culture, which focuses on high scores in mandatory tests. Parents believe that success is based largely on academic performance, and they expect teachers to contribute directly to maximising the opportunities for their children to achieve this success. Such expectations cause tension in the application of formative assessment. While some aspects of Thai culture were barriers to implementing formative assessment, at the same time, aspects such as the inspiration for being role models and playing the role of a 'second parent' could be supportive aspects for engaging teachers to consider implementing formative assessment as part of their practice.

In addressing the third research question, the findings showed that teachers described varied practices when asked about formative assessment as teachers faced many tensions. It was

evident from the findings that the teachers' practices were often mediated by cultural factors that strongly influenced the degree of implementation of formative assessment and change in teachers' teaching practice. Teachers adhered to an authoritarian view of teaching which, combined with a lack of knowledge, training and experience in formative assessment practices and the dominant norms of school culture, were an obstacle to the implementation of such an approach. Consequently, when some teachers described their formative assessment practices, their descriptions were similar to traditional summative assessment with students assessed for their recollection of knowledge found in the textbook.

Although, the interviews suggested that some teachers presented a desire to create a sense of trust between themselves and their students. They wanted to invite students to be involved in learning and assessment processes as well as encourage students to have a voice and to offer answers, ideas and thinking. Creating this sense of trust would create space for formative assessment practices in the classroom. These teachers showed some signs of beginning to negotiate between the Western concept of formative assessment and the traditional ways of Thai teaching.

Although the study enabled me to answer my research questions, there were some limitations I should mention.

9.4 Limitations of this Study

Although this study makes a potentially significant contribution to formative assessment research in the Thai context, there are some limitations.

The first limitation of this research concerns generalisation. While some of the research findings support the generalisability of findings from other studies, it is hard to claim that the findings of this study are generalisable to other contexts. As mentioned in Chapter 4, the participants in this study included only thirteen Thai primary teachers who were teaching in public schools from five regions of Thailand. There were no participants from the eastern region.

Due to the relatively small number of research participants, the findings of this study cannot reliably claim generalisations about all Thai teachers conclusively or claim that the findings are representative of the voices of all Thai teachers in all schools and educational settings in Thailand.

Second, this research conducted with teachers from public primary schools, suggests the need for caution when relating the findings to other settings. As pointed out in Chapter 1, Thailand's education system includes public, private, municipal and demonstration schools. Different agencies under the MOE promote teaching and learning in each type of school. While the MOE takes the lead on education, other ministries and agencies are also responsible for supervising all administrative matters under the jurisdiction of the ministry connected to local educational institutions. Thus, different school types may have different teachers, facilities, and school policies.

The third limitation is that this research relied on teachers' self-report of their formative assessment practices. For example, during an interview, teachers were asked to explain how they implemented formative assessment when teaching science. Teachers might have difficulty remembering the details of their classrooms or their practices of formative assessment or may have told the researcher what they thought she wanted to hear. However, I relied on teachers' self-report about what they think they do and why.

In the following sections, I would like to address and emphasise how further studies can build on my work as represented in this thesis.

9.5 Recommendations for Future Research

While this current study contributes significant knowledge about Thai primary teachers thinking and experiences of formative assessment, there are some avenues of future research that could build on the scope of this study.

First, this research investigated only Thai primary teachers in public school, so there is a need for further study with different groups of teachers to verify and expand on the results of the current study. The possible groups of teachers included pre-service teachers, primary teachers in private school, and teachers in different subject specialisations (e.g., mathematics). A further study might expand to investigate other groups of people, including teacher educators, school administrators, students, and parents. The thinking of these groups could bring to light factors that mediate teachers' understanding and practices about formative assessment. Further, this study raised the need to explore students' views and conceptualisations of formative assessment. Understanding students' conceptions of assessment is vital since these conceptions may influence their views on learning (Vermetten, Vermunt & Lodewijks, 2002; Peterson & Irving, 2008), adoption of learning strategies (Gijbels & Dochy, 2006), motivation (Brown, 2011), and academic achievements (Brown & Hirschfeld, 2008).

Second, the research used mainly a qualitative approach relying on semi-structured interviews. A different data collection method could be used in future studies, for example, employing classroom observation to investigate teachers' formative assessment practices further. Observation would allow a researcher to investigate what formative assessment strategies teachers genuinely implement and how students respond to support teachers in implementing formative assessment more effectively and confidently. Moreover, future studies could follow up on teachers' reflections about their ways of implementing and learning from formative assessment.

Third, this research did not focus on how education in Thailand works and does not cover issues related to the professional development of teachers, which may have an impact on teachers' formative assessment practices. Based on this research study, future research could build on its finding by looking into this issue.

Finally, although many Asian countries share similar cultural values, these cultures have now changed in varying degrees, subject to the social, economic and political situations of different countries. Therefore, the findings obtained in this study may not generalise to other Asian contexts, a gap that future research could fill.

The next section presents the personal implications drawn from my own reflections regarding what I have learnt from this PhD.

9.6 Personal Implications

Doing this PhD is one of the most rewarding learning experiences of my life. Through my involvement with this study, I have learned and gained many things. As mentioned in Chapter 1, this research arises partly from my work experience where I have found that many Thai primary teachers who attended PD about formative assessment still could not implement this approach in their science classroom. I wondered if there was specific information about formative assessment that Thai primary teachers needed that existing PD opportunities were not providing. I saw this problem and tried to solve it using my own perspective. So, at first, my PhD research was driven by my desire to explore and develop a PD program that could support Thai primary teachers to implement formative assessment in science classrooms. I thought that it would be beneficial if I could design a high quality PD program for Thai primary teachers. However, after working with my supervisors, they guided me to think and see the problem from different perspectives that led me to recognise that perhaps it was more important to understand more about how Thai primary teachers' think and begin to appreciate their existing knowledge and practices about formative assessment. In hindsight, I am truly glad that my supervisors guided me towards this direction. If I had pursued my original topic, I might have tried to force teachers to match with every element of formative assessment and would not have learned the impact of culture on teacher thinking about this approach. The current topic of this thesis opened

my eyes to see the entire picture of the Thai education system and the impacts of cultural barriers and enablers on thinking and implementation of formative assessment practices.

The most beneficial thing about doing this PhD is that this study changed my way of thinking. Previously, I always saw things as either black or white; I lacked the ability to engage in critical thinking. I now realise that this is an example of Thai culture's influence on my thinking. My education taught me to be obedient, avoid conflict and not to criticise, so as a result, it was very challenging for me to overcome these behaviours. However, completing qualitative research required me to think critically. Critical thinking provided many benefits to my personal life as well. I now observe and consider things from many sides and perspectives, seeing things in shades of grey. I have learnt to suspend my judgement, become a more open-minded person, and to appreciate and understand diversity.

Learning by doing in the PhD journey is the most rewarding aspect of my job and my personal life. I have a much greater understanding and appreciation of people compared to the old me. I understand that people think and understand the world in different ways which derive from their own contextual perspectives, beliefs and values accumulated from their experiences, interaction with, and interpretation of the world. Through listening to teachers, I was able to gain insights into their thinking, their classroom culture, and their goals for teaching and learning science. I am sure that I can bring knowledge to generate ideas about ways in which teacher implementation of formative assessment might continue, as well as supporting teachers with appropriate teaching practices for improving the quality of teaching and learning in Thailand.

9.7 Concluding Remarks

The literature indicates that formative assessment is a powerful tool in education. However, this study revealed that achieving effective implementation requires significant effort. In Thailand, although the government announced educational reform and presented a formative assessment framework, Thai teachers still could not effectively use formative assessment in their

classrooms. My findings suggest that the increased policy attention given to formative assessment has promoted the idea but not ensured its effective implementation. The findings in this study reflected that the adoption of formative assessment is affected by cultural expectations and societal preferences of all people involved in Thai society, particularly in educational contexts, for example, teachers, students, parents and administrators. One might assert that if formative assessment were relevant to Thai society and culture, it would be adopted quickly. On the other hand, if society and culture continue to resist formative assessment, it could be easily abandoned. Therefore, successful implementation of formative assessment seems inextricably tied to a deep understanding of contextual factors.

Adoption of a concept or pedagogy from one context into another context without adaptation creates tensions for teachers. For example, teachers are frustrated with being told to implement formative assessment, while at the same time not having the clarity, education or experience in how to develop effective assessment practices in their classroom. Teachers feel they are forced to do what policymakers, external to their school setting, want them to do, i.e., change their teaching style. Teachers feel they are rarely asked their opinion about the value of such changes or what they believe they need to learn.

From my perspective, Thai education systems should address formative assessment as a dynamic and adaptable pedagogy that teachers can use in a range of ways rather than as a one-size-fits-all approach, depending upon their distinct situation. Western curriculum and pedagogy require appropriate adaptations for success in non-Western classrooms. Moreover, policymakers and educators should encourage and assist teachers in adapting approaches, such as formative assessment, for use in their own ways rather than judging whether teachers accurately employ formative assessment and whether their practice meets the policymaker's expectations. Comprehensive formative assessment will not come about solely through changes in policies nor solely by adopting specific programs. Successful and lasting change takes time and in-depth

examination. I hope that this study can be an inspiration for current and future teacher educators and researchers by raising awareness of what matters to Thai public primary teachers and how best to integrate formative assessment practices into routine use in primary science classrooms in Thailand as well as in other non-Western contexts.

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Appendices

Appendix 1: Permission letter from the Secretary-General of the Office of the Basic Education Commission (OBEC), Ministry of Education (MOE), Thailand

Approval letter

20 February 2017

Mr. Karoon Sakulpradit, Secretary-General
Office of the Basic Education Commission, Ministry Of Education
319 Wang Chankasem, Thanon Ratchadamnoen Nok
Dusit, Bangkok 10300, Thailand

Dear Monash University Human Research Ethics (MUHREC) committee:

It is my understanding that Ms. Sanikan Saneewong will be conducting a research study with Thai primary science specialist teachers on "Thai primary science specialist teachers' perception of formative assessment". Ms. Sanikan Saneewong has informed me of the design of the study as well as the targeted population.

I support this effort and will provide any assistance necessary for the successful implementation of this study. If you have any questions, please do not hesitate to call. I can be reached at +66 2288 5511

Sincerely,



Mr. Karoon Sakulpradit
Secretary-General
Office of the Basic Education Commission, Ministry Of Education

Appendix 2: Ethics Approval from the Monash University Human Research Ethics Committee



Monash University Human Research Ethics Committee

Approval Certificate

This is to certify that the project below was considered by the Monash University Human Research Ethics Committee. The Committee was satisfied that the proposal meets the requirements of the *National Statement on Ethical Conduct in Human Research* and has granted approval.

Project Number: 0645
Project Title: Thai primary science specialist teachers' thinking about formative assessment.
Chief Investigator: Dr Rebecca Cooper
Expiry Date: 06/06/2022

Terms of approval - failure to comply with the terms below is in breach of your approval and the *Australian Code for the Responsible Conduct of Research*.

1. The Chief Investigator is responsible for ensuring that permission letters are obtained, if relevant, before any data collection can occur at the specified organisation.
2. Approval is only valid whilst you hold a position at Monash University.
3. It is responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash letterhead and the Monash University complaints clause must include your project number.
6. Amendments to approved projects including changes to personnel must not commence without written approval from MUHREC.
7. Annual Report - continued approval of this project is dependent on the submission of an Annual Report.
8. Final Report - should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected completion date.
9. Monitoring - project may be subject to an audit or any other form of monitoring by MUHREC at any time.
10. Retention and storage of data - The Chief Investigator is responsible for the storage and retention of the original data pertaining to the project for a minimum period of five years.

Thank you for your assistance.

Professor Nip Thomson

Chair, MUHREC

CC: Miss Sanikan Saneewong, Dr Angela Fitzgerald, Dr Kathy Smith

List of approved documents:

Document Type	File Name	Date	Version
Consent Form	Consent Form 281116	22/11/2016	word
Questionnaires / Surveys	Questionnaire 281116	22/11/2016	word
Supporting Documentation	Permission Letter 281116	22/11/2016	word
Explanatory Statement	Explanatory statement 281116	22/11/2016	word
Consent Form	Consent Form	10/05/2017	word document
Supporting Documentation	Approval Letter_OBEC	10/05/2017	PDF
Supporting Documentation	letter of agreement	10/05/2017	PDF
Questionnaires / Surveys	Questionnaire	13/05/2017	word document
Explanatory Statement	Explanatory statement	17/05/2017	word document
Explanatory Statement	Amended Explanatory statement	06/06/2017	2

Appendix 3: Explanatory Statement

Project: Thai primary teachers' thinking about formative assessment.

Chief Investigator: Dr.Rebecca Cooper

Faculty: Education

Email address

Student's name: Sanikan Saneewong

Faculty: Education

Email address:

You are invited to take part in this study. Please read this Explanatory Statement in full before deciding whether or not to participate in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact the researcher via email addresses listed above.

What does the research involve?

Aim: The purpose of this study is to gain a better understanding of the nature of Thai teachers' thinking about formative assessment in a primary science classroom.

Participant involvement:

Primary teachers who agree to participate will become participants in this study and will have their questionnaires used as data for this study. It should take 10-15 minutes to complete this questionnaire. The researcher will contact the teacher participants who volunteer to take part in a semi-structured interview. The semi-structured interview will be conducted at a mutually agreeable time for the teacher and the researcher and will take place in a meeting room at the school. The interview will take approximately 30-40 minutes. Participants can decline to be interviewed if they wish.

Why were you chosen for this research?

You have been chosen for this research because you are a primary teacher.

Consenting to participate in the project and withdrawing from the research.

Teachers who volunteer to be participants in the research need to sign a consent form and return it together with a questionnaire to the researcher (Sanikan) via the email address listed above. All teachers can choose not to participate in this research.

The interview is optional for all questionnaire participants and will be conducted with those teachers who volunteer and formally consent to participate. The researcher will contact only participants who volunteer to take part in an interview.

All participants may withdraw from the research at any stage prior to data analysis. If a participant decides to withdraw at any stage, all data that has been collected from them will be excluded from the research. Teacher participants may stop the interview at any time if they do not wish to continue. The audio recording will be erased, and the information provided will be excluded from the study.

Possible benefits and risks to participants

The possible benefits for participants are increasing professional knowledge and improving their classroom practices. The benefits to the education community are identifying teachers' learning needs, informing curriculum development and providing insight for assessment policymakers.

Participation in this research will not cause inconvenience or any discomfort.

Confidentiality

During the project, all data will remain confidential. Only the researcher and supervisors can access to primary data. Pseudonyms will be substituted in transcripts for teacher names and school names. The research data will be published as a PhD thesis and conference proceedings. A digital file of the thesis will be deposited in the research database of Monash University. Non-digital files will be stored at Monash University. Readers of the research will be unable to identify the teacher participants and the schools.

Storage of data

All collected data will be stored as digital files and non-digital files. Digital files will be stored securely, for example, password protected computer, hard drives, transportable devices, and Monash's Google apps. Non-digital files will be stored in secure facilities located at Monash University, for example, lockable filing cabinets. Only the researcher and supervisors will have access to primary data. All research data will be retained for 5 years after the publication of results.

Results

The research results will be reported to Monash University. Members of the university and all participants in this research will be able to read the thesis. Digital files of a thesis will be submitted to Monash University, and members of the university can access the digital file by using their username and password.

Complaints

Should you have any concerns or complaints about the conduct of the project, you are welcome to contact Dr Kusalin Musikul. Dr Musikul is fluent in Thai and English and will act in the role of sharing any concerns raised with the researchers as well as Monash University so that they can be acknowledged and addressed

Assistant to the IPST President (Compulsory Science)

The Institute of the Promotion of Teaching Science and Technology (IPST)

924 Sukhumvit Road, Phra Khanong Subdistrict, Klong Toei District, Bangkok, Thailand

10110

Tel: +66 2 3924021

Email: kmusi@ipst.ac.th

Fax: +66 2 813849

Thank you,

Dr Rebecca Cooper

Appendix 4: Questionnaire

Project: Thai primary teachers' thinking about formative assessment.

A. Demographic details:

Please put a tick in the box next to the answer of your choice or write the answer in the space

1. What is your gender?

☐ Male ☐ Female

2. Including this school year, how many years have you been teaching in primary schools?

☐ 1- 5 years

☐ 6-10 years

☐ 11-15 years

☐ 16-20 years

☐ More than 20 years

3. Including this school year, how many years have you been teaching in science subject in primary schools?

☐ 1- 5 years

☐ 6-10 years

☐ 11-15 years

☐ 16-20 years

☐ More than 20 years

B. Teachers' thinking about formative assessment:

Please indicate the degree to which you agree or disagree with each statement below by putting a tick in the appropriate box to the right of each statement

SA = Strongly Agree

A = Agree

UN = Uncertain

D = Disagree

SD = Strongly Disagree

	Item	SA	A	UN	D	SD
1.	Students have a role to play in the formative assessment process.					
2.	Formative assessment provides teachers with evidence of what students have learned in science.					
3.	The purpose of formative assessment is to improve student learning.					
4.	Formative assessment helps teachers to identify student's abilities.					
5.	Testing is important when teaching science.					
6.	When teaching science, I rely on the result of the paper-and-pencil tests.					
7.	Student achievement in science is improved when they have an opportunity to assess their own work.					
8.	Student achievement in science changes when I provide student feedback.					

	Item	SA	A	UN	D	SD
9.	Providing student feedback in science motivates student learning.					
10.	Students should ask questions in science classrooms.					
11.	Frequent formative assessment allows teachers to see if their teaching has been effective.					
12.	Students benefit from being actively involved in their learning.					
13.	Formative assessment strategies give teachers the necessary information to design the activities that match the different learning styles of their students.					
14.	I need to learn more about formative assessment strategies.					
15.	I was successful in teaching as a result of teachers who used a lecturing method for science teaching.					
16.	I feel that the implementation of assessment during science class is time-consuming.					
17.	I am confident when answering students' questions.					
18.	I have adequate training in formative assessment.					
19.	I feel satisfied when my students ask questions in the classroom.					
20.	I am continually finding better assessment technique to assess student understanding in science.					

	Item	SA	A	UN	D	SD
21.	When teaching science, I encourage students to assess their own work.					
22.	When teaching science, I provide an opportunity for students to assess other students' work.					
23.	When teaching science, I give students oral feedback on their own work.					
24.	When teaching science, I give students written non-grade feedback.					
25.	When teaching science, I welcome student questions.					
26.	When teaching science, I motivate students to express their opinions.					
27.	I use different questioning techniques to assess student's understanding of science.					
28.	I take time to check student understanding of each science concept.					
29.	I share assessment criteria with students.					
30.	I allow students an opportunity to share their learning goals in science.					

If you are willing to take part in a semi-structured interview, please provide your contact details.

1. Name:

.....

2. School name and address

.....

3. Email address

.....

4. Phone number

.....

End

Thank you for responding to this questionnaire.

Appendix 5: Semi-Structured Interview Questions

Educational background

1. What educational degree do you have?

Professional experiences

2. How long have you been teaching in science?
3. How do you teach science subject in the classroom?
4. Why do you teach science that way?

Knowledge about assessment and formative assessment

5. Have you ever heard the word formative assessment? If yes, what does formative assessment mean to you?
6. What will you do when you want to know that your student understands the lesson?

Formative assessment practices

7. What formative assessment technique do you use when teaching science? Give an example of how do you implement this formative assessment technique in your class.
8. Why do you use this technique?
9. When do you use formative assessment in science class?
10. When teaching science, what type of written non-grade feedback do you provide to students?
11. When teaching science, how often do you give written non-grade feedback to students?
12. What is challenging when applying formative assessment in science class?

Teacher thinking about formative assessment

13. What value do you see in doing these?

14. Does it help in teaching Science? Why?
15. What do you learn about your students when you use these techniques?
16. What do you do with this information?
17. Do you think the implementation of formative assessment is time-consuming? Why?

Training about formative assessment

18. Have you ever attended Professional development training about formative assessment? If yes, what have you learnt from PD? Do you apply what you have learnt in your class?
19. Have you ever learnt about assessment when you were a student teacher? If yes, what have you learnt?
20. Do you apply what you have learnt in your class?