Science and Mathematics Education Centre

Revealing and Reconceptualising Teaching Identity through the Landscapes of Culture, Religion, Transformative Learning, and Sustainability Education: A Transformation Journey of a Science Educator

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DECLARATION

This thesis contain no material which has been accepted for the award of any other degree or diploma in any university

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

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Signature:

ABSTRACT

Motivated by Parker Palmer's call for teachers to understand the self who teaches, I recently completed a transformative research journey that revealed and reconceptualised deeply sedimented dimensions of my teaching identity. I am a university based science teacher educator from Indonesia, and recently participated in a 3-year longitudinal co-teaching project in lower secondary schools in Western Australia. Conducting co-teaching and narrative research stimulated me to think deeply about and reflect critically on my teaching identity. I came to understand the powerful role of culture, religion, and personal experiences in transformative learning and sustainability education in shaping my teaching identity.

As the research involved critical reflection on my professional praxis, I adopted a multi-paradigmatic research approach with three focus paradigms - interpretivism, criticalism, and postmodernism - and adopted critical auto/ethnography as my research methodology. I applied multiple genres within arts-based research, including poetic reflections (poems), stories, dialogues within narrative, and metaphors. My five research quality standards were critical reflexivity, praxis, representation, trustworthiness and authenticity, and crystallisation.

I discovered that my teaching identity is not fixed and that the journey in revealing my teaching identity is endless. I revealed and reconceptualised my teaching identity from four main perspectives. I came to understand that I am a product of cultural hybridity resulting from interactions of very different cultures, including Javanese, Bimanese, Indonesian and Australian. As I was growing up Islam became my way of life and shaped my values, beliefs and actions in all aspects of my life; I discovered religion as a hegemonic power in my teaching identity. My postgraduate journey embedded three aspects of transformative learning in my teaching identity: (1) constructivism, (2) empowering teacher-student relationships, and (3) dialectical thinking. I came to realise the power of sustainability education in shaping my teaching identity, through my core life values of religion and childhood education. These values have found expression in my teaching practice via 'Green Chemistry'.

This doctoral research was an empowering journey that enriched my personal and professional life by enabling me to examine and develop core values, beliefs, and practices that form my teaching identity. I hope that my newly transformed teaching identity enables me to further develop my professional practice as a science teacher educator who has a passion to empower the agency of her student teachers and to empower her readers to reflect on their own identities, both personally and professionally.

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...never give up hope of Allah's soothing mercy: truly, no one despairs of Allah's soothing mercy, except those who have no faith (Qur'an, 12:87)

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To my husband, Toto Witoyo, for the love, spirit, and patience and for being with me through this journey, I love you. For my lovely daughter, Faiqa Atiya Witoyo, thanks for the spirit with your smiling happy face every day which make me strong. You are really an inspiration.

To my parents, Rugiyat and Sumarni, thank you very much for the great love and patience. My gratefulness for both of you who educated me within lovely and religious environments, I love you. To my two sisters, Desy and Lia, for the love, spirit, and courage, I miss the ways and the moments we spent together.

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PART ONE: AN INTRODUCTION

CHAPTER 1

A BEGINNING JOURNEY: "THE FISH BECOMES AWARE OF THE WATER IN WHICH IT SWIMS"

INTRODUCTION

Welcome to the Journey…

I sit in front of the computer
Looking back and forward
Reflections and Visions
Open up the black box
I don't know where to start and when to end

Mixed-up feelings
Happiness and Sadness
Unclear and Unsure
Open up the endless tunnel
I don't know what is at the end

Learning and teaching
Teacher and Student
Disempowering and Empowering
Open up the closed mind and heart
I don't know who I am at the end

Exploring teaching identity
Silent Voice and Unspoken words
Exciting and Afraid
Open up the Blocked Journey
I don't know what identity will be at the end

Welcome to the journey
The journey of a beginning teacher
The journey of a beginning researcher
The journey of struggling and being empowered
The journey of silent voice and mixed-up feelings of an Asian and a Muslim woman
The journey of revealing and reconceptualising her teaching identity
In the landscape of culture, religion, transformative learning and sustainability

I wrote this poem to represent my journey in writing this thesis. At the beginning I struggled to reflect critically on my personal and professional life, not only because I had never gone deeply into thinking about and understanding my journey as a teacher, but also because I was not used to speaking up about my culture. As an Asian and Muslim woman, I struggled to understand how my own culture and religion had shaped my teaching practice. The chapter title, "The Fish Becomes Aware of the Water in Which it Swims**",** represents my journey which was full of revelations about myself and my professional practices. Thus, the journey of both conducting the research and writing up my thesis was both very challenging and very empowering.

The study focused on my personal journey as a teacher in revealing and reconceptualising my teaching identity. As a doctoral student who was, at the same time, working on a directly related 3-year ARC (Australian Research Council) research project, I had the opportunity to conduct co-teaching research. During the journey of co-teaching, working with Australian teachers provided an opportunity for me to learn from them and reflect on my own teaching practice. Co-teaching was a powerful experience that stimulated me to think that there is a teaching identity that shapes each teacher's teaching practice. Working with three different teachers from different cultural backgrounds and histories provided rich experiences that provoked me to think about my own teaching identity.

During the process of co-teaching and critical reflection while writing this doctoral thesis, I found different images of myself within my various professional practices. When I thought deeply about my teaching practice, I found that culture and religion have strongly shaped my teaching identity. However, the effect was almost unseen and unspoken, as I had never realised the strength of the impact of my culture and religion on my teaching identity; as represented by the title of this chapter.

When I looked back on my learning, teaching and co-teaching experiences, I realised how valuable *transformative learning* and *education as sustainability* have been in shaping my teaching identity. I had encountered transformative learning firsthand while undertaking postgraduate studies at the Science and Mathematics Education centre (SMEC). During this thesis research, I came to realise that transformative

learning had shaped the values associated with my teaching identity. However, I also realised that it was very challenging to remain empowered as a transformative educator within the strong power of objectivism. The experience of co-teaching and reflective writing in this doctoral thesis revealed, enriched and reconceptualised the transformative learning values that help to shape my teaching identity.

Similarly, I discovered that sustainability education had become a core value both in my childhood and my religion. During reflective writing, I discovered that my negative experience in a university chemistry laboratory had empowered me to engage in sustainability education which I applied both during my later teaching and co-teaching experiences. However, I came to realise that sustainability education should not simply be about delivering the content of environmental sustainability (i.e., education about sustainability), but should move forward into empowering students (i.e., education as sustainability).

Engaging in a process of prolonged critical reflection about these two dimensions constituted an insightful journey that both revealed and reconceptualised my teaching identity. However, I know that this journey has not ended because I have realised that my teaching identity is not permanent; it will keep changing throughout my ongoing teaching journey. Thus, this thesis research focused on my personal experience in revealing and reconceptualising my teaching identity in the landscape of culture, religion, transformative learning and sustainability education.

I have written this chapter with the aim of sketching the 'big picture' of my research and thesis writing, and have divided the chapter into two sections: *Understanding the Journey and Representing the Journey*. The first addresses my journey in relation to questions of: Who is the traveller in this journey? What was the journey about? Why was the journey important? and How was the journey conducted? The second section addresses my thesis writing through the question of How do I represent the journey?

UNDERSTANDING THE JOURNEY

Who is the Traveller in This Journey?

In this section, I portray the big picture of myself as a traveller in this journey; the journey of being a teacher, a teacher educator, and a master's and doctoral student. Following this, I portray a more detailed autobiography in Chapter 4 to explain my science teaching.

I am a teacher and teacher educator

I started my journey as a chemistry teacher in 2003 in a vocational school in Indonesia. I taught in the vocational school for almost 3 years before I was accepted to the position as a teacher educator in the chemistry department in a pedagogical university in late 2004. In 2005, I taught both vocational school and university. In 2006, I received an AusAID scholarship for a master's degree in science education at SMEC, Curtin University. Before I studied at SMEC, I joined Academic English Preparation (AEP) for 9 months, which required that I take teaching leave from my university. In 2007, I started my master's degree, and I finished the program in 2008. I was then offered the opportunity to start my PhD in the same institution in 2009. The timeline of my journey is represented in Figure 1.

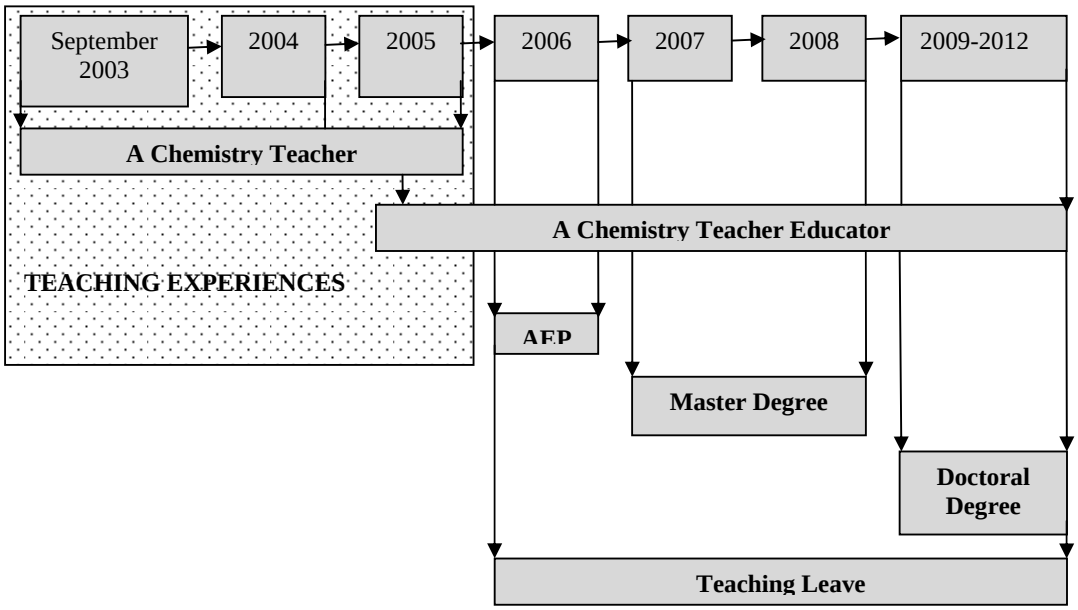


Figure 1. The Timeline of My Journey

In this thesis, I portray my teaching experiences from 2003 to 2005, and the experience of an empowering learning journey in both my master's and doctoral degrees from 2007 until 2012. My experiences as an educator and as a student are integrated as both have shaped my teaching identity, which I reveal and reconceptualise.

I started my journey as a teacher without any passion for teaching. In my country, to study in public universities you have to pass the national test. I had to study in a public university because the economic status of my family meant they could not afford the fees of a private university. I sat the tests for two public universities. My first choice was the best university in the country and the second was a public university which specialises in pedagogy; but this was not my passion. It was my dream to study in the first public university, however, my test results did not fulfil the requisite entry score. Eventually, I accepted a place in the second university as I had little choice. In the second university, I was trained to be a chemistry teacher. In 2003, I finished my study; I still didn't have passion for being a teacher, even though both my parents are teachers. After I graduated I applied for a job as a chemist in several companies. During this period one of my lecturers asked me to help teach in a vocational high school as a relief teacher. At that time my lecturer persuaded me by assuring me that it would only be for a short period of time. However, the main teacher decided not to return to the school and so the principal asked me to be a chemistry teacher. That was the start of my journey as a teacher.

I began to develop my passion as a teacher after I taught in that school (I portray this empowering journey in Chapter 4). However, dealing with my spirit and the environment I was in, I struggled to be an empowering teacher. Dilemmas about standardised assessments, overloaded curricula, large classes, and other influential factors shaped my character as a teacher. I controlled my classroom to fulfil the requirements of the standardised education system. In the overloaded curricula I focused on finishing the content within the allocated time. As a result I focused on transferring knowledge rather than meaningful understanding. I comprehend now that this teaching restricted my students' thinking development, stifled their creativity, and separated their experiences from the learning process. It seems to me that that was a meaningless process: memorising a list of content knowledge simply

to pass the examination. I have come to believe that the way teachers handle students has a great impact on them, as students are prone to repeating and replicating the way teachers behave. Bad or meaningless learning experiences could be repeated by students later, even if they do not become teachers. As a result, the great goal of the education process to generate great people is in danger of failing.

The beginning journey of empowerment: My master's degree

During teaching leave in 2007, I pursued my master's degree. The journey was empowering since it required that I examine my values, beliefs, and practice as a teacher. Thus, in this thesis research, I have included reflections on this journey in order to better understand my teaching identity.

December 2005,

The Dream Will Come True

I sit in my living room and watch the television. I enjoy my time with my parents today because we have school and university holidays. It is nice to be together, even though I am quite nervous and excited because AUSAID sent me an email announcing that the scholarship results will be sent by mail this week. I really want to get the scholarship; studying overseas is my dream. I have realised since I pursued my undergraduate studies that my parents don't have enough money to send me to a private university, so I have to work hard to compete with others to get accepted into a public university which is cheaper. During my undergraduate studies I also tried hard to get a scholarship as well as working as a tutor while I was studying. Again, for my postgraduate study I have tried hard to get a scholarship because my parents could not give financial support to me and my salary as a teacher educator is not enough for me to be able to pursue further study. Therefore, a scholarship is the only way for me to achieve my dream of further study.

We watch the television until we hear the sound of a running motorcycle in front of our house. All of us turn our heads and look at the front door, "Yes, it's the post officer, it might be the scholarship letter!" I say. My heart is beating, my hands are sweating; I realise that my expectation to get this scholarship is very high. I can see my parents are worried. It's clear to me they really want me to get the scholarship as well. I walk over to the post officer at the door where he holds many letters. I look at the letters one by one, until he hands me one of them.

Post Officer : "Yuli Rahmawati"
Me : "Iya saya"
Post Officer : "Ini surat untuk kamu"
Me : "Terima kasih"
Post Officer :" sama-sama"

As the post officer leaves, I notice that the sender is AUSAID. I open the letter with very mixed feelings. My parents stand beside me silently. I open the letter slowly both worried and afraid, and read carefully until I reach the second part where it says "you are accepted". I jump and hug my parents.

"Alhamdulillah, Uwie diterima", I exclaim.

I am happy and crying and both of my parents are also crying. I am so happy and can't say anything except thanks to Allah for this big present and to my parents for their continuous praying every day. I am imagining studying in Australia with high expectations of the best academic environment as well as developing great learning, knowledge and skills as a science teacher educator. The story of my excellent study experience in Australia is already playing out in my mind. I am so happy! The dream will be coming true!

This story is the beginning journey of my further study in Australia. I will never forget that day when I was so happy and excited because of the announcement of my scholarship. I started my journey with high expectations of further study. The story reminds me of my aspiration for being a professional science teacher educator so that I can contribute to better education in my country. In my writing here I reflect critically on my two-year journey (one year for a postgraduate diploma and one year for a master's degree) and I ask myself, what changes have come about? What are the new skills and knowledge that I have developed? Who am I now and who was I before?

During my master's degree study, I discovered my worldview related to teaching and learning. I realised that being an educator is not simply about transferring knowledge, but is also about empowering students for their active participation in society. Most of my journey as an educator was within the trappings of the technical interest. The learning journey for my students focused only on academic

achievement and passing their examinations. I overlooked my students' understanding, the process of meaning making and empowerment. My teaching was strongly influenced by standardised systems of curricula and assessment. During my master's studies I discovered different knowledge and skills for developing my professional practice as a science teacher educator. I learnt different perspectives for looking at students' learning, teaching practice, curriculum, and assessment. There are several key learning areas that shaped my teaching identity.

1. Students' understanding

When I was undertaking pre-service teacher education I often noticed Professor David Treagust's name in chemistry education publications. I was very excited when I discovered that he would be the lecturer of my science teaching and learning unit. During my learning experiences in David's class, I discovered different perspectives on science teaching and learning, especially in chemistry, including constructivism, misconceptions, meaningful learning, and pedagogical content knowledge. Regarding students' misconceptions, David provided examples of misconceptions in chemistry which sometimes surprised me, as I had often ignored the idea that my students could have these kinds of conceptions. When I had thought about my teaching, I had understood that they could perceive things differently to what I was teaching, however, I had never thought that my students could really stray too far from the original concept. Straight away I thought about my student teachers to whom I had previously taught basic chemistry and analytical chemistry. As I had ignored the concept of misconception in my teaching, I imagined what must have happened later when their students had misconceptions in chemistry. I felt miserable to remember this and considered that I had not prepared my student teachers adequately for this scenario, even though I eventually did realise that learning is not simply about students' conceptual understanding and that I needed to be aware of their thinking.

2. Transformative learning and agency

I learnt the term 'transformative learning' from Associate Professor Peter Taylor, my inspiring and empowering lecturer as well as my supervisor for both my master's research project and doctoral thesis research. Understanding transformative learning helped me to realise that teaching and learning are not simply about changing

students' understanding. It should be a process of transformation that allows students and teacher to understand and reflect on themselves. As stated by Taylor (2013), transformative learning is about cultural-self knowing, relational knowing, critical knowing, visionary and ethical knowing, and agency. Thus, I came to realise more and more that a teacher has a great moral responsibility to society and to human beings. Becoming a teacher means educating people to become holistic individuals in society. Good holistic individuals and great leaders are shaped through education. Therefore, education plays an important role in building community. I would like to move towards becoming a transformative teacher; a teacher who has passion to empower students to actively participate in society within their various roles and engage students as lifelong learners who develop their knowledge throughout their whole lives. I have come to realise that teachers' morals, values, and ethics influence students' perceptions of others and the world, thereby shaping how they behave.

3. Diversity

I appreciated Associate Professor Bill Atweh, my lecturer in Assessment, pointing out the issue of diversity. It is important for teachers to realise difference among students, from ways of learning to psychological, emotional, social, and cultural differences. Thinking about diversity raised the issues of: why we standardise assessments, why we approach students in different ways, and why we create generalisations about students' understanding. Bill also pointed out the role of socio-economic factors, which are important in my country because, even though people have access to education, not all students can afford good or appropriate facilities for their education, such as books and uniforms. The issues that Bill raised always stimulated my thinking and reminded me that teaching is very challenging.

I remember the feeling of empowerment in Peter's classes on research project, curricula, and constructivism. I remember the feeling of focusing on students' understanding in David's class. I remember experiencing issues related to learning environments in Rekha's class. I remember the powerful experience of understanding assessment in Bill's class. I can see how these key learning experiences have shaped me in different ways. However, the most important thing for me is not so much the content knowledge that I gained at SMEC but the changes in beliefs, values and practices that I can now see in myself.

In the landscape of two worlds: My doctoral study

Here, I represent my current journey in this doctoral study during which time I worked in two different landscapes that provided rich experiences for my personal life and my professional practice. These two different but intersecting landscapes were the ARC (Australian Research Council) project and my doctoral thesis writing. I received my scholarship from the ARC through the Australian Government which required me to work on the project, "*Using Co-Teaching and Co-Generative Dialogue to improve Teacher-Student Interactions and Students' Awareness of their Place in the Environment*". As 3-year longitudinal study, the overall aim of this project was to investigate the effectiveness of co-teaching and co-generative dialogue in the learning and teaching of environmental education in lower secondary science classes (years 8 to 10) to improve teacher-student interaction and students' awareness of their place in the environment. I worked with three different science teachers in three different schools (two public schools and one Islamic school). Each teacher had their own profile, and I have named them Tony (Public School A), Tina (Public School B), and Emilia (Islamic School). I provide detailed information of my participants in Chapter 2. The big picture of the project is represented in Figure 2.

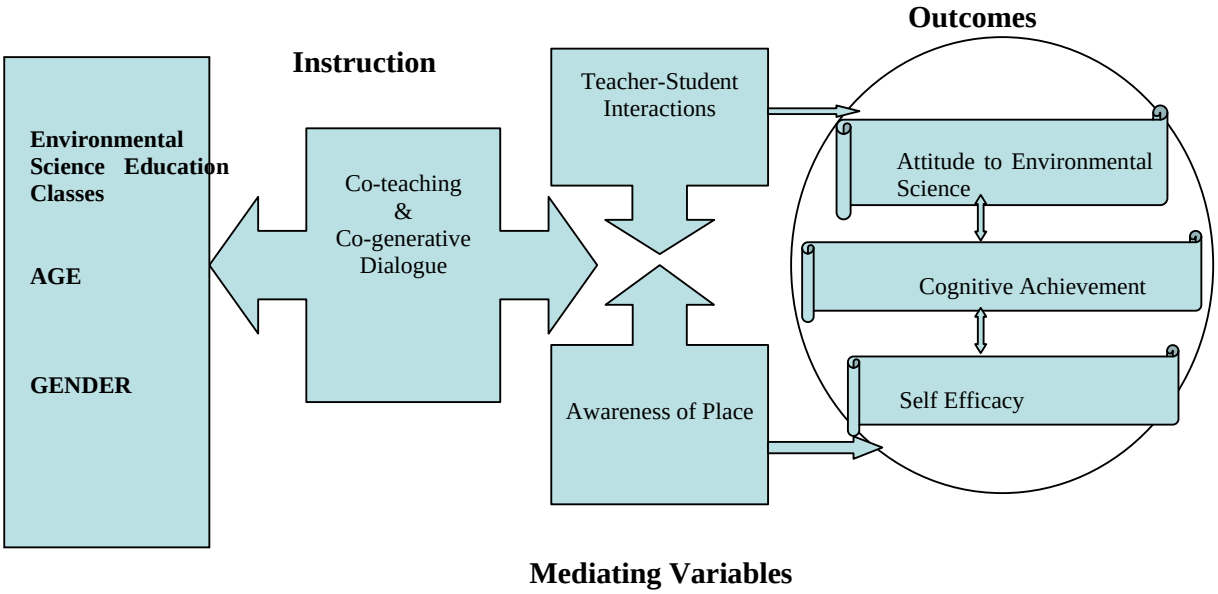


Figure 2. Big Picture of ARC Project

In the ARC project, I worked as a co-teacher in the implementation of co-teaching and co-generative dialogue in science classrooms for classroom transformation, with specific focus on students' attitude to the environment, cognitive achievement, and self-efficacy. In general, the project aimed to influence students' engagement and behaviour as well as teachers' pedagogical practices and behaviour. During co-teaching, I experienced different levels of collaboration with the teachers. With Tony, collaboration took the form of me giving feedback on his teaching and suggesting teaching approaches and resources. Collaboration with Tina and Emilia consisted of jointly creating lesson plans, finding teaching resources, and co-teaching in the classroom. With Emilia in the Islamic School I was able to engage in intensive co-teaching.

For my doctoral research, I conducted a critical auto/ethnography to provide a detailed picture of my personal and professional struggle to engage in co-teaching and in undertaking different approaches to research at the same time. This is outlined in Chapter 2. I sketch the different (but complementary) features of the ARC project and my doctoral thesis research in Table 1.

Table 1. The Landscape of Two Worlds: ARC project and My Doctoral Thesis Research

FEATURES	ARC PROJECT	DOCTORAL THESIS
Focus	Co-teaching and co-generative dialogue	Co-teaching
Outcomes	**Students:** • Attitude to environment • Cognitive achievement • Self-efficacy • Students' engagement • Students' behaviour **Teachers:** • Pedagogical practices • Teachers' behaviour	**Myself as a co-teacher:** Revealing and reconceptualising my teaching identity in the landscape of culture, religion, transformative learning, and education as sustainability

Participants	• Three schools (2 public schools and 1 Islamic school, • Three science teachers and their students	• Myself as main source of data • The teacher and students from the Islamic school
Research Paradigm	Post/positivism	Multi-paradigmatic research (Interpretivism, Criticalism, and Postmodernism
Research Methodology	Mixed methods	Critical auto/ethnography
Research Methods	Questionnaires, interviews, classroom observations, reflective journals	Narrative inquiry, interviews, reflective journals, classroom observations
Presentation	Statistical and interview results	Rich and thick descriptions of the data with multiple genres of arts-based research.

My journey was very challenging, like working in two different worlds. Even though the ARC project results illustrate the implications of the intervention for the teachers and students, the importance of the doctoral research for me was to illustrate the implications for myself as the researcher. I decided on a self-study focus for this doctoral thesis, primarily focusing on my role as a researcher and a co-teacher, since the co-teaching stimulated in me the revelation and reconceptualisation of my teaching identity, about which I next provide detailed explanation.

What Was the Journey About?

The doctoral thesis research journey was about revealing and reconceptualising my teaching identity. An early experience of collaborative teaching helped me realise that this can provide a dynamic structure in the classroom. I found that teaching collaboratively can assist teachers to improve their pedagogical practices as well as their students' learning. But in the context of this doctoral research, I found that co-teaching not only helped me to transform teachers' pedagogical practices and students' learning, but importantly stimulated me to reveal and reconceptualise my

teaching identity. I discuss in detail the concept of teaching identity in Chapter 5. The four dimensions that shape my teaching identity - culture, religion, transformative learning, and sustainability education - are discussed in Chapters 5, 6, 7, and 8, respectively.

How Was the Journey Conducted?

I worked in two different worlds – the ARC project and my doctoral thesis research. The nature of the ARC project required me to work in the post/positivist world, whereas writing my thesis required me to work in a multi-paradigmatic research world. Thus, these two contrasting worldviews shaped my challenging journey. During co-teaching, I tried to engage teachers and students in improving their classroom practices, including empowering them to transform their practices both as teachers and learners. I spent two years working in schools. I conducted survey research by administering questionnaires to measure teachers' and students' improvement in their interactions as well as in their physical environment. Thus, I came to realise how the 'rainbow' of my research shaped my view of conducting research, which I discuss in detail in Chapter 2.

In my third year, when I started to focus on my thesis writing, I chose to focus mostly on myself rather than on my co-teachers and students. I employed critical auto/ethnography within a multi-paradigmatic research design, rather than being informed by a single paradigm, to empower myself. I incorporated my critical self-reflections as a student, an educator, a co-teacher and a researcher to understand both my personal and professional practices and to reveal and reconceptualise my teaching identity. Further, to incorporate meaning making and emancipation, multiple research methods and quality standards guided my research. I have structured my writing as an autobiographical story and have included reflections based on my enthusiasm for understanding my teaching identity. I am committed to being a self-reflective educator as I believe that it is an appropriate way to be equipped for empowering myself to be a transformative teacher educator and to create a better future for the world. Therefore, the process of inquiry is emphasised in this thesis.

Why Was the Journey Important?

These questions, which I conceptualised at the outset of my doctoral research, guided my inquiry:

1. How do my experiences in co-teaching stimulate me to reveal and reconceptualise my teaching identity?
2. How can I reflect on my past science teaching experience to understand my science teaching journey in order to reveal and reconceptualise my teaching identity?
3. What are the roles of cultural identity, religious belief, transformative learning, and sustainability education in shaping my teaching identity?
4. How can the journey of revealing and reconceptualising my teaching identity help me to transform my future as a science teacher educator at my university in Indonesia?

The journey was important because it was personally transformative: it empowered my personal and professional lives. In my personal life, I came to more deeply understand myself, especially the cultural and religious dimensions that have strongly shaped my values, beliefs, and actions. In my professional life, I came to appreciate that it is important to understand who I am as a teacher by reflecting on hegemonic power that may be shaping my teaching practice. Throughout the journey, I discovered four key dimensions of my teaching identity: culture, religion, transformative learning, and sustainability education. I came to realise that teaching identity is the heart of what shapes teachers' practices. But, revealing and reconceptualising teaching identity is not a simple process; as it required me to open 'the black box' of my silent voice and think reflectively about the (invisible) values and beliefs that have shaped my teaching practice.

As a beginning researcher who was trained within the hegemonic power of positivism, conducting this auto/ethnographic inquiry via a multi-paradigmatic research design was very challenging. The power of personal experience and critical reflexivity in this research caused me to 'jump' to another worldview. I had earlier in my career believed that research should be measurable and quantitative, and I had to encounter these sedimented beliefs throughout this research journey. I realise that I will face major challenges in conducting multi-paradigmatic research when I return

home, as educational research in my country and university hold strongly to the post/positivist worldview.

As a result of this journey, I have realised that, within my role as a teacher educator, understanding my own teaching will have major implications for my student teachers. I have been empowered as a transformative educator with the passion to educate my students as holistic individuals and to empower them as agents of change in their future roles. I have realised that I will face a major challenge in shifting their thinking from passive learners to active learners. I believe that teachers could benefit from learning about my personal experience of more deeply understanding my teaching identity, especially the importance of reflecting on my teaching values, beliefs, and practices. In reading this thesis they could perhaps be stimulated to engage in pedagogical thoughtfulness which could be powerful for transforming their professional practices. There are benefits also for policy makers, especially in my country, as they could be enabled to consider new ways of improving the quality of teachers and student learning.

REPRESENTING THE JOURNEY

How Do I Represent The Journey?

This section outlines my thesis structure.

Part One: An Introduction

Chapter 1 - A Beginning Journey: "The Fish Becomes Aware Of The Water In Which It Swims"

Chapter 1 portrays the 'big picture' of my doctoral research

Part Two: A Methodology

Chapter 2 - Puzzling Over My World View: The Rainbow of My Research Design

Chapter 2 explains my research design, which includes setting the scene and my reflections on research methodology. When setting the scene I provide profiles of the schools, teachers, and students and describe how I conducted co-teaching. Following this are my personal reflections on research design in which I include an account of why I chose this transformative educational research. I also discuss the research paradigms, methodology, methods, and ethical issues of my research.

Part Three: Understanding My Past Science Teaching

Chapter 3 - Walking on the Pathway of Different Perspectives: Powerful Theoretical Referents for Reflections on My Past Science Teaching

Chapter 3 discusses the multiple facets of various theoretical perspectives which helped me to reflect on my past science teaching in Chapter 4. I discuss: (1) the nature and history of science, (2) science education, (3) my journey of being a teacher, and (4) reflecting on my science teaching in relation to Habermas' three interests and their implications for theories of constructivism, curriculum, and assessment.

Chapter 4 - Opening the Black Box: Reflecting Critically on My Past Science Teaching

Chapter 4 is a portrayal of my past science teaching based on the theoretical perspectives in Chapter 3. Chapter 4 is important as a beginning process of revealing and reconceptualising my teaching identity through my reflections on the journey of becoming a science teacher and my previous science teaching experiences.

Part Four: Revealing and Reconceptualising My Teaching Identity

Chapter 5 - A Beginning Journey of Revealing and Reconceptualising My Teaching Identity: Co-Teaching, Identity, Cultural Identity, and Teaching Identity

Chapter 5 explores my co-teaching experience and how it stimulated me to uncover and reconceptualise my teaching identity. It portrays different theoretical perspectives on co-teaching, identity, and teaching identity. In this chapter, I start to reveal and reconceptualise my teaching identity in the landscape of my cultural identity. I reflect on the values, beliefs, and practices from my culture that have shaped my teaching identity.

Chapter 6 - I Believe in the Truth: Religious Belief in My Teaching Identity

Chapter 6 explores the role of Islam in my teaching identity. I provide an account of how Islam has guided my way of life. Then I explain how my religious journey since I was a child has helped me to understand how Islamic values and beliefs have shaped my teaching identity

Chapter 7 - In the Cloud of Empowerment and Disempowerment: Transformative Learning in My Teaching Identity

In Chapter 7, I present transformative learning theory which has challenged and shaped my teaching practice. Transformative learning theories that have been influential are constructivism, empowering teacher-student relationships, and dialectical thinking.

Chapter 8 - In a Dark Line of Sight: Sustainability Education in my Teaching Identity

In Chapter 8, I portray my negative experience in a university chemistry laboratory when I was a student teacher which empowered me to integrate the value of sustainability, including 'green chemistry', in my teaching practice. Reflections in this chapter enable me to understand more deeply the role of sustainability education in my teaching identity.

Part Five: Revisiting the Journey

Chapter 9 - Revisiting My Research Questions

In this chapter, as the end of the current journey, I provide a holistic picture of my research, my envisioning, and my transformative process through critical self-reflections. It comprises a summary of the answers to my research questions.

Chapter 10 - I See the Light: The Journey Has Not Ended, It Has Just Begun

Chapter 10 is about my envisioning of my professional practice as a science teacher educator who has the passion to empower my student teachers to participate in a better future for education in my country, Indonesia.

PART TWO: A METHODOLOGY

CHAPTER 2

PUZZLING OVER MY WORLD VIEW: THE RAINBOW OF MY RESEARCH DESIGN

INTRODUCTION

What Should I write?

I sit in front of my computer, it is already 3.17pm. Several times my eyes wander to the clock on my computer screen. Every day when I write my thesis, this time after lunch is really unproductive. I always become sleepy and tired. Uuuf, I try hard to stay focused and open my eyes widely. But I am just getting sleepier. I look at my empty water bottle and my empty lunch box. There's nothing that I can drink and eat anymore, sometimes drinking and eating helps me stay focused but not this time. I try to open one of my project folders on statistical analysis. I look at the number and look at my analysis. Oh, how positivist I am, justifying teaching improvement and students' achievement with the higher mean of the questionnaire scales and students' exam results. Well, I feel confident that I am doing well in this type of research. But, when I look at the blank page on my computer screen, I am just stuck. It's been blank for this entire 2 hours, since I finished my lunch and went for Dzuhur pray. What should I write? I don't have any justifications of my transformation during co-teaching, I don't have any questionnaire results on my teaching profile, and I don't have any assessment of my teaching performance. The transformation is in my heart, the emotions and feelings of being empowered are in my soul. I am just feeling blurred within this dark tunnel. Again, I am stuck in the power of objective truth, in the power of measurement, in the power of objectivity. Uuf, what should I write?

The story above was part of my personal experience in writing my doctoral thesis. I really can't ignore the power of objectivity in my writing. When I looked at the ARC project and wrote the quantitative data analysis, then wrote my reflective writing in my doctoral research, I became more aware of how I had previously thought that good research should be objective and measurable. As I stated in Chapter 1, I am living in two worlds with different research paradigms. However, I don't want to put

myself deeply into the war between paradigms, since experience of different paradigms enriches my knowledge. Focusing on my doctoral research, I decided to do that which could transform my professional and individual praxis. I wrote the poem below to represent my struggle.

I Have a Choice

I realise…
I am in two ways of thinking
I am in two ways of feeling
I am in two ways of creating

At the moment…
I can't say, I am strong enough to stay
I can't say, I am confident enough to walk away
I can't say, I am brave enough to blow away

But…
I can say…
I have a belief to fight for
I have a heart to be felt
I have a soul to be comforted

I have a choice…
I choose this way….
I choose to be struggling
I choose to be empowered
I choose to be transformed
I choose to stay

Because of my struggle in working in both the mixed methods ARC project and my qualitative doctoral thesis, I chose the title of "Puzzling Over my World View: The Rainbow of My Research Design". I have divided this chapter into three sections.

1. ***Setting the Scene***

   In this section I describe the participating schools, my co-teachers, and their students.

2. ***Reflections on Different Research Approaches***

   In this section, I reflect on different research approaches, especially my struggle in conducting the doctoral research, and my personal reasons for choosing this approach.

3. ***The Rainbow of My Research Design***

I discuss the value of truth which shaped my research design and give an overview of my research paradigms, methodology, methods, quality standards, and ethical issues.

SETTING THE SCENE

After gaining ethics clearance approval, I conducted survey research for the first year, including classroom observations and interviews to understand the different classroom cultures. In the second year, I conducted case studies of the three participating schools (one class in each school). I went to the schools 7 times a week, the frequency of visiting depending on the teachers and the lesson topics. I worked with the teachers in planning the lessons, conducting teaching, searching for teaching resources, and conducting assessments. I also tried to create dialogue between teachers and students to improve classroom practices. The entire process took two years. In the third year, I focused on writing up my doctoral thesis.

The Participants

Ardross School is an 8-12 public school with a good academic reputation and achievements in sport and art. This school has outstanding science teaching and learning resources: a wide range of science videos and textbooks. I worked in the science academic extension class with an enthusiastic science teacher, Tony, a young male Australian science teacher, aged around 30 years old with 5 years of science teaching experience. Tony employed an interactive technology system in his teaching and his passion in education for sustainability inspires him to integrate this empowering idea in many classroom activities.

Every time I came to the class, I found the students and the teacher engaged in learning activities. The students were mostly high achievers and highly self-motivated. Tony was always well-prepared and provided different learning activities to engage the students, from role playing to ICT based approach. He provided excellent explanations of science concepts often related to environmental sustainability. I tried to enrich the classroom environment by creating different learning approaches; but my efforts were not successful. Every time, I tried to create dialogue with the students, they seemed to prefer Tony's established teaching

approach. In these circumstances, I decided to focus on other schools where co-teaching was likely to be perceived as useful.

Keith School is an 8-12 public school with an excellent reputation in academic and other achievements. The school has very good science teaching and learning resources which benefit both teachers and students. I worked with 25 students in the selected year 9 class wherein the students were mostly not highly motivated to learn science. Compared to other year 9 classes in the school, the students in this class demonstrated lower levels of academic achievement. Thus, the student's disengagement had me challenged. However, I had a problem since the science teacher changed three times during the year.

The first teacher, Rebecca, was an experienced and enthusiastic science teacher. She was around 50 years old and was from Europe. I started working with her in term 2. I was really happy to work with her and we developed a good relationship and collaboration. One day we went outdoors to teach the topic of biodiversity to the students who seemed to enjoy the activities. In the classroom, we collaborated to manage learning activities. However, the sad news came through that she contracted lung cancer. I felt so sad. The last time I met her we hugged each other. I gave her a present to motivate her to survive. She had great willingness to live, however sadly, she passed away one month after I had met her. The relief teacher, Susan, was an Australian around 40 years old. She intended to teach the year 9 class until the middle of term 3. Her teaching approach was very teacher-centred, most of the time she asked the students to write summaries of the science text book. Students were bored with the science classroom. I gave her several ideas to engage the students; however, she chose not to integrate the feedback. Therefore, I decided to wait until the new science teacher arrived. In the middle of term 3, the new science teacher, Tina, came. She had been working as a science relief teacher. She was from Singapore, and was around 40 years old and had been working for 21 years. She was a well-organised teacher with a passion for improving her students' understanding. Tina faced the challenges in the classroom and she was a good co-teacher. She eagerly faced challenges in the classroom. I could see various changes in her teaching from the middle of term 3 until term 4. Although, I was happy to work with

her, the time was limited, and I couldn't facilitate much improvement during short period.

Southgate School is an Islamic private 8-12 school with a good academic reputation and a multicultural environment. Compared to other schools, this school has less science teaching resources and thus the teachers had difficulties finding resources such as science textbooks, audio-visual aids, and laboratory equipment. The students came from a variety of countries with different cultural backgrounds. Most of them came from Arabic, Asian, and African countries. In my experience, most were not highly motivated or engaged in the science classroom. Some of them were chronically misbehaving students. Most of their teachers got angry when teaching them. Their parents chose this school because of the Islamic environment. The first time I met the students, I realised that I was working with very challenging students. The teacher told me that the most important thing in teaching in this classroom was classroom management and that we needed to find ways to keep the students well-behaved. Since I had had experience in teaching misbehaving students, I felt that co-teaching would be a great way of helping the teacher to engage the students.

Another reason why I engaged deeply in the Islamic school was the enthusiastic and open-minded teacher that I worked with. I had previously worked in this school for a year before working with Mrs. Emilia. In 2009, I worked with Mr. Abdullah, the science teacher for year 8. In 2010, the school decided to exchange Mr. Abdullah for Mrs Emilia to teach year 9. Mrs Emilia was an experienced teacher who had been teaching for 23 years. She was 43 years old and from Singapore. As a Moslem, she had a passion to practise Islam in all activities, including science teaching. Her friendly face made me feel comfortable to work with her. Our similar backgrounds created a comfortable zone between us. She was an enthusiastic and open-minded teacher. These characteristics helped me to engage with her in co-teaching.

Because this Islamic school is shaped by an Asian and Islamic environment, I felt comfortable working with the teacher. Most of the teachers and staff are Asian, including the principal. Although, it might have been less challenging compared to other schools, conducting co-teaching requires rapport and a trusting relationship. Working in this environment helped me to engage deeply during co-teaching.

Co-Teaching Methodology

In this section, I portray the process of co-teaching with these three teachers. The process was divided into three phases, which are collaboration, dialogue and reflections (see Figure 3) which I discuss below.

1. In **the collaboration phase**, I worked with the teachers to plan the lessons, classroom activities, and assessment. During the science lessons, I taught together with the teachers. However, I had different types of collaboration with the three teachers, and conducted intensive collaboration with Mrs. Emilia, the science teacher in the Islamic school.

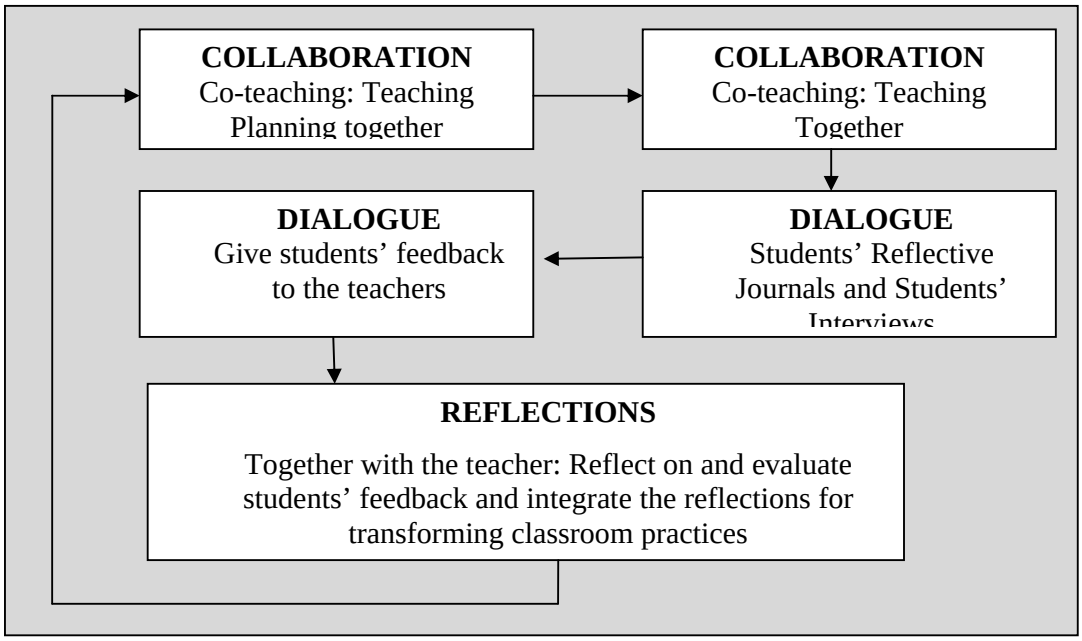


Figure 3. The Process of Co-teaching

2. In **the dialogue phase**, I talked to the students to obtain their feedback on our teaching and classroom activities. Common questions were: "Do you like the lesson? Are you engaged with the activities? And do you have any suggestions for ways to improve the classroom activities?" To discuss with students I used three different ways: informal conversations, interviews and reflective journals. In students' reflective journals I added my comments on their reflections to encourage them to do more reflections. I planned to create dialogue by sitting together with the teachers and their students but, because

of the time limitation, and both teachers' and students' willingness to discuss together, I created another dialogue with the teachers during the reflections phase.

3. In **the reflections phase**, I worked with the teachers to evaluate and reflect on our co-teaching in order to improve classroom practices. Students' feedback, including their reflective journals, were powerful enough for helping to transform our pedagogical practices. We usually sat together after the lesson and at other times when both of us were free. After we reflected on our practices we implemented our ideas in the next lesson. The examples in Figure 4 are taken from the feedback/reflections from students' interviews and reflective journals.

Examples of students' reflections (interview and reflective journals):

Today, we had lab work to identify 6 different chemical elements. I enjoy it, but I would like it if for the next experiment if we had different lab partners
(Student's reflective journal, July 26, 2010)

...I would like the feedback on my work, since she doesn't always tell us where we went wrong, and so I don't know how to correct my mistakes..
(Student interview, May 5, 2010)

...the lesson today was very fun because we got to work outside in the fresh air. My partner and I worked well in this activity as we didn't argue. I think we should have more lessons and activities outside as it is fun and at the same time we learn something…
(Student's reflective journal, July 29, 2010)

Figure 4. Student's Reflective Journal

REFLECTIONS ON DIFFERENT RESEARCH APPROACHES

Working on different research paradigms stimulated me to reflect on my worldview. My personal experiences since my master's degree in transformative educational research had enriched my perspective on different ways of conducting educational research. Unconventional research is still considered unacceptable in my University in Indonesia, which holds a strong post/positivist worldview. Thus, this part provides important reflections on examining my personal values and beliefs in conducting research and the challenges I will face when I return to my home country. I have divided into three sub-sections: (1) *Reflections on Different Research Approaches*, (2) *Personal Experiences: It Is Not Easy to Stay Empowered*, (3) *Reflections: Why I Stand for This Research.*

Reflections on Different Research Approaches

My learning experiences, as well as working with different research approaches, has enriched my perspective on conducting educational research. However, I have realised that I am a beginning researcher who always needs to learn different theoretical perspectives. There are two different approaches -qualitative (my doctoral thesis) and mixed methods (the ARC project and my institution)- which are relevant to my context. When I was a student teacher I only knew the terms qualitative research and quantitative research but without understanding the term research paradigm or understanding different approaches to doing educational research. According to Willis (2007), the terms qualitative and quantitative are two ways of conducting research in the social science but are not clearly understood, thus the term "research paradigm" is used and I describe it in the third section.

In this sub-section I portray eight moments of qualitative research from Denzin and Lincoln (2008) which integrates different theoretical perspectives to help me understand different stages of conducting educational research. As a beginning researcher in qualitative research, I was overwhelmed with the philosophy and various bizarre terms describing research. I was thinking that it might be because of a language barrier, but when I reflected on it I realised the real challenge was moving from quantitative research, which holds to objective truth and objectivity, into the multiple truths and subjectivity of qualitative research. But, I couldn't ignore the power of objective truth in my mind which influenced me to become confused and

insecure in conducting educational research. When I conducted the ARC project and my doctoral thesis I became more aware of the distinctive power of each paradigm. However, at the same time, I also became confused about who I was and what I wanted to do. Therefore, I wrote this section to help enrich my understanding of qualitative research. Denzin and Lincoln (2008) divided the history of qualitative research into eight phases:

1. Traditional phase (early 1900s) focuses on objective research,
2. Modernist phase (1970s) still embraces quantitative studies,
3. Blurred genres (1970-1986) moves into qualitative studies with more interpretive work,
4. Crisis of representation (mid 1980s) involves reflective writing and validity questioning,
5. Postmodern period of experimental ethnographic writing (mid 1990s) comprises new ways of composing ethnography which are more activist-oriented research
6. Post-experimental inquiry (1995-2000) involves varied representations in writing such as autobiographical, visual, and poetic
7. Methodologically contested present (2000-2004) involves debate within qualitative research on political contestation with conservatives in terms of what is 'valid' research.
8. The future (2005-now) involves confronting the "methodological backlash" associated with "Bush science" and evidence-based social movement.

Meanwhile Taylor and Wallace (2007) divided the eight phases into (1) the immediate future, which emphasises social justice, and (2) the fractured future which involves political praxis, new ethics, aesthetics and theologies for a globalized world. When I reflected on this history I realised how educational research in my institution and my country is situated mostly in the modernist phase. Some educational researchers in my country are moving forward into blurred genres. The course at SMEC, Curtin University, help me to open my mind to different ways of conducting research, and therefore at this stage I challenged myself to go in-depth into eight moments of qualitative research, not only to develop my professional practice but also develop educational research in my institution.

Furthermore, mixed methods is one of the contemporary research approaches that strongly influences educational research, not only because it was applied in the ARC project but also in my home institution. My colleagues believe that mixed methods research design has been considered as the middle way in the war between quantitative and qualitative research approaches. According to Brewer and Hunter (as cited in Cresswell, 2005, p. 510), "a mixed methods research design is a procedure for collecting, analysing, and mixing both quantitative and qualitative data in a single study to understand a research problem". My experiences have stimulated me to reflect on my personal experiences in mixed methods research design for which I have several reasons, including that I am inspired to be an agent for campaigning for transformative education research in my institution. To prepare myself, I need to understand the kind of values and beliefs about educational research that are held in my institution. There could be different facets of educational research that are shaped by the post/positivism paradigm, including this mixed methods approach. According to Denzin (2010, p. 420), "the mixed methods discourse has been shaped by a community of post-positivist scholars who have moved back and forth between quantitative and qualitative research frameworks". Denzin (2010) points out several interesting issues in mixed method approaches: paradigm wars, dialogue, and dilemmas in combining qualitative and quantitative which clearly has differences. I came to realize that combining qualitative and quantitative ways are not necessarily solved in satisfying ways.

In addition, the positivism paradigm which has influenced the natural and social sciences during the twentieth century (Kincheloe & Tobin, 2009) has also strongly influenced my institution. For example, when my colleagues conduct action research they are still influenced by the power of measurable and objective truth by using triangulation. For example, they try to improve students' achievement by using constructivism, and then they seek to justify the improvement in students' achievement by triangulating quantitative and qualitative data. When I reflect deeply and look at the nature of mixed methods research design, I realise the power of objective truth and generalisation in this approach. Sometimes, I feel isolated when I embrace my beliefs in transformative research design which focus more on self-reflection for transforming praxis because most of my colleagues hold to mixed methods as the more powerful research approach. They believe that combining

quantitative and qualitative data and finding the one truth provides an integral picture of the data. However, within different approaches in educational research I have come to understand distinctive the characteristics of each approach. Holding only to a single approach would not help to transform my institution. I realise that I need to use dialectical thinking to campaign for transformative educational research in my institution (see Chapter 7).

Personal Experiences: It Is Not Easy To Stay Empowered

My department office consists of the head of department, the secretary, the lecturers' meeting area and administration room. It's not too big, but most of the lecturers spend their time there having discussions with other lecturers and students

In this sub-section, I portray my struggle to conduct transformative educational research by means of is critical auto/ethnography within a multi-paradigmatic-research (interpretive, postmodernism, criticalism) design. In 2007, during my master's degree, the first time I joined the research project in Peter's class I really faced difficulties, not only because I had to understand deeply new perceptions of research but because of new terminology that I found difficult to understand, such as research paradigms, positivism, post positivism, interpretivism, postmodernism, criticalism, integralism, autoethnography, and quality standards. When I completed my master's degree and returned to my home country, I faced another challenge, that is, I had to deal with the hegemony of the positivist paradigm in my university. I had been empowered to transform research practices in my institution but I was questioning myself. Can I become an agent of this transformative research and face the challenge of implementing other research paradigms? Can I celebrate the plurality of different paradigms or should I just stay in the comfort zone of becoming the next supporter of the positivist paradigm? Can I deal with the authority of the university system? Can I deal with seniority, since I am the youngest lecturer? Can I speak my own silent voice? Can I? Thus I wrote a story of my experiences dealing with reality in my university when I spent my semester breaks during my master's degree back in my country (see Appendix 1 and Appendix 2). These experiences gave me a harsh 'reality check" about what I will face when I return home after finishing my doctoral degree.

Writing story was really a valuable experience. As the youngest lecturer in my department and a graduate of that department, I sometimes feel anxious to say my own views. I have shared my personal experiences with colleagues from The Philippines and Malaysia who graduated from SMEC in the same year and who belong with me to a network to support each other. We realise the power or our learning experiences at SMEC. Most of us agree that the most powerful learning experiences are shifting to 'new eyes' for looking and new ways of conducting educational research. When we talk about our struggles to implement new research approaches, we almost all had similar experiences of feeling rejected and isolated. However, some of them have succeeded in implementing new research approaches. I have put an interview with my colleagues in Appendix 3. Conversations with these colleagues have inspired me to stay on the pathway. I realise that it is not going to be an easy journey, however, when we support each other we get stronger and feel that we were not alone.

Reflections: Why I Stand For This Research

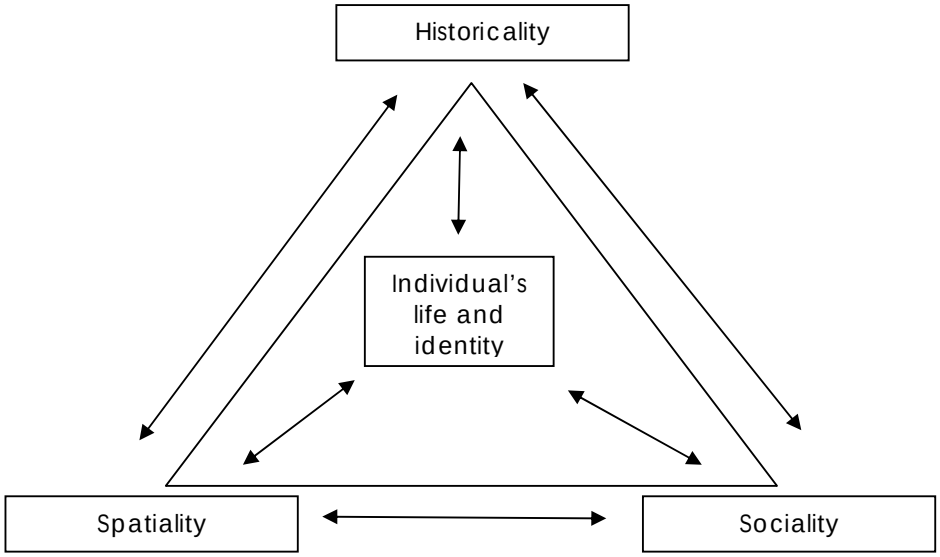
This sub-section portrays my reflections on conducting critical auto-ethnographic research which I chose as my methodology for this thesis research. Critical auto/ethnography represents transformative research which helps me to understand myself and my professional practices as well as my view on what constitutes research. Thus, I discuss several reasons for my decision as a beginning researcher who had the dilemma of working in different research paradigms and decided to choose this approach. These reflections could be powerful for other beginning researchers as well as for my student teachers in conducting their research.

The power of writing personal experiences

> *You have to begin to lose your memory, if only in bits and pieces, to realize that memory is what makes our lives. Life without memory is no life at all*
> *(Bunuel as cited in Sacks, 2008)*

The first main reason for taking a narrative research approach is the power of writing stories about my personal experience. I have never had the experience of being asked by my teacher to write a story, except at SMEC. When I was a child, I liked to write stories in my diary, but it has not been for a long time. But ever since I started narrative research I have shifted my perspective: how powerful is my story, how

powerful are my experiences, and how powerful are the memories. I have found that this type of research has helped me to understand more deeply my teaching identity. Figure 5 represents how my narrative research constitutes an interplay between the historical, social, and spatial contexts of my life and identity (Harnett, 2010). In these three contexts, I incorporate a range of spaces, relationship with others, and personal histories for reflecting on my life journey across a range of emotions of happiness, sadness, and feelings of dis/empowerment, and dis/comfort.



Influences on Lived and Imagined Experiences (Harnett, 2010, p. 164)

Figure 5. Influences on Lived and Imagined Experiences

I can feel how difficult it is, but I also can feel how joyful and engaging is a narrative genre. I used to think that I don't have talent in my right brain for writing stories. I believed that my talent lies in chemistry, logical thinking, and other modes of linear thought. But I can do it, and I can hardly believe it, even now. I do realise that it is still an unripe journey, but I can feel it change and reshape me especially how I see myself, others and the world. Therefore, I chose this research approach because writing stories is really engaging and powerful.

Challenging the research approach

As did my other classmates, I heard about autoethnographic research, postmodern and critical theory research paradigms at SMEC during our master's course. Since

most of us were trained to know and understand only one paradigm, which is positivism, we used to think that research had to be valid and measurable and statistics-dominated. I had never thought that subjectivity had a role in and was acceptable as research. I used to think that if I didn't use statistics for analysis that is not research. Therefore, I felt challenged in doing this research. In addition, I do remember my struggle to understand the new terms which were really confusing - research paradigms, ontology, epistemology and quality standards. It seems that I have come from an isolated space into an alien space which is an absolutely different world.

This research is really challenging because not only does it require critical reflection, creativity and imagination, but also it challenges me to deal with people who disagree with doing this type of research. I had conversations with friends studying elsewhere in Australia on their master's degree. I had thought that the postmodern research paradigm and autoethnographic research methodology was widely chosen by students in education and the humanities, or other social research areas, but I was wrong and I realised more the challenges that I will be facing when I return home.

Emerging creativity, imagination, and envisioning (art-based research)

This research is really an opportunity to develop my creativity, imagination, and envisioning capacities, as multiple genres are allowed to represent our voices, thinking, experiences and methodology, and to engage our readers. I can say that this research is shaped by the Arts. I believe that creativity, imagination and envisioning are important for individuals to cultivate their personal sustainability and societal actions. As an individual agency, creativity can help me to solve problems in real life, and as a societal agency, creativity can stimulate me to be a pioneer in the development of society, especially in relation to science, technology, and the Arts (Sak, 2004; Cropley, 2006). Imaginative thinking and envisioning are important because they help solve problems in life that require critical thinking. Therefore, I agree that imaginative thinking can give power to transcend as a human (Young, 2003). However, I also realise how it is difficult to be a creative, imaginative and visionary thinker. I am still on my journey of learning, changing and transforming I don't say that it is easy, but I can say that I will endeavour to do so.

The insightfulness of critical reflection

After arriving at SMEC, I learned to think critically and reflectively which was very difficult for me because my education system and family education did not encourage me to think that way. My struggles got tough when I began doing this research because all aspects of writing in this research stimulated me to think critically and reflectively. My experience in doing this research through the insights of critical reflection helped me better understand who I am as an individual, as a student, and as an educator (see Chapter 4). For example, I realised how powerfully the technical interest had shaped my teaching and how widespread is the influence of this factor in shaping my curriculum. I realised also how my experience in doing research under the positivist paradigm had limited my thinking and bordered my critical reflections.

Engaging the readers

The other main reason that I decided to take this research approach is to engage my readers. When I read an auto/ethnographic research report I sense the emotional engagement of the writer and that encourages me to reflect on myself and my pedagogical practice. It seems that I had conversations with the writer, with the text, and with the experience. I can learn from these writers how they deal with problems, challenges and realities. Most of the auto/ethnographic research I read helped me to reflect on my own experiences, especially as a student and an educator.

In relation to me as an educator, can I empower my students? Can I engage and empower my readers through my personal experiences in this research? But I also need to be aware of the social realities in my country. I need to apply dialectical thinking to face the challenge. I believe that we need to open our hearts and minds to accept differences, including our different perspectives on how to conduct educational research.

THE RAINBOW OF MY RESEARCH DESIGN

This section portrays my research design which consists of my research paradigm, epistemology and ontology, research methodology, research methods, quality standards, and ethical issues. But first I discuss seeking the truth, which is a major issue when conducting educational research. Different researchers hold different

perspectives on what they call 'truth' and 'reality', which influence the way they conduct educational research.

Seeking the Truth

I always believe that truth lies in every aspect of my life. There are multiple truths for different aspects. I find peace of mind when I hold a truth that I believe. For example, in my religion I believe in one God, and I hold that as an absolute truth. I believe God creates humans and the universe. In my belief, God allows us to find out the truth. In order to seek the truth we need our brain to think, our soul to believe and our heart to feel. I consider my religion as the basis for seeking any truths in my life, including when I am doing this research. My religion influences my way of conducting research and my transformation.

I can't ignore aspects of my religion when I write my reflective writing. My belief will be a part of my transformation.

However, I have realised that different people hold different truths based on their personal experiences, and they express their beliefs and truths in different ways. According to Ellis, Adams, and Bochner (2011), different people have different ways of representing their worldview and their truth; it could be by speaking, writing, valuing, or believing. Therefore, different ways of seeking and representing the truth also occur in educational research. I realise that educational research embraces human aspects which are complex and dynamic. Previously I believed in one truth when I was doing educational research. The belief in the absolute truth in science guided me to put this practice into my educational research. I believed that research had to use questionnaires and statistics; that truth had to be measured and observed. Then, I realised when I came to SMEC to study for my master's degree that objective truth ignores human values and beliefs and ignores other aspects of human behaviour. Not everything in research can be judged by mathematics, by 'one gold standard', or by one truth. I remember conducting research on the relationship between students' creativity and achievements. The way of conducting the research was by giving students an instrument (questionnaire) for measuring creativity. Then, by obtaining the data of their achievement, I could calculate statistically the relationship between students' creativity and achievement. At that time I believed

that was a good way of representing the truth about my students' creativity. But then I asked myself several questions:

1. How about the conditions that caused my students not to choose particular responses that perhaps represented their true feelings? Could I say that their response is the whole truth?
2. How about the instrument? Can it truly represent my students' creativity? Can I say that it gives the whole truth about my students' creativity?
3. How about other aspects, not only students' achievements that can influence their creativity? Did I measure the whole truth?

At that time I kept questioning myself but I still didn't think there were other research approaches. Now I have realised the powerful influence of the post/positivism paradigm in my past research journey.

Research Paradigms

When I write this chapter, I remember the first time I heard the terms "research paradigm", "ontology"," epistemology" and other new words in Peter's research class, when I studied my master's degree. As I recall, I had only feelings of confusion, chaos, and desperation in my mind. I remember how I felt and what I thought, it was like a black endless tunnel. All I said in my mind was: "I don't know anything about research …"

I am thinking of the book "The Periodic Kingdom: A Journey into the Land of The Chemical Elements", by Atkins (1995), when I look back into the research paradigm. The concept of chemical elements, as arranged on a periodic table, is a fundamental concept in chemistry. However, the periodic table is not simply a list of chemical elements with different names and colours, but it is also the basis of every material in the world. Therefore, I am thinking of research paradigm as a chemical element and research as a kingdom. A kingdom of elements represents different types of elements. It is full of differences, but there are synergies between the differences. Research paradigms represent different characters in conducting research. According to Willis (2007, p. 8), "a paradigm is thus a comprehensive belief system, worldview, or framework that guides research and practice in a field". Research paradigm as worldview consists of the basic concepts which influence the key ideas of conducting research. Guba and Lincoln (1989) distinguished among

paradigms of positivism, post/positivism, constructivism, and critical theory, which are analysed based on ontology, epistemology and methodology. Ontology, epistemology and methodology shape how the qualitative researchers see the reality of the world and act in it (Denzin & Lincoln, 2008). According to Denzin and Lincoln (2008, p. 245), there are four basic terms included in paradigms: ethics, epistemology, ontology, and methodology. Taylor (2009) divides the educational research field into 6 major research paradigms: positivism, post/positivism, interpretivism, criticalism, postmodernism, and integralism. Each paradigm, just like a chemical element, has its own characteristics. During my journey at SMEC I found the powerful idea of multi-paradigmatic research, which I describe below, for representing the integration of different research paradigms.

Multi-paradigmatic research design

Differences between the research paradigms caused me to struggle to cross the borders between different research paradigms when I was conducting research for the ARC project and my doctoral thesis. Like a magnet, different research paradigms have forces to follow and power to hold on. Sometimes there are debates among educational researchers. According to Guba and Lincoln (as cited in Denzin & Lincoln, 2008) there are seven basic critical issues among the research paradigms: axiology, accommodation and commensurability, action, control, foundations of truth, validity, and voice, reflexivity, and postmodern representation. A critical analysis of the paradigms stimulated me to choose a multi-paradigmatic research design. It fulfilled my need to satisfy those seven basic principles, especially axiology, action, foundations of truth, and voice, reflexivity, and postmodern representation.

A multi-paradigmatic research approach was highly relevant to research that aimed to transform my practice, especially as I intended to explore my teaching identity as a result of deep understanding of both my personal and professional practice. According to Taylor, Taylor, and Luitel (2012b), multi-paradigmatic research design allows science educators to transform their professional practices by drawing methods from different research paradigms. In this research, I applied three research paradigms: interpretive, critical, and postmodernism paradigms. These three paradigms, which I describe in the following sections, helped me to reconceptualise

my professional practice. When I conducted multi-paradigmatic research during my master's degree I experienced unique opportunities to reflect on my experiences, values and beliefs, to envision myself in different roles, and to speak for my silent voices.

Interpretive paradigm

I came to realise that there are different assumptions influencing the way we understand the world whether reality lies outside or within us. It is challenging to move from objective truth of the scientific worldview to the interpretive worldview. In conducting my research, the interpretive research paradigm helped me to understand different interpretations and different ways of understanding the reality of different assumptions underpinning my teaching identity. The interpretive research paradigm enabled me to seek complex understanding and to make sense of others' meaning perspectives and experiences (Merriam, 2002; Willis, 2007; Taylor, 2008a). For example, during my reflection on my teaching identity, I tried to understand the influence of my culture and religion, and this helped me realise that I could have varied interpretations. I found that varied interpretations across different perspectives gave rich descriptions for my research context.

Critical paradigm

According to Denzin and Lincoln (2008), the critical theory paradigm was developed in accordance with an historical realism (ontology), a transactional epistemology, and a dialogic and a dialectical methodology. So reality in this paradigm is shaped by social, political, cultural, economic, ethical and gender values (Denzin & Lincoln, 2008). The critical paradigm promotes ideals of social justice, bio-cultural diversity and sustainable ecosystems (Taylor, Taylor, & Luitel, 2012b) and involves self-criticism and consciousness of "oneself as a product of power-driven socio-historical process" (Kincheloe & McLauren, 2002, p. 100). As a result, critical theory tends to see an unbalanced reality which needs to be changed. Critical theory does not reject natural science and hermeneutics as legitimate scientific methodologies, but it is critical of each as being incomplete methodologies. Both are also theoretically incomplete in the sense that they are unable to create the conditions for the full realization of human potential. Critical theory criticises empirical social science for having the capacity to describe individual and social behaviour but not having the

capacity to understand or explain it. In addition, “critical theory criticizes interpretive social science for having the capacity to understand behaviour, from the participants' perspective, but is lacking the capacity to expose the distorted knowledge underlying the understanding as well as distorting the understanding itself” (Ewert, 1991, p. 355). Thus, in this research, this paradigm helped me to self-reflect critically, not only on myself but also on the world around me which was really important in understanding my teaching identity. My learning experiences, which have been shaped by powerful social, political, economic, and other factors, stimulated my critical thinking to envision a better system and environment for the future of education. It served not only to criticise others, but also to look back at myself and realise what I can do for my society. Thus, this paradigm allowed my empowerment for being an agent of social change.

Postmodern paradigm

The postmodern paradigm helped me to focus on seeking understanding through textual reconstruction (Polkinghorne, 1992). Moreover, according to Taylor (2008a, p. 888), “postmodernism elicits both fear and favour via its basic principle: *be suspicious of all grand narratives* (*including that of postmodernism*, respond its critics, not without irony)”. Postmodern representations use narrative to develop understanding, voice, and human experiences (Guba & Lincoln, 2008). In this research, the postmodern paradigm allowed me to employ multiple logics and impressionistic writing to express my emotionality in an engaging manner, especially stories, poetry, metaphors and others. These became powerful ways to reveal and reconceptualise my teaching identity. According to Taylor and Wallace (2007), Arts based modes of conducting qualitative research provide opportunities for knowing in thoughtful, emotional and spiritual ways. Moreover, throughout the practice of critical reflexivity and impressionistic writing, I created my vision for being a better social being committed to empowering others to participate in the reconstruction of society, especially in an educational context.

Finally, by putting emphasis on these three research paradigms I found it becomes a powerful way to facilitate my research as reflecting on and voicing multiperspectival thinking, not only for revealing and reconceptualising both my teaching identity and my professional praxis.

Epistemology and Ontology

According to Pallas (2001, p. 6), "epistemologies are central to the production and consumption of educational research". Thus, it becomes important for my research. Epistemology refers to what we can know and how we can know the reality (Willis, 2007). As my epistemology in this research is shaped by three research paradigms, I use different facets to acquire knowledge by investigating the phenomena of the world and human beings in many ways such as the reality of my experiential world, my thinking and behaviour as well as that of others. Constructivist theory, critical theory and postmodernism helped me to understand myself and others. Personal and social constructivism represent my voice in "making sense, constructing knowledge, and building ideas". Constructivism is enriched by radical constructivism which recognises the individuals' own experiential reality. Critical theory gave me opportunities to transform myself and the environment through critiquing practical, political, and social issues via self-reflection and criticism.

Ontology concerns the nature of reality (Willis, 2007), and within this concern my ontological assumption about the world is that there is not an absolute truth about reality within human observation. I comprehend that the absolute truth is from "the God's-eye", but we humans are just trying to find out the truth. Therefore, we will never know 'absolute truth'. However, I can't hold to the extreme (if I can say) of the postmodern paradigm regarding being sceptical of any truth which leads to no basic differences between truth and falsity (Gubrium & Holstein, 2003). I reflect on my understanding of teaching science, where scientific knowledge becomes an historical process, rather than the absolute truth. However, by embracing social constructivist and socio-cultural perspectives on science education, I understand that my reality is subjective and needs to be negotiated with others through a communicative-pedagogic process. Therefore, the interpretive paradigm emphasizes that the world of social phenomena has different meanings.

Research Methodology

The research methodology that I have engaged represents these three focused paradigms (interpretivism, criticalism, and postmodern) as part of a multi-paradigmatic research design. I employ critical auto/ethnography as my research methodology to bring an integral perspective to my research.

Critical auto/ethnography

According to Roth (2000, p.1), "auto/ethnography and auto/biography are genres that blend ethnographic interests with life writing and tell about a culture at the same time it tells about a life; at the same time, auto/ethnography has become a central means of critiquing other forms of representing individuals and their culture". Roth (2000) points out that autobiography can help science educators to understand issues in teaching and learning science. According to Barton and Darkside (2000), critical to our autobiography is not simply remembering stories in our lives, but working out how to make them convincing, coherent, and meaningful. Thus autobiography is the highest and most instructive form to understand our lives. In addition, Barton and Darkside (2000, p. 10) states, "narratives can be used to construct knowing and an understanding of this knowing...rather than seeing in autobiography a flight into personal, inner subjectivity, we should adopt it as a way to establish and stabilize inter-subjectivity". However, I still feel the challenge of subjectivity in using myself as an instrument in this methodology. According to Fontana and Frey (as cited in Mulholland, 2007, p. 54), the researcher as the main instrument will write in a reflexive, problematic, and contradictory nature about the data. I realise that this type of writing not only challenges the writer, but also the readers to reflect on their own experiences, beliefs, and values.

Critical auto/ethnography represents my personal experiences, self-narratives and relationships with others (Burdell & Swadener, 1999; Ellis & Bocher, 2000). In the 1960s, critical ethnography was developed by Marxist/Neo-Marxist critical theory. Currently, contemporary critical ethnographers use multiple epistemologies, such as: introspection, memory work, autobiography, and dreams (Foley & Valenzuela, 2008, p.288). According to Taylor (2008a) and Taylor and Settlemaier (2003), critical auto/ethnographic research involves an autobiography of individual lived experience to engage the reader via pedagogical thoughtfulness and to generate critical reflexivity, which can help teachers to reflect on their own experiences in order to improve their students' learning. I have found that imaginative self-reflection is a powerful way to improve my pedagogical practice as well as to envision my future life.

Research Methods

Narrative inquiry becomes the main research method in my methodology. And because, as part of the ARC project, I worked with three secondary schools in Western Australia and science teachers and year-8 students, I used a small portion of that data in my thesis drawn from classroom observations, interviews, and reflective journals.

Narrative inquiry

Narrative inquiry allowed me to use narratives for both methods and phenomena to describe my personal experiences and social interactions (Connelly & Clandinin, 1990; Pinnegar & Daynes, 2000). According to Freeman (2007), autobiography is the fundamental form of narrative inquiry, since it involves study of life and human actions. Narrative inquiry helped me to communicate meanings, share practical experiences, and integrate lived reality (Ospina & Dodge, 2005). Narrative was a way to represent my silent voices and reflections. Within this research, I used different genres, such as stories, poems, and dialogues. According to Bauman (Cohen, Manion, & Morrison, 2000, p. 303), "stories are oral literature whose meanings, forms and functions are situationally rooted in cultural contexts, scenes, events which give meaning to action". The story of my personal experience constituted a living interaction with the reader.

Classroom observations, interviews, and reflective journals

I conducted classroom observations in order to understand classroom culture and interactions. According to Glesne (2006) and Punch (2009), observation provides opportunities for the researcher to understand the research setting and the participants' behaviour and interactions. It was also my way of engaging with the participants. I used interviews to explore my participants' voices. Interviews were a process used to investigate detailed information on people who respond with opinions, attitudes, feelings, and perceptions and events (Burns, 1996; Anderson & Arsenault, 2004; Glesne, 2006), a method to engage with my participants. I also used reflective journals to express my own and my participants' voices, as I believe that writing can be the best way to express personal and critical voice. Through reflective journals I was able to understand the participants' thinking and feelings (Creswell, 2005).

Data Production, Representation and Processing

The data production, representation, and production in my research related to the nature of multi-paradigmatic research and critical auto/ethnography as my methodology. I produced context-rich data texts thorough the forms of "narratives of lived experience, stories, informal interview excerpts, vignettes of observed/recalled activities, evocative images, boxed quotes or poems…" (Taylor, 2012a, p. 39). Rich and thick descriptions of the data (Merriam, 2002) were generated from my own reflections and envisioning, observations, interviews, and reflective journals. As most of my writing was about my lived experiences in relation to my teaching identity, I followed the characteristics of auto/ethnography research advocted by Van Maanen (1988), which are realist, confessional and impressionist writings with several characteristics: textual identity (to engage the readers), fragmental knowledge (complexity of life and pedagogical occasion), characterisation (personalise the characters), dramatic control (keep the audience alert and interested). Thus, throughout the production, representation, and processing text, I applied multiple forms to engage my readers in representing the complexity of my lived experiences and social reality. As I did not want to be trapped by the generalization and certainty of positivism, I used perspectival terms such as 'seems', 'tends', and 'can', which helped me to represent the complexity of social reality (Taylor, 2008b).

I present my writing through multiple genres within arts-based research, such as poetic (poem), stories, dialogues within narrative and some metaphor languages. According to McNiff (2008, p. 29) art-based can be defined as "the systematic use of artistic process, the actual making of artistic expressions in all different forms of arts, as a primary way of understanding and examining experience…". Poetic language is presented throughout my thesis to engage my readers in reflecting on my lived experiences. Meanwhile the stories represent my lived experience, classroom observations, and interviews. The researcher constructs data-texts in the form of reflective fieldnotes, vignettes of significant activities and transcripts of informal 'inter/views' that capture students' voices (Taylor, 2012a, p. 40). I also represent some discourse and spoken action through dialogue. According to Atkinson and Delamont (2005, p. 826), "we need, in contrast, to ensure that the analysis of spoken language remains firmly embedded in studies of organizational context, processes of socialization, routines of work, personal transformation, people processing, and so

forth". Then as narrative inquiry is the main method in my research, I use narrative analysis as stated by Polkinghorne (1995, p. 16) "narrative analysis relates events and actions to one another by configuring them as contributors to advancement of a plot…The result of a narrative analysis is an explanation that is retrospective, having linked past events together to account for how a final outcome might have come about'. Atkinson and Delamont (2005, p. 825) point out that to analyse narratives; we need to treat them as instances of social actions with "common practices, recurrent structures, cultural conventions, and recognizable genres". I remember the aims of narrative as stated by Dawson (2007, p. 84), "a narrative aims to portray in a rich and compelling way the problematic nature of life (including research)". In addition, I use metaphoric language in some of my chapter titles. For example in Chapter 1, "A beginning journey: the fish is not aware of the water in which it swims" represents my unconscious identity in the initial journey of revealing and reconceptualising my teaching identity. I also use interpretive commentary (Erickson, 1998) by including different theoretical perspectives into my texts to provide my emerging understanding on the topics discussed, which could be to confirm, disconfirm, enrich, and/or extend what is already known (Taylor, 2012a). Finally, as stated by Denzin and Lincoln (2005, p. 26), "qualitative research is endlessly creative and interpretive…there is no single interpretive truth…there are multiple interpretive communities, each with its own criteria for evaluating interpretations".

Quality Standards

Five quality standards guided my monitoring of my constructions (Guba & Lincoln, 1989) of the meanings of phenomena within my narratives. I used five research quality standards to think critically about my teaching identity and to envision my agency though reflections on both my personal and professional practices. Then, I wished to engage and empower my readers to think and act for a better future for education.

Critical reflexivity

My subjectivity could lead to overestimating my judgment of the phenomena that I have considered in my inquiry, especially in revealing and reconceptualising my teaching identity. I explored various factors that shaped my teaching identity, both

from within myself and within others, especially powerful factors According to Brookfield (2000), the central goal of critical reflection is ideology critique in which critical reflection illuminates power and the recognition of hegemonic assumptions. Brookfield (2000) points out the benefits for adult education of a critical reflection on ideas for better, authentic and compassionate lives, that is mistrustful of grand theories and grand narratives. To achieve the benefits we must consistently involve others and use experiences and opinions as the foundation. Thus, I consider that critical reflexivity does not only enable me to express my critical voice about others, but also it helps me reflect critically on my own thinking and actions. This quality standard represents my awareness and self-exposure to make judgments about my point of view within my different roles (Richardson, 2000). Reflexivity allows the researcher to reflect self-critically (Guba & Lincoln, 1989). According to Glesne (2006), reflexivity involves self-awareness and critical self-reflection by the researcher on his or her potential biases throughout the research process. In this way, my readers can judge the quality of my subjectivity in my narrative writing and self-reflections.

Praxis

Writing about my lived experiences served as a powerful tool to reveal and reconceptualise my teaching identity and develop my pedagogical practice, and also to engage my readers in developing their pedagogical thoughtfulness (van Manen, 1988). Therefore, I applied praxis as one of my quality standards. According to Taylor and Wallace (1996, p. 1), "Praxis concerns the way in which the researcher attempts to stimulate the reader to take deliberate action towards changing practice." My reflection on my own practice, not merely as self-evaluation, can be a learning process for readers. According to Bain, Ballantyne, Mills, and Lester (2002, p. 10), "reflection is an intrinsically good and desirable aspect of professional development." Furthermore, writing becomes the process of inquiry for exploring individuals' own voices (Richardson, 2000).

Representation

Embracing the postmodern paradigm stimulated me to reflect on how I would represent my data to engage both myself and my readers in understanding teaching identity and developing pedagogical practices. According to Taylor and Wallace

(1996, p. 1), “representation concerns the challenge of representing others without reducing them to objects of the researcher’s gaze” and I realize that it not easy to apply this quality standard. In presenting the voices of my co-teachers and their students, I intended to not ignore their meaning perspectives. Therefore, in relation to this quality standard, how I represent others’ realities via others voices becomes important.

Trustworthiness and Authenticity

Since I include others’ voices, constructivist based trustworthiness and authenticity are important for evaluating my research. Trustworthiness is called the parallel or foundational criteria because it is deliberately parallel to the positivist criteria of internal validity, external validity, reliability, and objectivity (Guba & Lincoln, 1989). Through the trustworthiness criteria (Guba & Lincoln, 1989), I progressively evaluated my research in terms of its credibility (via member checking), transferability (via thick description), dependability (via emergence), and confirmability (via data audit trail). In addition, the authenticity criteria are about relationships between others and me. Educative, catalytic, and tactical authenticity helped me to reflect on the engagement and empowerment process in my research (Guba & Lincoln, 1989).

Crystallization

According to Denzin and Lincoln (2008), within the crystallization process researchers can present the same narrative tale from different perspectives. Moreover, according to Richardson (2000, p. 934), within the postmodern paradigm, “we do not triangulate; we crystallize. We recognise that there are a far more than “three sides” from which to approach the world”. The crystallization concept encouraged me to value other perspectives on my teaching identity which could be different from mine and to accept them. Therefore, it was not only important for my pedagogical practice, but also for my emerging pedagogical self-knowing.

Taken together these quality standards enabled me to progressively evaluate my research as it unfolded. They provided guidelines to account for my belief in an empowering notion of teaching as well as for my vision to not just criticize, but to act constructively for a better future. As a result, this research has helped me to

understand my teaching identity and to affect me emotionally and intellectually within my pedagogical practice.

Ethical Issues

Because educational research is part of human research it has potential ethical problems. Due to the nature of autobiographical research, I realise the importance of considering how to avoid harming myself, especially for my professional practice once I return to my home country. Thus ethics of self-care, privacy and confidentiality are important. Drawing from the ARC project, I have used several voices of my co-teachers and students. Thus, I observed ethics of site access and acceptance, informed consent, and confidentiality. In general, I also endeavoured to avoid misinterpretation and the misrepresentation of data through adequate interpretation and representation**.**

Ethic of self-care, privacy and confidentiality

I realised the importance of an ethic of self-care in my research, since the research was about my personal and professional life. I needed to protect my privacy, especially related to my professional development. The risk that I faced was investigating my experiences as a student at various levels, especially negative experiences in my university. I needed to describe the weaknesses of the teaching and learning processes throughout my educational process. The stories relate to the reputation of my country, educational institutions, and some people included in the stories. This is especially relevant to my professional development as a lecturer when I return to my university. Therefore, "having empathy can be beneficial in research…if [the confidential information is] not handled correctly, it can cause discomfort and even a job loss" (Goffee & Jones as cited in Kakabadse, Kakabadse, & Kouzmin, 2002, p. 122). Therefore, I needed to use appropriate language to describe critical events properly, by: keeping the participants and institution as anonymous as possible, using the promise of confidentiality (Anderson & Arsenault, 1998; Cohen, Manion, & Morrison, 2000), including my family and colleagues. As "it is the duty of the researcher to protect the identity of individuals, there is a distinction between one's public role and private life" (Anderson & Arsenault, 1998, p.21).

Access and acceptance and informed consent

As part of using data from my participants in the ARC project, I consider the ethical issues related to access and acceptance and informed consent. “The initial stage of research project-that of access to the institution or organization where the research to be conducted, and acceptance by those whose permission one needs before embarking on the task” (Cohen, Manion, & Morrison, 2000, p. 53). I obtained written consent from the principals, science teachers, parents, and students to do this research. I informed them in writing about the aims, nature and procedures of this research (Cohen, Manion, & Morrison, 2000). And that their participation was voluntary and they could withdraw at any stage of the research. Informed consent offered information to the participants about “the nature and the purpose of the research, the risks, and benefits” (Anderson & Arsenault, 1998, p. 18). The participants were given an information sheet about the research process and their contribution (Hoornard, 2001). “Informed consent is a central canon of research ethics policy (Halse & Honey, 2005, p. 2148). The research involved observations, questionnaires, interviews, and reflective journals such as participants’ opinions and evaluations, subjectivity, and relationships. To meet the ethical requirements I gave a list of interview questions to my participants (Halse and Honey, 2005) and informed them about the time involvement and the process of interviewing.

Adequate interpretation and representation

Subjectivity sometimes can distort the research process and possibly the interpretation and representation of data (Kakabadse, Kakabadse, & Kouzmin, 2002). To not only protect myself, but also my participants, I used ‘member checking’ to get feedback on my interpretations. According to Connelly and Clandinin as cited in Creswell (2005, p. 483), this collaboration reduced “the potential gap between narrative told and narrative reported”. The participants were asked to comment on the relevant parts of my report that represented their perceptions, behaviour and cultural context (Cohen, Manion, & Morrison, 2000). Therefore, I needed to “be compassionate to individuals and avoid language that discriminates on basis of gender, sexual orientation, race or ethnic group” (Creswell, 2005, p. 11). Appropriate language helped me to avoid this conflict.

PART THREE: UNDERSTANDING MY PAST SCIENCE TEACHING

CHAPTER 3

WALKING IN THE PATHWAY OF DIFFERENT PERSPECTIVES: POWERFUL THEORETICAL REFERENTS FOR REFLECTIONS ON MY PAST SCIENCE TEACHING

INTRODUCTION

"We conceal our true identities for fear of being criticized, shunned, or attacked"
(Palmer, 2004)

This quote from Palmer (2004) resonates deeply with me in terms of my fear of revealing and reconceptualising my teaching identity. Once I began the journey of understanding myself as a science teacher I realised how this journey would ultimately open up the somewhat closed box of my personal and my professional identity as a teacher. Although I graduated in chemistry education and had experiences in teaching chemistry, I never really had a clear and comprehensive picture of myself as a teacher. During my pre-service education my lecturers always talked about techniques, skills and knowledge, but we almost never discussed our feelings, passions and visions. Thus, I used to feel that teaching was not much more than simply a technique. I agree with Palmer (2007, p. 12) who states that "we rarely talk with each other about teaching in any depth - and why we should have nothing more than tips, tricks, techniques to discuss? That kind of talk fails to touch the heart of a teacher's experiences". Palmer (2007) also points out that because identity and integrity are more fundamental to good teaching than technique teachers need to talk to each other about their inner lives. Thus I realised that I need to reflect critically on my experiences and my inner life, not only to reveal my teaching visions but also to empower my agency as a teacher.

As a beginning journey in this thesis for revealing and reconceptualising my teaching identity, I have written Part Three to understand more deeply the nature of my past science teaching through reflecting on my journey of being a science educator as well as my experiences in science teaching. I have compiled two chapters in order to

understand in a scholarly way the personal and professional values and beliefs that shape my teaching practices. *Chapter Three* portrays the theoretical perspectives which help me to reflect on my past science teaching in *Chapter Four* which portrays my autobiographical journey of being a teacher and my beginning journey of science teaching. In C*hapter Three*, I provide a scholarly perspective on the nature and history of science, followed by science education, then my journey of being a teacher, and I close by reflecting briefly on my science teaching in relation to Habermas' three interests, constructivism, curriculum, and assessment. I chose these theoretical perspectives based on their relevance to my experiences in *Chapter Four*. By combining the theoretical perspectives with my autobiographical journey in Chapters 3 and 4, I have come through a powerful and engaging journey even though at the outset I really struggled to understand and think deeply about the different theoretical perspectives that have shaped my past science teaching practice. These two chapters provide a comprehensive picture of the beginning journey of my science teaching as well as a beginning journey of revealing and reconceptualising my teaching identity.

DIFFERENT FACETS OF THEORETICAL PERSPECTIVES

In this section, I have divided into four 'big pictures' the theoretical perspectives that help my critical reflections in Chapter Four. However, I have not presented comprehensive accounts of each perspective, because of the word limitations of the thesis.

1. The Nature and History of science

In this section, I explore the nature and history of science. I realise that it is important for me as a science educator to have a deep understanding of the nature, and history of science, although I struggled to understand deeply the philosophy behind these topics as I did not study them in my teacher education or through my science learning. My teacher education focused on knowledge, skills and techniques of teaching. Also I have not focused deeply on philosophy of science, because I found that the nature and history of science are more relevant to my science teaching reflections in Chapter Four.

2. **Science Education**

   As a science educator, it is important to understand the nature of science education, including the aims, problems and issues. I portray the importance of the nature of science and student-teacher relationships, as well as truth and pluralism in science in relation to students' learning.

3. **Being a Teacher**

   I started my professional journey without having any aspiration of being a teacher, as I convey in the story, "I don't want to be teacher", in Chapter Four. I struggled as a beginning teacher not only because I didn't have any aspiration of being a teacher but also because I had to deal with students' misbehaviour in a vocational boys' school. Being a teacher became a nightmare journey for me; therefore, in this part I portray different aspects of motivation in being a teacher, in pre service teacher education, and as a beginning teacher.

4. **Habermas Three Interests, Constructivism, Curriculum, and Assessment**

   Habermas' three interests is the main theory for reflecting on my past science teaching practices. Then it is followed by theoretical perspectives on constructivism, curriculum, and assessment.

The Nature and History of Science

The nature of science

When I was a student and a beginning science teacher I simply thought science was the way to understand the world through systematic methods, namely "scientific methods". I remember my teacher asked me to memorise the steps of scientific methods which I recognised as science itself. I had never thought about the philosophy of science, the truth, or the scientific community. Thus, throughout my doctoral thesis, I started opening my eyes to a far deeper insight into the nature and history of science. I used to believe that science is developed in the belief of one truth; in that science there is only right and wrong answer, there is no opportunity for other beliefs. Then I realised that scientific knowledge is recognised not only because of its symbolic nature but is constructed and validated through social interaction, or the dialogue process, within the scientific community. I remembered the agreement in August, 2008, when it was decided that Pluto would no longer be classified a planet. I realised the power of the scientific community in deciding the truth of

science. Therefore, once scientific knowledge is validated by the scientific community it becomes ‘acceptable scientific’ concepts.

In relation to philosophy of science, Theobald (1968) states that science is concerned with facts about the world we live in, meanwhile the philosophy of science focuses on the nature of scientific facts (the structure of facts and the relations between them). Martin (1972) pointed out that there are four different ways to understand the philosophy of science; (1) a systematic development of the world view presented by science (the universe), (2) certain scientific investigations of science itself (history), (3) critical investigation of science as a social institution (society), (4) and analysis, clarification and critique of the concepts and methods of science (most common). As cited in McComas (2008, p. 249), the nature of science (NOS) is closely related, but is not identical to, the history and philosophy of science when NOS is defined as “a hybrid domain which blends aspects of various social studies of science including the history, sociology and philosophy of science combined with research from the cognitive sciences such as psychology into a rich description of science; how it works, how scientists operate as a social group, and how society itself both directs and reacts to scientific endeavours. For this chapter, I focus on the history and the nature of science to help me gain an understanding of the big picture of the philosophy of science.

According to Hoyningen-Huene (2008), in order to understand the nature of science, we can look to the history of science itself, even though at the beginning of the 21st Century there was no consensus among philosophers, historians or scientists about the nature of science, however, we could see that science has its own characteristics as a unique cultural product. In addition, science comes from the language of ‘scientia’ (Latin) which means knowledge. However, science could be referring to, in the broadest possible sense, not only all the sciences in the sense of the natural sciences but also the social sciences and the humanities. Therefore Hoyningen-Huene (2008) provides the features of science which characteristically distinguish it from other forms of knowledge, especially from everyday knowledge, by its higher degree of systematicity through eight dimensions - descriptions, explanations, predictions, the defense of knowledge claims, epistemic connectedness, an ideal of completeness, knowledge generation and the representation of knowledge. Meanwhile Milne (2011)

provides four components in science which are empirical criteria, logical argument, sceptical review and the natural world. These four components refer to the use of our senses/observations, the rules of logic, what is science, and exploring nature. Then, when I came across aspects of the nature of science I found the following statement by Lederman (as cited in Deng, Chen, Tsai, & Chai, 2011, p. 963) to be relevant to seven aspects of the nature of science:

> Scientific knowledge is tentative (subject to change), empirically based (based on and/or derived from observations of the natural world), and subjective (involves personal background, biases, and/or is theory-laden); necessarily involves human inference, imagination, and creativity (involves the invention of explanations); and is socially and culturally embedded. Two additional important aspects are the distinction between observations and inferences, and the functions of and relationships between science theories and laws.

Even though it has been debated whether scientific inquiry ought to be included in the nature of science, these seven aspects are recognised by many science educators (Deng, Chen, Tsai, & Chai, 2011). Thus, throughout the literature, I can see science is about exploring nature and everyday lives through scientific methods by certain rules of logic. Finally, I agree with a famous quote by Albert Einstein: “the whole of science is nothing more than a refinement of everyday thinking”, which means the whole of science is nothing more than a systematisation of everyday thinking (Hoyningen-Huene, 2008, p. 180).

In relation to the issue of science as a body of knowledge, according to Rosenblatt (2011), we need to differentiate between the body of understanding and the body of information. My understanding is that science in an effort to understand the world, not simply the source of information. Since understanding the world is complex and we need different points of view the issue of complexity in science is becoming important. Science is viewed not only as a singular body of knowledge but more as general systems, cybernetics, chaos, deep eco-logical, enactivist and autopoietic theories which emerge in dynamic structure (Fenwick, 2009). Thus, as science educators we need to realise whose knowledge has been privileged to understand the

world. As Tytler (2007, p. 22) points out, most scientists and science educators "see science as universal, and scientific knowledge as having privileged status on the basis of the reliability of the methods of science which has been criticized by different perspectives from "feminist, post-colonialist, sociological, anthropological, and from critical and cultural studies" with questions which refer to knowledge production such as "what can be known and by whom, and what constitutes and validates knowledge".

Since scientific ideas involve human beings science is not value-free. It involves passion, love, even ambition. Thus, Bekoff (2000) states that science supposes to tell us what things are and the way they are, however, science is not value-free with many prejudices embedded in scientific training and thinking. Even though most scientists are grounded in the common sense notion of science that "science is viewed as a fact-gathering, value-free activity in which individual values and subjectivity play no role", however we cannot ignore that scientists are humans who have individual agendas — personal, social, economical and political (Bekoff, 2000, p. 60). As science is also concerned with control, scientists often feel uncomfortable when they can't control the variables and sometimes controlled experiments ignore the existence of complex relationships among variables (Bekoff, 2000). Therefore, some scientists feel that they learn to deal with complex situations by not oversimplifying complex relationships among variables (Bekoff, 2000). According to Bekoff (2000, p. 62) "reductionism (in science) promotes alienation, isolation, and disconnection", thus he proposed scientists as holists and more heart-driven, which means that science is embedded with a "sense of togetherness and relationship, family and community, and awe" and "is infused with spirit, compassion, and love".

In education, the issue of including the nature of science has been widespread as, according to McComas (2008, p. 249), science curriculum reform starts to include the nature of science which helps students to understand and appreciate the scientific enterprise both as content (the facts of science) and process (the generation and testing of truth claims in science). According to Deng, Chen, Tsai, and Chai (2011, p. 962), views of the nature of science will help students to "(a) understand the process of science, (b) make informed decisions on socio-scientific issues, (c) appreciate science as a pivotal element of contemporary culture, (d) be more aware of the norms

of the scientific community, and (e) learn science content with more depth". Students' views of the nature of science involve 10 dimensions and can be conceptualized as a continuum ranging from positivist/empiricist to constructivist/relativist perspectives, [in which] positivist/empiricist views are labelled as naıve or inadequate views, whereas the constructivist/relativist views are labelled as informed or adequate (McComas, 2008).

Finally, we must also acknowledge indigenous scientific knowledge. McKinley (as stated in Milne, 2011, p. 8) "argues that Indigenous Knowledge is place-based knowledge, which is often dismissed as irrelevant in educational settings as science becomes, if it is not already, increasingly global and universal". According to Milne (2011, p. 8), "Indigenous Knowledge is local and, for people, their knowledge is specific to place. Indigenous Knowledge typically consists of creation stories and cosmologies that explain the origin of the Earth and people, codes of ritual/behaviour that organize human interactions with the environment, practices and patterns of resource allocation, and a body of factual knowledge". According to Milne (2011), the tide of positivism, logical empiricism and Eurocentrism views science as the knowledge of power, whereas a pluralist model recognises all knowledge as equal. Eurocentric science is not uniquely Western or modern. It has borrowed from knowledge traditions across the world, including the Americas, African, Chinese, Indian, Islamic, Arabic and Pacific (Milne, 2011).

The history of science

According to Erickson (2010), there are different ways to write the history of science: (1) a pragmatic or traditional approach, (2) inductivists or conventionalists, (3) anachronical (historical past of science in the light of current understandings of science) or diachronical history (present the past in its own context as if, later discoveries had not taken place), (4) vertical (a snapshot of the overall situation) or horizontal history (a film of a narrow part of science) and (5) internal (the ideology of the internal group) or external (express the ideology of a larger social group). We also need to consider reaching a broad audience and our readers' perceptions (Fuller, 2010; Rouse, 2010). Therefore, in this section, to reach a broad audience I represent briefly the history of science in a traditional way with several logical explanations of discovery at each stage.

I shall take the history of modern science as starting in the late 18th century in the form of factual narratives (the word 'scientist' had not yet been invented). From the mid-19th century, the history of Galileo struck the truth of science against religion, then during the 20th Century came 'the Scientific Revolution'. The history of science can be divided into four phases:

1. *The first phase,* the time of Plato and Aristotle until the 17th century. It is about scientific knowledge as absolute certainty in which there was an essential contrast between episteme (knowledge) and doxa (belief), and only episteme qualified as science. Its certainty was established by proof from evident axioms.
2. *The second phase,* the 19th century is continuous certainty for scientific knowledge, however it was not generalized to include inductive procedures. The whole set of rules were called 'the scientific method' (or 'scientific methods'). Scientific methods were mostly conceived as strict rules of procedure.
3. *The third phase* begins in the second half of the 19th century and ends sometime in the late 20th century. Empirical knowledge produced by the scientific method(s) was now assessed to be fallible. However, a special status was still ascribed to it due to its distinctive mode of production.
4. *At present, we are in the fourth phase,* which started around the last third of the 20th century. In this phase, belief in the existence of scientific methods of the above kind has eroded. Historical and philosophical studies have made it highly plausible that scientific methods with the characteristics as posited in the second and third phase do not exist.

Meanwhile Milne (2011) describes the history of science by using a timeline of science development; it is attached in Appendix 1. She points out that "when historians began to examine the history of Eurocentric science, especially in the 19th and 20th centuries, they typically elevated the role of Greek thinkers such as Pythagoras, Socrates, Plato, Hippocrates, Democritus, and, of course, Aristotle" (Milne, 2011, p. 21). On the other hand, McGrew, Alspector-Kelly, Allhoff, (2009) portray the history of science from an anthropological perspective, from the ancient and medieval periods, the scientific revolution, and the modern philosophers. However, similarities are found throughout the literature of the history of science - Aristotle and Plato were very influential in the development of science. Aristotle

promoted observation of nature, meanwhile his teacher promoted the separation of practical and abstract knowledge in schools (Milne, 2011)

Table 2. How Aristotle Valued Different Knowledge Fields

Aristotle's Classification Scheme for Knowledge		
Theoretical	***Practical***	***Productive***
Knowledge for its own sake- *Highest Form*	Knowledge about personal and collective (polis) conduct	Knowledge and skills - tools for utility- *Lowest Form*
Examples: metaphysics – nature of reality, physics – natural sciences, mathematics	Examples: Ethics and politics	Examples: dentistry, stonemasonry, home economics, metallurgy, smithing

Source: Milne (2011, p. 29)

In relation to education, the idea of the nature of science and philosophy of science has been influencing science education, such as in science teaching and curricula (Develaki, 2010). According to Martin (1972, p. 215-216) on the relevance of philosophy of science to science education, one obvious way for philosophy of science to enter science education is in the first sense of science education, that is, as part of what is learned in science courses. This could occur in several ways.

1. First, philosophy of science in any or all of the senses of the term philosophy of science could be part of the knowledge of what is the ease that is acquired in a science course
2. Secondly, not only could students acquire this intellectual knowledge connected with different senses of the term philosophy of science, they could acquire the knowledge of how to do certain things connected with philosophy of science in these different (p.216) senses; in short, they could acquire certain appropriate skills.
3. The science student could develop the ability to critically evaluate the use of science in society (philosophy of science in its third sense).
4. Finally, the student could learn how to analyse and criticize the concepts and methods of science

In addition, according to Niaz (2001), research in science education also has recognised the importance of the history and philosophy of science and its implications for textbooks. According to Hipkins (as cited in Tytler (2007), teachers don't feel comfortable to explicitly teach the epistemological basis of science. Finally, reading history of science helps us to understand and reflect on the history to improve the future (Fara, 2010). Meanwhile, an understanding of the development of science as well as the rules of logic in science would help student to understand the nature of science and other concepts in science.

Science Education

Science education and its aims

According to Webster (2008), science education could be understood as ways to make better people and enable them to live well in the world through their science learning. Webster (2008) points out that science education should not only help learners to have an understanding of scientific issues, but also have social intelligence which allows them to have the capacity to make decisions and judgements about all sorts of things in their lives. On the other hand, Tsai (2004) and Develaki (2010) argue that one of the primary goals of science education is helping students to have the capacity to use scientific methods along with science content learning and the nature of science. Davson-Galle (2004) points out that the general aims of science education are preparing professional scientists and the liberal education of non-scientists. Science education aims are having students develop an understanding of the *distinctive* nature of the scientific enterprise (including religion, ethics, and morals). In more detail, Yager (2000) points out four major goals of modern science education:

1. *Personal Needs*. Science education should prepare individuals to utilize science for improving their own lives and for coping with an increasingly technological world.
2. *Societal Issues*. Science education should produce informed citizens prepared to deal responsibly with science-related societal issues.
3. *Career Awareness*. Science education should give all students an awareness of the nature and scope of a wide variety of science and technology-related careers open to students of varying aptitudes and interests.

4. *Academic Preparation*. Science education should allow students who are likely to pursue science academically as well as professionally to acquire the academic knowledge appropriate for their needs.

Thus, science education aims not simply to help students to understand science, but also to use the knowledge for their personal and social lives.

Science Education and its problems

According to Tytler (2007), in Australia there are four main elements of crisis in science education which I believe is also happening all over the world including my country: (1) increasing negative attitude towards science in secondary school years, (2) decreasing participation in post-compulsory science subjects, (3) shortage of science-qualified people in the skilled workforce, and (4) shortage of qualified science teachers. According to Kruckeberg (2006, p. 1), one of the problems in science education is students' alienation, which means for them the science course is often 'hard'- obscure, puzzling and often irrelevant to the concerns of students. That science is 'hard', 'difficult', and 'irrelevant' are also a common belief in my country, thus it is a challenge for science educators to engage their students in science learning. Students need to understand that science is a rational process of conceptual development (Duschl & Gittomer as cited in Kruckeberg, 2006). According to Tytler (2007, p. 34), "the role of the teacher in this process is to work with students' ideas, scaffolding them to establish the very powerful discourses of the scientific culture and scientific ways of viewing and dealing with the world". Kruckeberg (2006) also states that, in Dewey's way, through learning science students should become better relational, system thinkers which facilitates them to have greater associations with others within the natural environment, thus science becomes primarily the means for making connections in their experience.

The issue of curriculum reform also has implications for science education. According to Coll and Taylor (2008), there are two factors that influence curriculum reform and development in science education which are the political dimension and "lack of coherences between what is purported to be a leaner-centred approach to education as detailed in various curricular documents and supporting teacher manual, and the assessment regime" (Coll & Talyor, p. 357). According to Tytler (2007, p.

18), “During the 20th Century, there have been many attempts to widen the school science curriculum in order to place greater emphasis on the cultural and human aspects of science. Recent examples of such attempts include arguments for a ‘science-technology-society’ or a ‘science-for-all’ or a ‘scientific literacy’ perspective. Science has a higher cultural value than other disciplines. “Science education of the twentieth century will be remembered not only for its role in perpetuating uncritically (and unwittingly) the cultural myths of seventeenth century experimental science, but also for the revolutionary role of constructivism in contesting the epistemological stranglehold of these 300-year-old myths on the practices of school science “ (Milne & Taylor, 1998, p. 20). In addition, teaching and learning approaches have gone in new directions, such as putting more emphasis on active learning so students have more opportunities to conduct scientific investigations. Also traditional assessment and evaluation has transformed to more authentic assessment, performance-based assessment and educative assessment (Hodson, 2003). However, there are still some problems, firstly with incoherence which has distorted and confused students’ understanding of the nature and methods of science, secondly, with using their scientific knowledge effectively and purposely and, thirdly, with decreasing students’ motivation once they pass through secondary schools (Hodson, 2003).

Students’ science learning: The truth and pluralism in science

According to Hodson (2003, p. 647), “ there is increasing recognition among science educators that science is a product of its time and place, inextricably linked with its sociocultural and institutional location, and profoundly influenced by its methods of generation and validation”. Ideas that are accepted by the scientific community could be problematic for some learners who struggle to relate these concepts to their own observation of the natural world. Many science teachers have an empiricist view of the nature of science rather than constructivist views, and they believe that scientific knowledge involves discovering the objective truth through experiments and observations. Therefore, if their teacher fails to facilitate the process of introducing students to this culture or social institution, students will find ideas about scientific concepts of nature separate from their experiences of nature itself. It is the basic idea of social constructivism to view scientific knowledge as the result of the scientific community’s activities through social processes. This view has major implications in

teaching and learning science for creating social activities in the classroom. The learning process should recognise that individuals construct their own meaning of scientific knowledge (the basic tenet of personal constructivism), which is further validated and communicated through social processes. It is important to shape science teaching in terms of helping learners to make sense of scientific knowledge at their individual level within this cultural process. It is different from the empiricist view which organizes individual sense-making and forces students to accept the scientific view without any personal sense of it. Therefore, the teachers' role is important to create a 'bridge' between individuals' construction and the community of scientific knowledge through creating the social cultural setting in the classroom.

On the other hand, the positivist position views scientific knowledge to be a true reflection of the world. This view claims there is absolute truth about the world, and that it is impossible to have different perspectives on it. Within this framework scientific knowledge is as true as nature itself, with no recognition of the intervention of social processes from within the community. According to Yore, Craig, and Maguire as stated in Rosenblatt (2011, p. 155), because they have absolutist views about science, where science is the body of truth, this means students see science as a truth. "Students' approach to science texts has less to do with how students understand the nature of science than how they understand the nature of being a student" (Rosenblatt, p. 156). As a result, there is only one way to acquire knowledge, which is through observation of the world itself. However, progress of scientific knowledge becomes problematic from this perspective when knowledge is changed as a result of social processes within the scientific community. Further, the social constructivist perspective proposes another view related to this ontology, which is that scientific knowledge is constrained by the world itself, but is further constructed by social processes. However, even though the positivist view needs to be evaluated, it is still widely applied in teaching science, including in my teaching.

Aikenhead (2000) proposes the idea of pluralism in learning science which relates to the interaction between different cultures of students and science itself (which is represented by Western science). School science should consider pluralism of cultural perspectives to be honoured in teaching and learning, so the silenced voices from other cultures will be heard. Since the science classroom is a subculture within

the school culture, students will face different cultural experiences, such as the cultures of their own experiences (daily lives) and the cultures of science itself (multi-science). Therefore, learning should recognise this border crossing of cultural experiences by the students. Then, successful learning experiences will involve a negotiating process between those cultures. Again, the teacher's role is important as 'a culture broker' to introduce the cultural borders, guide students back and forth over the border (it is reminiscent to me of the equilibrium concept in chemistry), help students to make sense of those different cultures, and motivate them to look at the contributions of 'Western science' in their lives.

Teaching in our schools requires the promise of making sense of things and nurturance of humility in the face of complexity, as well as nurturance of voice (Rosenblatt, 2011). We need to teach them that being critical is valuable as it allows them to express themselves if the text contradicts their sense of things (Rosenblatt, 2011). We need to encourage students to exercise their critical judgment of historians and scientists and to offer their views. They must be taken seriously, tracing the consequence and testing them where possible. According to Feynman as stated in Rosenblatt (2011, p. 163), "the first character of effective science teaching is before your begin you must not know the answer. There is a tension between the right answer and the right reasoning. We want our students to build an effective understanding of modern science which needs a solid foundation and critical habits of mind. It's a matter of students building an understanding of their world, not preparing them so that they may be given one". According to Bekoff (2000, p. 66), "children are inherently and intuitively curious naturalists", it is easy for children to absorb knowledge and retain new knowledge, but as teachers we often forget to help them "to develop their roles as future ambassadors with other animals, nature and ourselves". "So, it makes good sense to teach children well, to be role models, to infuse their education with kindness and compassion so that their decisions are founded on a deeply rooted, automatic reflex-like caring ethic" (Bekoff, 2000, p. 66).

Furthermore, enculturation in the science classroom needs to consider two perspectives: students' learning and a political dimension. Aikenhead (2000) points out students' stages of learning as: rote learning, in-depth meaning making, and learning as a cultural phenomenon. I consider these stages a hierarchical learning

process which reminds me of Habermas' three interests - technical, practical and critical - which is influenced by individuals' frameworks. Here, teachers play an important role to engage students at each step. Teachers who only focus on students' achievement to pass the assessments and curriculum will result in students' simply swallow learning. On the other hand, according to Solomon (1987) as cited in Aikenhead (2000), meaning making learning should include a social constructivist approach to gaining knowledge. This means a focus on students' engagement in the enculturation process of their own science culture with Western science, (only). Moving on to the next stage of learning as a cultural phenomenon, students will have the opportunity to engage with multicultural science, not only Western science in order to understand themselves from their own culture, even though the process of enculturation is similar to social constructivism. Social constructivist perspectives also recognise learners as anthropologists who have experience crossing over between everyday culture and science culture (Duit & Treagust, 1998), but the science culture is Western science itself. Driver et al. (1994) also point out teachers' role as mediator to guide students within their everyday language and science world, as the science world itself is "Western science". Therefore, using language becomes an important activity in the enculturation learning process (Garrison, 1995). The learning outcomes and experiences are successful only when the students' identities and their ability to harmonize their own culture (their everyday language) with Western science or have experienced a smooth transition through their border crossing. Therefore, the concept of proliferation seems to fail with uncultured students, and even the social constructivist teacher. On this perspective, Aikenhead (2000) proposes a different idea of enculturation through the use of pluralistic science in the school/classroom to engage students throughout their own identity which recognises the equity of all students. Moreover, according to Holland (2000), cultural processes must be highly dynamic and ever changing because the nature of minds and self also involves personal meanings and subjectivity. Therefore, including culture in science will help teachers to engage students' in their personal worlds.

Furthermore, it is important to involve learning within students' own context (their own culture). However, some teachers and students are uncomfortable with this multiscience curriculum because they need to negotiate the border crossing between

science and cultures. In addition, in multiscience students will have different experiences of border crossing with different types of science which lead to their understanding of: (1) their own biological and physical world, (2) their community, (3) another culture's ways, and (4) norms, beliefs, values and conventions of Western science. With this process, students could be free to take the science that makes sense to them, which is called acculturation, where the individual takes the features of other cultures. This acculturation process could empower students to participate in the community because they are aware of the border crossing of each science which is different from the concept of proliferation. Moreover, the notion of concept profile by Driver et al. (1994) provides opportunities for learners to have plural conceptual schemes which are appropriate for specific social settings. However, when it is not appropriate or does not make sense, the notion of replacement will happen. On the other hand, Aikenhead (2000) proposes a pluralistic approach where the new concept can be added to students' conceptual profiles and "old" concepts (the "common sense" knowledge) are still part of individuals' conceptual profiles. This process will give opportunities for students to have different perspectives which allow them to recognise difference. Learning in this way will be challenging for them. As a result, learning as a cultural phenomenon which is proposed by Aikenhead will be not powerful. Moreover, the stakeholders also needed to be considered as a dominant power, so the school science innovators must renegotiate their science culture. Finally, pluralism in science culture should be recognised and applied in the classroom to help students to engage with their learning within their own identity. However, negotiating the science content, both from rational criteria and political power by stakeholders, needs to be considered.

Being a Teacher

Being a teacher is not simply a matter of transferring knowledge and skills but about touching the hearts of students and empowering young generations to participate in building a better future for the world. Thus, teaching is always challenging. In addition, the literature provides several definitions of teaching, as Ball and Forzani (2009, p. 498) point out that teaching is "helping others learn to do particular things, is an everyday activity in which many people engage regularly". According to Henniger (2004), teaching also can be perceived as an art which involves the creative

interchange between teacher and students to create an inspired education process. Eisner (as cited in Block, 2008, p. 418) points out that teaching allow us to "(a) participate in the world of great ideas, (b) realise a form of immortality, (c) enact performance, (d) provide opportunities to create and participate in forms of aesthetic experience, (e) experience and represent a passion for learning, and finally, (f) make a difference in students' lives". Hiebert, Morris, Berk, and Jansen (2007) and Ball and Forzani (2009) also point out that the goal of teaching is to support students' learning, thus teachers should analyse their teaching in relation to effecting students' learning. Teaching consists of activities that help students' learning including activities carried out both inside and beyond the classroom, and also include cultural competence such as broad cultural competences, relational sensitivity, communication skills, and a combination of rigor and imagination fundamental to effective practice (Ball & Forzani, 2009). Teachers must enable others to learn, understand, think and do. According to Richardson and Watt (2006, p. 27), "quality of teachers and teaching are central to the development and maintenance of an intelligent and informed citizenry". Thus, this profession involves high responsibilities which include not only transferring knowledge to students, but also supervising, caring, understanding and emancipating. People have different factors that motivate them to choose the profession of a teacher. However, their motivation is important to guide them to being a good teacher. Therefore, in this section in relation to my personal journey of not wanting to be a teacher, I address the issue of the motivation to be a teacher, followed by an exploration of pre-service teacher education and beginning teachers.

Motivation of being a teacher

I realise that becoming a teacher is a great profession. It is not only transferring knowledge and performing in the classroom, but also educating, supervising, caring, and understanding. One powerful aspect of being a great teacher is motivation. Motivation could lead teachers to give the best performances and shape their students as holistic learners. Unfortunately, not all teachers are motivated to be teachers for the sake of teaching. For example, for some it is a means to increase employability and/or social status. However, the journey as learners and teachers often changes their minds. For example, some of them become motivated because of their teacher as a role model and others are motivated because of interactions with their students.

Therefore, I believe that becoming a teacher is a calling from the heart which encourages people to be good teachers. According to Palmer (2004), good teachers have the capacity of connectedness with themselves, their subjects, and their students, so their students can weave their world for themselves. In my experience as a chemistry teacher in a vocational school, I tried to understand my students' world to provide opportunities for my students to understand that their world is also an important part of learning.

Unfortunately, since I was a child, I didn't want to be a teacher. Thus, I didn't have any teaching motivation which caused me to struggle to engage with my teaching. I had the aspiration of being a doctor, but I could not afford the expensive training, thus I was not able to realise my dream of being a doctor. According to Banks (as cited in Miller & Endo, 2005), most students aspire to be doctors or lawyers. Darling-Hammond (as stated in Richardson & Watt, 2005) also points out that new university graduates from Australia, USA, and UK also do not see teaching as their chosen career. Thus, teaching is not a career priority for many people. Richardson and Watt (2005) point out five factors that influence students choosing a career as a teacher which are social status, career fit, prior considerations, financial reward and time for family. Meanwhile, Kyriacou and Coulthard (as cited in Mtika & Gates, 2011) state that many research studies show the reasons for choosing career as a teacher tend to cluster around: (a) *altruistic reasons*: seeing teaching as a worthwhile job, a desire to help children succeed, and a desire to help society improve; (b) *intrinsic reasons*: considering aspects of teaching itself, and an interest in subject knowledge; and (c) *extrinsic reasons*: considering aspects of teaching which are not inherent in the work itself, such level of pay and status.

According to Moore (1995, p. 209), "motivation can be defined as forces or drivers that energize and direct us to act as we do". Berelson and Steiner, and Tracy as cited in Ofoegbu (2004, p. 2) define motivation as all those inner striving conditions, described as wishes, desires, and urges to stimulate the interest of a person in an activity. Thus, motivation could empower individuals to perform the best in their activities. Teachers who have good motivation will try to give the best in the education process which influences their students' learning. However, teaching motivation is also influenced by cultural context. According to Mtika and Gates

(2011), research studies on motivation of those entering teacher education are mostly from developed countries, therefore it would be useful to gather views of teachers in developing countries. This is supported by Klassen, Al-Dhafri, Hannok, and Betts (2011, p. 580) who state that, “motivations for entering teaching may be influenced by the pathways that individuals follow to enter the profession, but also by cultural and contextual factors”. Thus, the integrated factors of choosing a career as a teacher, developed by Watt and Richardson, and Hofstede and McCrae as cited in Klassen, Al-Dhafri, Hannok, and Betts (2011), are: teaching ability, intrinsic career value, perception of teaching as a fallback career, prior teaching experiences, personal utility (job security, time for family, and job transferability), social utility (shaping the future of students, enhancing social equity, making a social contribution), and socio-cultural influences (social, religion, and gender roles).

According to Hoy (2008), by having a deep understanding of teacher experiences and aspirations, we could develop teachers’ education and commitment to their professionalism. The study of teacher motivation is important since it influences teaching quality, engagement and commitment (de Jesus & Lens, 2005). Teachers’ motivation is important because it effects their students’ motivation (de Jesus & Lens, 2005). Furthermore, teachers have both intrinsic and extrinsic motivation which influences them to enact their responsibility (Moore, 1995; Richardson & Watt, 2006). Teachers who are intrinsically motivated will view their job as a process which needs to be improved every time. One such example is that they will try to find ways to create meaningful and interesting learning experiences for the students. This motivation will influence the teacher to be creative in teaching strategies, evaluation, and interaction with their students. Furthermore, extrinsic motivation also influences teachers to perform better, such as salary. In my opinion, intrinsic motivation is more influential than extrinsic ones. But, teachers are also human and need to fulfil their needs. Therefore, both intrinsic and extrinsic motivations need to be concerned in order to improve the quality of teachers and thus influence the education process. According to Hare (1993, p. 117), “the good teacher believes in his subject and is genuinely, unashamedly enthusiastic about it”. Moreover, “the love of teaching can be identified in two components which are passion for the subject matter being taught and delight found in teaching others” (Henniger, 2004, p. 12). Therefore, teachers who show their love for teaching their students, are enthusiastic

with the subjects, and are caring for their students are those who will be great role models for their students.

Pre-service science teacher education

Different countries provide different types of teacher education. However, many have a similar approach to educating the pre-service teacher in terms of content knowledge, pedagogical knowledge, and teaching practicum. When I first began as a pre-service teacher I came across different terminologies used in pre- service teacher education. As a non-English speaker I was quite confused to come across terminology such as teacher candidates, pre-service teachers and student teachers. When I read an article by Hamman, Gosselin, Romano, and Bunuan (2010), I understood that there are different names for each stage in the process, from pre-service teachers, student teachers to in-service teachers. When teacher candidates enrol in teacher education they are pre-service teachers, then when they engage in the teaching practicum they are referred to as student teacher. When they graduate from university and gain a teaching position they are referred to as in-service teachers. In the context of teacher education in Indonesia, we only use the terminology of student teachers/pre-service teachers because we don't give a specific name to our students after they finish their teaching practicum.

I found my fellow pre-service teachers had many reasons for joining teacher education, including myself who joined the program because I didn't accepted in well-known university. According to Mtika and Gates (2011, p. 428), "trainee teachers' reasons for joining a teacher education course include: (a) as a result of a failure to follow a desired career choice; (b) a springboard to a career elsewhere; (c) a means to upgrade qualification; and (d) teaching as a vocation". Then, Mtika and Gates (2011, p. 428) also point out the images from the trainee teachers about teaching were: "(1) its ability to enhance teacher's knowledge; (2) low pay with no incentives; (3) low status profession; and (4) lack of trust for male trainee teachers". As a teacher educator, I realise that these reasons for joining teacher education influenced my own students to study the knowledge, skills, and emotional aspects of being a teacher.

According to Milner IV (2010, p. 118), “preparing teachers to teach is about teachers building a repertoire of knowledge, attitudes, mindsets, belief systems, and skills for success through a teaching journey; teachers develop the cognitive and analytic skills to continue learning through processes of improving their work”. Ball and Forzani (2009, p. 507) also point out that, “one challenge involved in centering teacher education in practice is careful deconstruction and articulation of the work of teaching with detailed elements”. Meanwhile Diez (2010) states the relationship between teacher educators and their student is to foster the development of the knowledge, skills and dispositions that constitute the intended outcomes of that program. The basic questions are these: Have they learned what we taught them? Does their performance demonstrate the outcomes of our program?

According to Davis, Petish and Smithey (2006, p. 608), ”one purpose is to help teacher educators and others concerned about teacher learning to make instructional and curricular decisions based not on assumptions or conventional wisdom but instead on the actual research base”. According to Davis, Petish and Smithey (2006, p. 620) “teacher educators need to consider how to build on new teachers’ strengths and devise instructional opportunities that could promote growth in areas of weakness, such as translating some productive ideas into practice”. In addition, teacher educators should help their student teachers to cross the border of theory into practice for being a teacher, as stated by Rots, Kelchtermans, and Aelterman (2012, p. 9), “teacher educators should strive to help their students develop realistic images of the teaching profession and of themselves as teachers in order to guarantee that their decision to (not) enter the teaching profession is well-considered and informed”. One way to help student teachers is through the teaching practicum. According to Hamman, Gosselin, Romano, and Bunuan (2010), teaching practicum is the phase of preparation by realignment or accommodation of personal identity as a beginning teacher to reconcile the differences between theory in university and the practical setting in the school. Rots, Kelchtermans,and Aelterman (2012, p. 9) also point out that:

> it is essential that student teachers’ field experiences are valid and representative of the teaching profession, i.e. that the conditions in practical training represent the real working conditions in the job. This way, student teachers can reconstruct their professional self-

understanding (especially job motivation) through their actual confrontation with the (different) realities of schools

According to Brouwer and Korthagen (2005, p. 155), “novice teachers do not feel sufficiently prepared by their teacher educators and come to view colleagues in their schools as “realistic” role models, as the people who “do know” how one should go about teaching. As a result it is important that, as teacher educators, we are careful that our students replicate our teaching, and thus we should strive to be good teacher educators to create good teachers. According to Goldstein and Freedman (2003, p. 452), teacher educators should engage their student teachers in the nature of the teaching and learning interactions because “our preservice teachers are paying attention not only to what we say but to what we do…, then teacher educators must be mindful of our day-to-day experiences and relationships with our students to enable them to learn from us”. Thus, at any education level role modelling is important.

According to Imig and Imig (2006, p. 286), “schools of education must become agents of change by preparing teachers steeped in the realities of modern schools but aware of the power of an individual teacher to impart change”. According to Hoy (2008, p. 497), “the tensions between serving and surviving, between caring and control, between deep investment and protective distance are seldom addressed in teacher preparation”. Alger (2009, p. 743) points out that “understanding the growth and development of teachers’ conceptions of teaching over time may help teacher educators, administrators, and professional developers work more effectively with teachers”. Meanwhile Goldstein and Freedman (2003, p. 442) stated that “teacher educators do not need to teach pre-service teachers how to care; however, we do need to help them understand the role of caring in teaching and prepare them to teach in ways that draw on the power of caring relationships in teaching and learning”.

A beginning teacher

Watt and Richardson (2008) point out three types of beginning teachers; highly engaged persisters, highly engaged switcher, and lower engaged desisters; with differences in choices of teaching as a career, perceptions about the profession, and career intentions. Thus, again, discussion of reasons for choosing career as a teacher

also influences their motivation of remaining a teacher. According to Flores and Day (2009, p. 219), “most of the studies of new teachers highlight the sudden and sometimes dramatic experience of the transition from student to teacher”. “Both the influence of the school context and the personal background experiences during pre-service education are identified as important variables to be taken into account in the assessment of early teaching experiences” (Flores & Day, 2009, p. 220). Thus, in relation to the school context, it is also important that beginning teachers build relationships with school communities. As stated by Johnson and Birkeland (2003, p. 581), “although the respondents’ prior career orientations, financial situations, and preparation played a role in their career decisions, their experiences at the school sites were central in influencing their decisions”. “Schools also can help teachers, students, and their families to foster positive, collaborative relationships by establishing explicit norms for respect and equity, enforcing school-wide expectations about behaviour, and engaging parents in the goals and life of the schools” (Johnson & Birkeland, 2003, p. 584). Thus, helping student teachers’ transition and school support are important in maintaining motivation of beginning teachers.

According to Levin, Hammer, and Coffey (2009), the first stage that beginning teachers face is identifying themselves as a teacher which occurs when they begin to interact with students with their differences. In this stage, they focus on their own behaviour, and once resolved their attention moves onto students’ learning (Levin, Hammer, & Coffey, 2009). In relation to beginning science teachers, according to Davis, Petish and Smithey (2006), there are several areas that should be understood by them: (1) the content and disciplines of science, (2) learners, (3) instruction, (4) learning environments, and (5) professionalism. They found that “new teachers hold relatively unsophisticated beliefs, which would cause difficulties in portraying science appropriately”. Davis, Petish and Smithey (2006) point out that new science teachers struggle with understanding their learners. They found that science elementary teachers tend to emphasize the use of hands-on activities, meanwhile secondary teachers, while showing variation, tend in general to focus on content which is what happened in my context.

In relation to the teacher metaphor, according to Alger (2009), beginning teachers tend to start teaching by means of a student-centred conceptual metaphor, meanwhile very experienced teachers began teaching with a teacher-centred conceptual metaphor. Alger (2009) classified different metaphors for identifying teachers' teaching metaphors in teacher-centred and student-centred methods, which are teaching as Guiding, Nurturing, Moulding, Transmitting, Providing Tools, and Engaging in Community. Davis, Petish and Smithey (2006) point out that new teachers want to apply student-centeredness but they focus on classroom management which may work against that goal. New teachers tend to have concerns about and struggles with management, sometimes leading them to engage in less reform-oriented teaching practices. Several studies show that the major concerns of beginning teachers are those of discipline and classroom management (Dropkin & Taylor, 1963; Grant & Zeichner, 1981; Varah, Theune, Parker, 1986). Even according to Doyle (1975, p. 38), "most beginning teachers (approximately 75 percent) encounter some difficulty with the demands of managing their classes. Failure to help them master the necessary group management skills often leads to discouragement and failure." In order to deal with classroom management, there is one way to solve the problem which is caring, according to Goldstein and Freedman (2003, p. 441), "caring is widely believed to be a central facet of teaching". Pre-service teachers generally enter their professional preparation experiences confident about their ability to care for their students. However, like all of the skills, attitudes, and dispositions required to teach well, caring is not always as easy as it may look to novices (Weinstein, 1998). Researchers have found pre-service teachers struggling with issues related to caring teaching during their field experiences. Finally, different problems are faced by pre-services teachers, thus in order to be successful in crossing the borders between student teachers/pre-service teachers into beginning teachers, into in-service teachers, they should know the reality that they will face and have the knowledge and skills to deal with these problems.

Habermas Three Interests, Constructivism, Curriculum, and Assessment

In this section, I review different theoretical perspectives that have shaped my past teaching practice. I use Habermas' three interests for reflection on my past science teaching, and then focus on theoretical perspectives of constructivism, curriculum, and assessment.

Habermas' three interests

Jurgen Habermas is widely considered as the most influential thinker in Germany over the past decade. As a philosopher and sociologist he has mastered and creatively articulated an extraordinary range of specialized literature in the social sciences, social theory and the history of ideas in the development of a comprehensive and provocative critical theory of knowledge and human interests. His roots are in the tradition of German thought from Kant to Marx, and he has been associated with the Frankfurt School of critical theorists which pioneered in the study of the relationship of the ideas of Marx and Freud. (Mezirow as cited in Ewert, 1991, p. 345)

> *Interest in general is the pleasure that we connect with the existence of an object or an action. (Habermas, 1972, p. 198)*

According to Grundy (1987, p. 9), "interests, in general, are *fundamental orientations of the human species* and pure interests are fundamental, rational orientations". Grundy (1987, p. 7) points out "a theory about the fundamental human interests which influence how knowledge is "constituted or constructed" which was proposed by the German philosopher Jurgen Habermas through three basic cognitive interests: technical, practical and emancipatory. These beliefs influenced my teaching approaches and my relationship with students, from focusing on students' achievement into engaging students' learning. Habermas (1971, p. 313) provides detailed explanations that "the specific viewpoints from which, with transcendental necessity, we apprehend reality ground three categories of possible knowledge: information that expands our power of technical control; interpretations that make possible the orientation of action within common traditions; and analyses that free consciousness from its dependence on hypostatized powers". In detail, these three interests are:

1. *Technical Interest*

   "The technical interest, like each of the fundamental human interests, is grounded in the need of the species to survive and reproduce both itself and those aspects of human society which are deemed to be of most worth" (Grundy, 1987, p. 9). According to Bullough and Goldstein (as cited in Ewert, 1991, p. 348), "people's technical interests are reflected in the need to control and to manipulate their external environment to satisfy their needs for shelter, food, and so on". I shaped my teaching practices within the measurement of academic achievement to facilitate my teaching and neglected my subject as "worth knowing" (Henderson & Kesson, 2004), and focused on controlling my

students' academic achievement (Grundy, 1987). Thus, in relation to educational research this would be evaluating the efficiency with which established goals are achieved by gaining a more complete mapping of the cause and effect relationships in education. Meanwhile in teaching this would be teaching as a skilled craft based on technical expertise (Ewert, 1991).

2. *Practical Interest*

"The practical interest is grounded in the fundamental need of the human species to live in and as part of the world, not to be, as it were, in competition with the environment for survival" (Grundy, 1987, p. 13). "People's practical interests are reflected in their use of language to further mutual understanding of individual interests and needs and to coordinate social action to satisfy mutual interests and needs" (Ewert, 1991, p. 351). Thus, in teaching teachers it would help students to interpret and understand the knowledge by: "(a) revealing the contextual social rules and assumptions that underlie their actions; (b) identifying the social norms and expectations bounding the range of acceptable policy actions; and (c) revealing how their actions are, or will be, perceived by other participants in the educational process" (Ewert, 1991, p. 352). According to Carr and Kemmis (as cited in Ewert, 1991, p. 352), the interpretation "must be authentic for the individuals involved and communicable within the group (that is, that they are mutually comprehensible).

3. *Emancipatory Interest*

"The emancipatory interest is concerned with empowerment, that is, the ability of individuals and groups to take control of their own lives in autonomous and responsible ways" (Grundy, 1987, p. 17). People's emancipatory interests are reflected in our motivation to grow, develop our interest in self-knowledge, self-reflection, freedom, and relational autonomy (Ewert, 1991). Since education is a social activity, teachers with emancipatory interest will use any opportunity to raise issues about educational purpose, social institution, relationship with participants, and then envision what kind of future that we need to build (Ewert, 1991).

Furthermore, Ewert (1991, p. 347) summarised Carr and Kemmis's book (1986) on these three human interests:

Table 3. Interest, Knowledge, Power, and Science Linkages

Interest	**Knowledge**	**Medium**	**Science**
Technical	Instrumental (causal explanation)	Work	Empirical-analytic or natural sciences
Practical	Practical (understanding)	Language	Hermeneutic or interpretive sciences
Emancipatory	Emancipatory (reflection)	Power	Critical sciences

According to Ewert (1991, p. 347), "in order to explain the relationship between knowledge and human activity, Habermas developed the theory of knowledge-constitutive interests. Because knowledge is rooted in the past as well as existing social structures, it can be understood only in relation to the problems humanity has encountered and continues to encounter in survival". According to Ewert (1991, p. 348), "Carr and Kemmis (1986) interpret Habermas' elaboration of interests, knowledge, and science as an attempt to identify both the importance of and the limits of empirical-causal and hermeneutic-interpretive explanations. On the basis of Habermas's description of critical social science, intended to overcome the limits to knowing inherent in the natural and interpretive sciences, they formulate a critical education science. Mezirow (1981, p. 3) sees Habermas' paradigm of interests, knowledge, and science as definitive domains of adult learning with discrete learning goals, pedagogical methodologies, and learning needs. Bullough and Goldstein (1984) focus on interests in their attempt to explain why the place of art in the elementary school curriculum is in danger from the dominating influence of technological rationality. However, a review of each interest is required for a basic understanding of Habermas' theme of comprehensive rationality as well as his implications of knowledge-constituent interests for education.

Constructivism

Constructivism has been recognised as a comprehensive vision for education and teacher references in educational philosophy. According to Kruckeberg (2006), the constructivist perspective is widely accepted in education, especially in science

education; however some educators are using constructivism without having a deep understanding of its meaning. According to Kruckeberg (2006), the simplest way to understand constructivism is as a theory of learning. Constructivism as a theory of learning is developed based on Kelly's work (1950s) on personal construct theory and Ausubel's work (1960s) on learning based on what the learner knows (Benner, 2003 as cited in Parkinson, 2004). Furthermore, one of the first psychologists to focus on children's thinking process was Jean Piaget. According to Piaget (1970), knowledge is constructed in learners' minds through their interaction with the environment. Piaget believes that there was a biological inevitability to how children developed (Marsh, 2000). Furthermore, according to Bodner (1986, p. 873), "there are three concepts of Piaget's work which relate to constructivist theory of knowledge which are assimilation, accommodation, and equilibration". Therefore, Piaget's work had some insights (Marsh, 2000) which are: (1) children think differently related to their stage of development, (2) learning requires active involvement between children and their environment, and (3) children construct their own cognitive structures. Therefore, Piaget's work is important in the constructivist theory of learning.

Constructivist learning is different from the traditional view of learning in the sense of the view of knowledge, truth, objectivity and reality. "The traditional view of knowledge is based on the common-sense belief that a real world exists regardless of whether we take interest in it or even notice it" (Bodner, 1986, p. 874). The traditional view of knowledge implies that the knowledge is reality that will be applied in the learners' mind. As a result, the teacher's task is transferring the knowledge to the learners. Furthermore, the traditional educational view focuses on "instructional goals such as recalling facts, generalization, defining concepts and performing procedures" (Almala, 2005, p. 9). This view ignores difference in the existing knowledge of the individual. Moreover, the traditional epistemology of behaviourism is concerned with the power of reinforcement and students' performance rather than the reason behind the learners' response. Therefore, the traditional view of learning focuses on students' achievement rather than the learning processes.

On the other hand, proponents of constructivism "emphasize reasoning, critical thinking, social negotiation, self-regulation and mindful reflection" (Almala, 2005, p. 9). Constructivism focuses on the knowledge which is constructed in the learners' mind (Bodner, 1986). It is an active process in which the learners actively construct knowledge as they try to comprehend their reality. Because every student has different experiences, teachers have to be aware that knowledge is constructed differently in learners' minds. Through the teaching and learning process, learners will face problems if their knowledge does not match with the 'acceptable' concepts (which are recognised in personal and social constructivism). Therefore, constructivism views learning as the product of interaction between existing understanding and new knowledge (Parkinson, 2004). Furthermore, constructivism also recognises the influence of the social context within the meaning making of knowledge. Therefore, it generates the concept of collaboration and discussion in classroom activities. According to Vygotsky (1978), the basic concept of constructivism is based on Piaget's idea which embraces that knowledge should not represent the real world as existing separately and independent of the knower. This view posits the idea that learners have independences about their own reality. It doesn't mean denying reality, but there is no certainty about reality. According to Vygotsky (1978) constructivism doesn't ignore conceptual knowledge, but teachers have to consider the nature of cognition which is adaptive. As a result, students could have different levels of cognition which are influenced by their effort to find reality within their experiential world. There are two main views to understand the differences between the epistemology of constructivism and other views which categorise them according to psychology or philosophy.

Table 4. Epistemology Differences between Constructivism and Other Views

Epistemology	
Constructivism	**Others**
Based on Philosophical: 1. The theory of knowledge which concerns "the logical categories of knowledge and its justificational basis". It involves both subjectivity of individual's knowledge and conventional knowledge 2. Knowledge is stronger than beliefs 3. Context of justification 4. Requires self-regulation, building conceptual structure through reflection and abstraction 5. Students' experiential world is important 6. Active learning process 7. Meaningful learning experiences	Based on Psychological: 1. The theories of knowledge development are constructed by individuals, theories, and general conditions of learning 2. Persons' beliefs are stronger than their knowledge 3. Context of discovery 4. Knowledge as absolute true 5. Learning is stimulus and response 6. Passive learning process 7. Memorizing, rote learning

Constructivists view learning as an active process in which learners actively construct knowledge as they try to comprehend the reality of their world. According to Kruckeberg (2006), the constructivist would agree that learning takes place when students are active, however what's important is how and under what conditions knowledge is constructed. Thus, Driver and Bell (as cited in Parkinson (2004, p.90) point out six characteristics of constructivist theory of learning:

1. learning is not only dependant on the learning environment, but also the knowledge of the learners,
2. learning involves the construction of meaning,
3. the construction of meaning is a continuous and active process,
4. meaning, once constructed, is evaluated and can be accepted or rejected,
5. learners have the final responsibility for their learning,

6. students construct meaning from their experience with the physical world through natural language.

According to these six principles, which are related to Piaget's work, teachers could use this information to apply teaching strategies using a constructivist theory of learning.

However, when I came across constructivism, I realised that it is not simply a theory of learning. Thompson (as cited in Richardson, 2003, p. 1624) "suggests that constructivism is not a theory of learning but a model of knowing, and constructivism may be used to build a theory of learning". According to Matthews (2002), debate and analysis on different views of constructivism could be separated into: (1) Constructivism as a theory of learning. (2) Constructivism as a theory of teaching. (3) Constructivism as a theory of education. (4) Constructivism as a theory of cognition. (5) Constructivism as a theory of personal knowledge. (6) Constructivism as a theory of scientific knowledge. (7) Constructivism as a theory of educational ethics and politics. (8) Constructivism as a worldview. In terms of my own personal experience, constructivism's role is more a worldview than a theory of learning which influences the way I teach and engage students' learning.

One of the insightful theories that I have found is the different forms of constructivism in Ernest's (1995) book - the chapter on constructivism in education explains the idea of "the one and the many". The author brings the idea of "the one" as different positions which are common in the concept of constructivism and "the many" as analyzing differences between different positions of constructivism. This table is a summary of the "many" different types of constructivism:

Table 5. Different Forms of Constructivism

Forms of Constructivism	Metaphors of Mind	Metaphors of World
Traditional Empiricism	• Mind as empty bucket, mirror • The objects in mind are reflection of reality • Students receive knowledge passively	• Absolute Newtonian physical space (moved and positioned) • The world is out there based on observations • Students' misconceptions related to carelessness in application or differences with the reality
Information-Processing Theory	• Mind as computer • Processing, recalling, and memorizing information (interactive) • Process on human problem solving (active mental processing) • Students receive the knowledge through complex mechanical process	• Absolute Newtonian physical space populated by material objects • The world of things we experience are out there • True knowledge and certainty
Trivial Constructivism	• Mind as an ideal "soft" computer (brain) • Self-constructed of information • All individual knowledge is constructed	• Absolute Newtonian physical space • The knowledge is constructed to match with the world • Constructed truths can be recognised by information from the world
Sociocultural Cognition	• Mind as game player and strategist • Involves rational rules, scripts and procedures which extend from simply	• Absolute Newtonian physical space involves human society • Apprenticeship, participation, and social

	computer processing • It has goal, strategies, and deliberation	activities • Social aspects in teaching and learning situation
Radical Constructivism	• Mind as an organism undergoing evolution • Cognitive evolution • Cognition is adaptive based on the experience, not discovery of reality	• Experience-able, but not knowable • Recognise the existence of subjectivity on individual experience to interpret the world • Knowledge being constructed by dialogue between cognitive process and individual experiential world
Social Constructivism	• Person in conversation and person in meaningful interaction and dialogue • Social construction of meaning • Effects of social contexts within the construction of self, beliefs, and cognition	• Socially constructed world that creates the shared reality of the underlying physical reality • The essential and constitutive nature of language and social interaction
Social Constructionism (both social and radical constructivism but less developed)	• Mind as dialogue or drama • Introjected social dimension • Individuals as actors • The mental is to be found in social performance and public display	• Social reality

Based on a summary of this table, it seems constructivism can be divided into trivial constructivism and radical constructivism. This is because I have found radical constructivism has great differences from other forms of constructivism. Even though, from the beginning, my understanding of constructivism was that it was divided into personal, social, and radical constructivism. Tytler (2002) points out that personal constructivism focuses on the prior knowledge of individuals which can be constructed by individuals. Social constructivism focuses on individual constructs of knowledge throughout the social process. Both of these types of constructivism emphasize 'conceptual change'. On the other hand, radical constructivism focuses on the way students find the truth, and the notion of truth itself (metaphor of the world) is different from other versions of constructivism. However, Matthews as cited in Richardson (2003, p. 1624) divides constructivism into 18 forms, including methodological, radical, didactic and dialectical, thus this book indicates "many unanswered questions in the constructivist theory literature such as those related to knowledge, how it is created, what is social, and how subject matter affects the way we are constructivist in practice". According to Thorburn and Collins (2003), crucially, there are relatively 'strong' and 'weak' forms of constructivism in which strong constructivism is characterized by proactive mental construction which requires deep understanding and which allows students to go beyond the provided information; whereas weak constructivism is characterized by notions of starting from learners? and teachers becoming facilitators.

Ernest (1995) points out several major implications of constructivism on pedagogical practices concerned with knowledge constructed by the individual, the role of social context, the importance of individual experiences and subjectivity of knowledge. Through personal constructivism, which is recognised by many paradigms other than traditional empiricisms, the teacher has to be aware that knowledge is constructed differently in the learners' mind which is influenced by their interaction and experience with the environment. Teachers could explore the prior knowledge of students then use the information to guide students' conceptions. Therefore, diagnostic skills become important in this stage. In addition, teachers can use the information of students' pre-existing knowledge to create instructions which can avoid the "misunderstanding" of concepts. Teachers should help students to construct their own meaning and knowledge through active

processes such as metacognition. As a result, the learning process will be a meaningful experience for the students. This metacognition is the approach that I implemented in my past teaching experiences which I reflect in Chapter Four.

Figure 6. Metacognitive Approaches

According to Winn and Snyder (1998), the metacognition process is divided into three steps: monitoring progress in learning, making changes, and adapting learning strategies to get the best achievement. In other words, the metacognitive approach consists of three steps: planning, self-evaluation, and self-monitoring (see Figure 6). According to Flavell as cited in Achacoso (2005), metacognition consists of both metacognitive knowledge and metacognitive experiences which relate to self-awareness. Therefore, metacognition refers to learners' automatic awareness of their own knowledge and their ability to understand, control, and manipulate their own cognitive processes. As a result, metacognitive skills are also important in individuals' lives, because they apply self-reflection to solve problems which is powerful to individuals' empowerment in their learning.

Metacognitive skills allow students to understand their thinking process and concepts (Wellman, 1983 as cited in Pressley, Mac Kinno, & Waller, 1985). Most studies of students' understanding stated solutions through the use of meaningful learning experiences (Rickey & Stacy, 2000; Treagust, Chittleborough, & Mamiala, 2004). Metacognition promotes meaningful learning in students because "metacognition involves, among other things, taking responsibility for one's own learning process" (Anderson & Nashon, 2006, p. 299). "In metacognition classrooms, learners are expected to ask questions about where they went wrong and to tell the teacher when they don't understand" (Parkinson, 2004, p. 99). Metacognitive skill is important in learning and teaching because awareness of one's of thoughts is important for developing an understanding of ideas and awareness and control of thinking. It has been shown that the control of thinking has a significant impact on problem solving

success. Therefore, metacognitive skills are important to understanding ideas and give significant impact on problem solving in chemistry (Rickey & Stacy, 2000).

I relate the metacognitive approach that I used with several theories on trivial constructivism on students' understanding. Tytler (2002) points out the basic principles of constructing students' learning through three learning models which are: (1) the generative learning model of Cosgove and Osborne, (2) the interactive approach of Biddulph, and (3) the Japanese science activity structure of Linn, Lewis, Tsuchida and Sanger. Although these models are different in several ways, the principle is similar, which is exploring and guiding students' prior knowledge through class discussion and generating shared meaning. The table below is a summary of these three learning models.

Table 7. Three Learning Models Guided by Constructivism

Principles	**Phase**		
	Generative Learning Model	**Interactive Approach**	**Japanese Science Activity Structure**
Explore students' prior knowledge	• Preliminary	• Preparation	• Connect lesson to students' interests & prior knowledge
Establish the context	• Focus	• Exploratory activities • Students' questions	• Elicit student ideas and opinions
Stimulate Students' Curiosity	• Challenge		• Plan investigation (create the predictions)
Conduct Investigation	• Application	• Students' investigations	• Conduct Investigations
Reflect on the students' ideas		• Reflection	• Exchange information • Analyze information • Reflect the prediction • Connect to the next lesson

Table 8. The Principles of Three Learning Models and a Metacognitive Approach

Principles	
Three Learning Models	**Metacognitive approach**
Explore students' prior knowledge	Explore students' consciousness of their prior knowledge and guide them to the topic (control of learning)
Establish the context	
Stimulate students' curiosity	Encourage students to predict the investigation
Conduct investigation	Select the strategies (investigation)
Reflect on the students' ideas	Monitor the progress of learning Correct the errors Analyse effective strategies Change the learning when necessary

I realise that this conceptual change approach can lead to the transfer and replication of knowledge approach because when teachers try to guide students' prior knowledge towards the acceptable knowledge, the decontextualisation of knowledge becomes a major constraint. As a result, science, math, or other knowledge becomes separate from learners' worlds.

Ernest's (1995) move on to radical and social constructivism provides the main implications for pedagogical practices such as that knowledge is subjective, even for mathematics and other logical knowledge; and therefore teaching strategies will be more reflexive rather than about finding the truth. According to Thorburn and Collins (2003, p. 188), within such 'broad constructivist' conceptions of learning, various authors have drawn upon the founding work of Vygotsky (1978) on the importance of social interaction and students' discussion in learning. Moreover, the focus is not only learners' cognition, but also their beliefs and knowledge conceptions. As a result, teachers' beliefs, conceptions, and personal understanding of subject matter become more important than teachers' knowledge of subject matter and teaching strategies. Furthermore, different learners have different realities in their minds, and therefore, there is not a fixed reality. Social constructivism emphasizes the idea of social context for meaning making such as discussion, collaboration, and negotiation. As a result, teaching is not simply about transferring content knowledge, and

learning is not simply ‘absorbing’ the information; there is students’ experiential world that we need to consider throughout our teaching.

Curriculum

Curriculum is what happens in classrooms and schools, not state capitals. Thus, it comes as no surprise that state-mandated models for improvement have not worked
Holdzkom (1992, p.12)

Smith (1984) provides several possibilities of curriculum definition which could be a means, an end, or a product of teaching and learning, however, he states simply the definition of curriculum is a document which states what it is that you want the students to learn. Meanwhile Haberman (1992, p. 11) provides different features of curricula which are, “what’s in the textbooks, what the teacher actually teaches, what the students learn, and what is included on tests”. Meanwhile Grundy (1987, p.5) points out that “curriculum” is often written and spoken about in an idealistic sense as if there is a perfect `idea' *(eidos*) of a curriculum of which all individual curricula are more or less imperfect limitations”. “Curriculum is quite often defined as a product - a document which includes details about goals, objectives, content, teaching techniques, evaluation and assessment, and resources [which are issued by government]” (Marsh, 2000, p.66). Grundy (1987, p. 5) also points out that “curriculum is a cultural reproduction, it is not an abstract concept which is outside or prior to human experience”. According to Holdzkom (1992, p. 13), curriculum is defined “as the goals, expectations, and ends for which schooling is supported …will include resources (fiscal and otherwise), statements of purpose or activity, and accountability structures”.

Curriculum can express “the desires of a hegemonic power structure, forcing teachers and learners to conform to rigidly controlled conditions” (Baptis, 2002, p. 27). Even though “curriculum is often portrayed as a formal and technical process…[it could] involve intense give and take, sharing of ideas, questions about philosophy, and so on by professional teachers” (Beane & Lipka, 1986, p. 199). Therefore, I believe that teachers still have the opportunity to shape their teaching in the classroom for meaningful learning for the students. Furthermore, it is a challenge for teachers to shift their paradigms from standardized tests to facilitating student

inquiry (Magestro & Stanford-Blair as cited in Henderson & Kesson, 2004). Even though it is difficult to shift one's paradigm, I believe that everyone could and should try to do so.

In addition, in the context of my teaching experiences, I also realise that curriculum is influenced by several factors, including politics, the economy, and social, and culture issues, including religion. In politics, the policy forces students to be people who could fulfil societal needs, not to express their individuality. Those who are considered the "curriculum experts" (Apple, 1997) are a powerful group but are they really experts? It is clear to me that politics is very powerful factor which influences the curriculum. According to Mitchell and Boyd (2001, p. 60) "Globalization, we argue, is fundamentally changing the parameters of political deliberation throughout the industrialized world, raising the stakes for education policy and changing the ground rules for its adoption and implementation". Meanwhile, in economics, in my country, jobs in science and technology fields such as doctors and engineers are most appreciated, which means they are given high status (Fensham, 1988). As a result, time allocation for science and math in primary and high school is much higher than other subjects. The power of society's influence is evidenced by the way that certain subjects are "elite and important fields" (Fensham, 1988, p. 7). It also influences parents to force their children to choose science and engineering in higher education. The influence of social, culture, and religion also shaped my curriculum practices, including the values and beliefs which are embedded in curricula. I discuss these influential factors in more detail in Chapter 4.

Curriculum metaphor and images

Lakoff and Johnson (1980, p. 5) point out that "Metaphor as linguistic expressions are possible precisely because there are metaphors in a person's conceptual system". According to Boostrom (1998, p. 397), "A metaphor is a compressed, imaginative expression of a perspective…[which allows] teachers [to] see themselves, their students, and their work". Furthermore, according to Provenzo Jr., McCloskey, Kottkamp, and Cohn (1989), metaphors provide opportunities for individuals to describe the differences between the expected and their experiences, reflect on the experiences into multiple meanings, and create new understanding. Moreover, using

metaphor in teaching strategies can help students to understand the concepts and learn more effectively in science (Cameron, 2002). As a result, metaphor not only shapes teaching practice for teachers but also for students to shape their learning strategies.

Lakoff and Johnson (1980, p. 4) use one example of "Argument is War" which could describe terminologies such as "…your claim is indefensible". They argue that within this metaphor people will view the argument as a weapon within a battle. As well as a battle, people could lose or win, they tend to see others as enemy or friend and they tend to defend or attack. As a result, it is difficult for people who hold this metaphor to accept difference. On the other hand, Lakoff and Johnson (1980) suggest viewing an argument within a culture, rather than as a battle allows there to be differences. It follows that people cannot dispute other peoples' cultures or impose their own, but instead accept that they do things differently. The writers also point out the term of "Argument is Dance" which means allowing everyone to have ideas of their own, expressed as a performance which is unique and acceptable. These metaphors allow people to have different arguments without thinking to attack and defeat others' arguments. Moreover, Lakoff and Johnson (1980, p. 5) point out that "the essence of metaphor is understanding and experiencing one kind of thing in terms of another". As a result, this reading focuses on encouraging readers to view metaphor not only as a poetic language device, but also a term which guides us to think and to act within our daily lives.

Curriculum metaphors by Schubert (1986) and Pinar (1975) stimulate me to reflect on my teaching practice via those metaphors. Schubert describes curriculum through eight metaphors which are: as *content or subject matter, program of planned activities, learning outcomes, cultural reproduction, experience, discrete tasks and concepts, agenda for social reconstruction, and currere*. Some of these curriculum images contradict each other, such as cultural reproduction and social reconstruction. On the other hand, experience and *currere* are related each other. For example, learners reconceptualise their experiences into the learning process. These experiences are supposed to be their guide to develop their own future as individuals, who are professionals and have social agency. Furthermore, Pinar explores *curriculum as currere* which is the relationship between knowledge, self-

understanding, and social reconstruction (Pinar, 1975). *Currere* focuses on reconceptualising one's life experience related to social reconstruction. However, I see that both Shubert's and Pinar's work have a close relationship with each other in several metaphors: curriculum as learning outcomes, as cultural reproduction, as experience, as an agenda for social reconstruction, and as *currere*.

Curriculum as currere and experience

Curriculum as currere and experience are related to each other in the process of reconstruction in the individual mind. According to Pinar as cited in Pinar (2004, p.35), curriculum as currere is related to "academic knowledge and life history in the interest of self-understanding and social reconstruction" which has four steps which are regressive, progressive, analytical, and synthesis. Currere includes self-reflection and self-awareness. Moreover related to experience, currere refers to reconceptualising and exploring existential individual life experiences (Schubert 1986; Ornstein & Hunkins, 2004; Print, 1993; Lovat & Smith, 1993). Teachers could help students to reconceptualise their experiences into the learning process to not only understand the subject matter, but also reflect on their experience to develop their own future as individuals, professionals and social agents. Integrating these experiences with the image of curriculum as currere in the classroom could give opportunities for my students to reflect, reconceptualise, explore and transform their personal experiences (Doll, 2002; Schubert 1986; Ornstein & Hunkins, 2004; Print, 1993; Lovat & Smith, 1993).

Curriculum as agenda for social reconstruction

I realise that helping learners to improve society as agents for social reconstruction is an intensive process. According to Schubert (1986, p. 32), curriculum should provide "the knowledge and values that guides the students to improve society and cultural institutions, beliefs, and activities that support it". Through this metaphor, teachers could stimulate students to think and create their perfect world related to the lesson topic, such as an environmentally friendly world which encourages them to think creatively and critically. They could imagine and assess critically their contribution and others' contribution, such as government and society. Furthermore, another example of an environmental topic is the government policy on 'a free car day'.

Teachers could empower their students to give their opinion on a controversial issue between environmentalists and socialists.

Curriculum as subject matter, cultural reproduction and discrete tasks and concepts

I realise that the other metaphors -*curriculum as subject matter, cultural reproduction and discrete tasks and concepts*- could disempower students from being imaginative and creative thinkers. Furthermore, according to Nijhuis, Segers and Gijselaers (2004), teachers and students need to be involved in creating the subject matter, cultural reproduction and discrete tasks and concepts. Educational practitioners such as teachers and students could give valuable information of the curriculum practice in the classroom (Lovat & Smith, 1990; Grundy, 1987). Therefore, it will be powerful to decline the power of experts who determine the content of the curriculum (Apple, 1997). There is growing evidence that the ways in which curriculum and teaching are becoming more tightly controlled may fly in the face of successful practices. "Rather than standardised, test based, factual curricula organized around totally discrete subjects, with rigid time schedules and standardized teaching models, other things such as variable time periods, interdisciplinary approaches, greater teacher input and varied teaching styles, and closer attention to linking the curriculum to students' patterns of learning and to their communities, are being called for" (Apple, 1988, p. 23).

Assessment

The influence of assessment in students' learning and teaching approaches has been recognised in research and different literature (Carrillo-de-la-Pen˜a and Pe´rez, 2012). Based on my experiences as a student and as a teacher, I realise the powerful influence of assessment. When I was a student my learning styles were related to my teachers' assessment and most of my teachers' assessment focused on content knowledge; thus I was busy memorizing facts. It was also replicable. When I became a teacher I used assessment of learning which focused on measuring students' skills and abilities without giving opportunities for students to learn from the assessment itself. I realise that there are possible negative effects of testing on students: anxiety, categorizing and labelling the students, damaging students' self-esteem, and creating self-fulfilling prophecies (Linn & Miller, 2005). I realised that I became the judge of

my students' capabilities and achievement level. Thus, my students only learnt when there were exams scheduled and only learnt by memorizing. According to Wass, Van der Vleuten, Shatzer, and Jones (2001), it is well known that students adjust their learning processes according to the particular type of assessment used. Consequently, the choice of the type of assessment is crucial and should closely correspond to the teaching objectives. In addition, according to Rust (2002), we should use different strategies of assessment which are concerned with students' different approaches to learning. Over-assessment or inappropriate assessment leads to students' surface and partial learning (George, 2009). Because each student is unique with a different approach to learning, each student should have the opportunity to engage in deep learning which can only be achieved by providing opportunities for different types of assessment.

In relation to the power of standardised assessment in my country, Brown (2010) points out that high-stakes, standards-based accountability school environments that many pre-service teachers were educated in evolved out of a series of governmental responses to the publication of documents by a range of organizations and commissions that questioned the effectiveness of the United States education system. The aim of these policies was to ensure that all students attain high levels of academic achievement. Researchers reported that these policies led to students experiencing a narrowed curriculum that emphasizes the mastery of basic skills to prepare them for multiple-choice standardized tests (Firestone, Camilli, Yurecko, Monfils, & Mayrowetz, 2000). Others found that high-stakes education policies created classroom environments where students are excluded from (Haney, 2000) or ignored during classroom instruction (Anagnostopoulos, 2006). Lastly, studies show that having such stakes in place can decrease students' motivation to learn (Amrein & Berliner, 2003; Madaus & Clarke, 2001).

In different types of assessment, Hagstrom (2006) and Pemberton, Rademacher, Tyler-wood, and Cereijo (2006) stated that educational systems worldwide have employed two forms of assessment originally popularized by Bloom over the past 5 decades. These are formative and summative. *Summative assessment* focuses on testing and rating of students, and occurs at the end of learning to determine the extent to which learning has been retained and has reached the standards of the

student and the education system as a whole (Thurlow, 2000; Hagstrom, 2006; Simpson-Beck, 2012). Meanwhile *formative assessment* refers to the continuous assessment of students' progress which is collected throughout the school year as a long-term objective (Dyck, Pemberton, Woods, & Sundbye, 1998) for the correction, clarification and adjustment of information prior to summative assessment (Adams, 2004). In addition, formative assessment can be reflective, student-centred, and used as an ongoing process to improve and increase learning (Hunt & Pellegrino, 2002; Gipps, 2002; Hagstrom, 2006; Simpson-Beck, 2012). Formative assessment is said to be linked to cognitive learning theory (Steadman & Svinicki, 1998). Meanwhile Hagstrom (2006) points out that formative assessment is an interactive pedagogy based on constructivist ideas about learning.

Feedback and grade

Giving feedback and grades is an assessment process which influences students' learning and motivation. I have included this topic because of my experiences as a teacher. I struggled in giving feedback and grades on my students' learning and thus I have always wondered if I gave good feedback to motivate my students' learning. Did my students' grades truly represent their ability? Did my students' grades truly represent my professional teaching? Firstly, I shall discuss feedback and then move to grades. According to Shute (2008), feedback is generally regarded as crucial to improving knowledge and skill acquisition and motivating learning. However, giving feedback is not easy and simple. According to Cohen (1985), feedback is one of the most powerful instructions and least understood features in instructional design. There are large bodies of feedback research over 50 years which provide many conflicting findings and no consistent pattern of results (Cohen, 1985) on what feedback criteria best help students' learning. Rust (2002) points out several criteria of good feedback, which are that it ought to be prompt, encouraging, specific, balanced, positive, general with specific suggestions, use conversational language, provide comments' explanations, grades' explanation and a discussion opportunity. Sadly research evidence suggests that just giving feedback to students without requiring them to actively engage with it is likely to have only limited effect (Rust, 2002). Regarding giving grades, there are many are good arguments against them (Winter, 1983: Rust, 2000). According to Rust (2002) giving grades doesn't mean very much, especially in giving numbers. For example, what does 52% actually

mean? A number of students could get 52% with different reasons within their different strengths and weakness. However, students tend to focus on accumulating their average grade rather than on what has been learnt or what is the strength and weakness of their work. Teachers need to question whether, alongside their tendency to use grades to help students succeed in national examinations, as part of assessment of learning, this leads to meaningless learning experiences. So the main question always comes to my mind, 'what is education for?'

CHAPTER SUMMARY

This chapter has proven an insightful journey for me in understanding a range of theoretical perspectives that have shaped my teaching practices. I feel ashamed when I realised that, as a science educator, I had a surface understanding about the nature of science and its history which influenced the way I taught science to my students. The journey of being a teacher reminds me that teaching is about touching the heart, not simply having knowledge and skills to transfer the knowledge. When I looked at the three human interests, I comprehended that my journey as a student shaped my teaching experiences which focused exclusively on technical interests. Different aspects of constructivism have reminded me that constructivism is not simply a theory of learning; it is a worldview with an ontology and epistemology. Moreover, when I first became a teacher I understood curriculum as simply a list of standard achievements, however when I came through curriculum images, I have realised that it is more complex and detailed than this. I closed the chapter by exploring different issues of assessment that relate to my own teaching experiences, reflecting on several questions - So, what was my students' learning for? What was I teaching for? And who was I as a teacher? These questions are addressed in Chapter 4 in reflections on my past science teaching experiences.

CHAPTER 4

OPENING THE BLACK BOX: REFLECTING CRITICALLY ON MY PAST SCIENCE TEACHING

INTRODUCTION

2002 (Third Year of Teacher Education)
Micro Teaching Lesson

Teaching is So Difficult…

Today is a very special day, because I will be teaching my first micro-lesson. I will practice my teaching skills and knowledge in front of my lecturer and my classmates. I wear my best clothes and scarf because I recall that my lecturer said that it is important to be concerned with your performance, because your students will look at you all the time, including your behaviour. After a couple of my friends teach their micro-lessons, the lecturer gives feedback for their improvement. Then it is my turn. I walk slowly to the front of the classroom and start the lesson. After the introduction, I begin teaching the topic of chemical equations. I write a chemical equation, then I explain why we have to and how to balance chemical equations. I write questions on the board and since my "students" keep silent, it is my assumption that they understand my explanations. Some of my classmates are smiling, but I just ignore this. I feel confident teaching until the 15 minute micro-lesson is finished. Then my lecturer gives me feedback.

My lecturer : "Yuli, what do you think about your teaching?"

Me : "I am not sure, but I think I understand the concepts"

My lecturer : "Becoming a teacher is not simply transferring knowledge; you should know what your students are thinking and how they are learning, so it's better not to keep explaining without asking questions or interacting with your students"

Me : "They were silent, so I thought they understood"

My lecturer : "You should ask questions and interact with them. They were silent, but this doesn't mean they understood"

Me : "Ok, fair enough"

My lecturer :*"Other minor things – you said more than 46 times the word "ehmmm" between your words which sometimes disturbed your explanations, what's happening? Are you nervous?*

Me :*" Really? I didn't realise, I felt that I talked normally (with a smile)"*

My friend :*" Yes Yuli, you always use word "ehmm", and you also talk and explain at the expense of interacting. I agree with Mrs Bety, you need to consider your students' understanding more*

Me :*"Ok, thank you for your feedback"*

Then, I sat back down in my seat, still smiling. I didn't realise I talk so much and say "ehmm" so often. I don't want to be a teacher! I don't like teaching! Why is teaching so difficult?

The story above is one of my first experiences teaching in a simulated class environment. I had little motivation to be a teacher and, as a result, this micro teaching lesson was the most frightening subject in my education course. I just wanted to finish my studies and apply for a job in the chemical industry - not become a teacher. Even though micro-teaching was not real teaching, this experience was really frightening for me. I spoke too much and ignored my students' lack of understanding. I also didn't notice how often I said "ehmmm". I continued these behaviours when I became a beginning teacher - teaching without any passion, talking too much and ignoring students' understanding. Teaching was so difficult and I just didn't want to do it. I felt really challenged by trying to understand how students learn and engage.

However, these experiences have shaped my science teaching identity. In this chapter, I describe and reflect on several critical events in my science teaching journey. The theoretical perspectives discussed in Chapter 3 help me to reflect critically on these experiences. Thus chapter is important as the beginning process of revealing and reconceptualising my teaching identity through reflections on the journey of becoming a science teacher and my earlier science teaching experiences. This chapter provides an account of myself as a science teacher before I start portraying my science teaching identity in Chapters 5, 6, 7, and 8 that emerged during this doctoral research.

DIFFERENT FACETS OF MY PAST SCIENCE TEACHING

In this chapter, I have divided my experience into four sections related to Chapter 3:

1. **When I am Blind: Reflections on the Nature and History of Science**

   In this section, I reflect on my narrow understanding of the nature and history of science. Although I have learnt science since primary school and teach science, I have never thought about or focused deeply on the philosophy behind the nature and history of science. In my understanding both of these concepts were just things to memorise as definitions and facts in history, rather than a philosophy which could shape my past teaching practices.

2. **Do I Understand? Reflections on Science Education**

   Although I started my science teacher education without any motivation to learn about teaching, I realise that it actually provided an insightful journey for shaping my science teaching practice. Through these reflections I also realise that the nature of science education and science teaching and learning are very complex issues.

3. **I Don't Want to be a Teacher: Reflections on Being a Teacher**

   In this section, I portray my journey of becoming a teacher, a pre-service teacher educator and a beginning teacher. I realise that there are several factors which influenced my journey of becoming a teacher. This section also portrays the journey from being an unmotivated teacher to becoming a motivated teacher and the journey of crossing the border from pre-service into in-service teaching.

4. **The Mirror of My Past Science Teaching: Reflection on Habermas' Three Interests**

   Then, going deeply into reflections on my past science teaching practices, I use Habermas' three interests to introgate my science teaching, focussing on implementing constructivism theory, my curriculum and assessment practices.

When I am Blind: Reflections on the Nature and History of Science

1992
I was a student in year 7

What is Science?

I remember the first class
When my science teacher asks me
What is science?

What should I answer?
I don't remember the definition of science in the book
What should I answer?
I remember it is about scientific methods
I just remember it is about universe, animals, plants, humans

Then, my teacher asks me
Do you like science?
What should I answer?
I don't like it because it is just memorising
I don't like it because learning science is stressful
I don't like it because the exams are so difficult
But
I like it when we go outside to see the plants
I like it when we are doing experiments

I keep silent
floating; thinking
Until my teacher tells me
"Yuli, you should read your science book properly to understand what science is"
Oh! science is memorising again...

The poem represents my experiences of learning science which have shaped my understanding of the nature of science. When I was a student we had to provide a definition of science which was almost identical to the definition of science in the book. Even in our exams full marks were given if we could provide a similar definition of science to what was in our text book. Thus, unless students had rote learned the answer, they did not feel confident to answer the teachers' question on what is science. We also had to remember the steps of the scientific method. I actually repeated this during my own science teaching experiences when I asked my students to define science and the scientific method. Reflecting upon this, it is clear that I believed science is from a book, not part of our daily lives.

The theoretical perspectives in Chapter 3 provide an insightful landscape for me to understand the nature of science, including the philosophy of science. Science as a

body of knowledge has its own characteristics which are presented by Hoyningen-Huene (2008) as 8 dimensions of science. I also found that Milne (2011) helped me to understand the components of science. Integration of the understanding of the nature of science by Lederman, who provides 7 aspects of nature of science, also helped me to understand that science is socially and culturally embedded. At this stage, I could say that I was blind to all these concepts, and writing about the nature of science is new knowledge for me. I realise that I have taught science based on text books and curricula as subject matter, without having a deep understanding of the nature of science.

Furthermore, I also believed that in science there was only one truth, thus there was only right and wrong. My teachers told me that in the social sciences you can have different right answers but in science there are only right and wrong answers. It influenced the way I learnt and taught science. Science had to be objective; there is no subjectivity in science. However, I realised that scientists are human and have subjectivity in their decisions, including in their scientific concepts. As stated by Bekoff (2000) in Chapter 3, science is not value-free. I learnt from this view that we have to be careful to teach students that scientific invention is a process; what is believed to be true now could be changed in the future. Thus, their personal experiences in finding the truth become important.

I have also found indigenous scientific knowledge to be extremely insightful. I never realised previously that it is important to acknowledge indigenous scientific knowledge in our science teaching. Even though Indonesia has a rich culture, including indigenous scientific knowledge, science teachers ignore this since we tend to think that Western knowledge is all powerful. As a result, my students didn’t understand indigenous scientific knowledge is already part of their lives, for example, herbal medicine. I probably understand something of herbal medicine, but only because my parents taught me. However, I have realised that I never teach my students or my daughter about indigenous scientific knowledge since we science teachers often ignore the importance of this knowledge in sustaining our culture, but also engage our students in their lives and their culture.

It is my recollection that most of the chemistry textbooks in Indonesia write about the history of each topic, for example the history of atomic structure. However, based on my experiences as a student and as a teacher, history is simply remembering who the inventor is and what the invention is without understanding the philosophy of science that is held by the inventor or the role of the logic that is applied. Thus, Milne's (2011) book on differentiating between knowledge in a timeline of scientific development helps me to understand that history is important to understand the philosophy of science itself. Finally, these topics of the nature and history of science help me to reflect on my science teaching which has been influenced by my surface and narrow understanding of the nature and history of science.

Do I Understand? Reflections on Science Education

I often came across the words science education since pursuing my master's degree in science education. I am used to dealing with the world of chemistry rather that science itself. Thus, I have to shift my focus to science education before I learn to understand chemistry education. Different theoretical perspectives provide different views of the aims of science education including helping students to understand scientific concepts and applying these concepts in their future roles. Yager (2000) divides concepts into four major goals - personal, society, career, and academic preparation. If I look at my context, I need to ask myself as a science teacher and as a science teacher educator have I prepared my students to apply and incorporate these scientific concepts in their future roles, including becoming scientists? I don't want to limit myself to only equipping students with scientific concepts, but to also engender the value of science in their lives, such as being responsible for their knowledge and working together with others. This I applied in my science teaching.

In the context of the problem of science education, as stated by Tytler (2007), in Indonesia the science curriculum is considered to be an information overload and a difficult subject, thereby decreasing positive attitudes toward science in secondary schools. However, in Indonesia the decrease of attitude toward science starts in primary school (from years 5 and 6), when students are required to pass science in the National Examination in year 6. Following this is the mismatch between competence based curricula and standardised assessment, then teacher quality and quantity. Thus these complex problems become 'a spider web' which is complex and

intercorrelated. Every time I remember these problems I always ask myself, what should I do to solve the problem? And which problem should be solved first? How can I participate in solving the problem? The questions are increasingly being raised for me, especially during my thesis writing and undoubtedly when I finish my study and return to my home country. As a teacher educator who will graduate in the field of science education, I realise that I need to have a deep understanding of the nature of science education - its aims and problems. Only then will I be empowered to help facilitate a better future for science education in Indonesia.

One of the problems that I discussed in Chapter 3 is about student learning, as the one truth and objectivity in science has been widespread in science teaching in Indonesia. Thus, science teachers and students tend not to recognise the plurality inherent in the scientific community and in science itself. Even though constructivist views have been acknowledged in science teaching and learning, the culture of positivism is very powerful. Thus the control of one truth still shapes science teaching and learning. Science teachers become the controller rather than facilitator in helping students to make border crossings between their own experiences and the scientific concepts that are accepted by the scientific community. Thus science is difficult and far from students' everyday lives.

I Don't Want to be a Teacher: Reflections of Being a Teacher

In this section, I portray my journey of becoming a science teacher and the beginning journey of science teaching. As part of my science teaching journey, I portray the idea of the power of science in my community which influenced my science teaching journey. Thus, I divide the section into several sub sections:

1. **The power of science in my community**

   In my community, people place a prestigious value on science in terms of its importance in education and science related jobs in the community. To understand this value, I consider: 1) science as an important subject in school, 2) science as one of the dominating subjects in the curricula, and 3) science as a matter of pride

2. The journey of becoming a science teacher

In this sub section, I consider my journey of becoming a science teacher: 1) Childhood: teacher is a perfect job for a woman, 2) Secondary school: the world of chemistry, 3) Pre-service teacher education: I don't want to be a teacher, and 4) Beginning teaching: The soul for being a teacher.

The power of science in my community

Since childhood I was influenced to aspire to become a doctor or an engineer. My parents and my community held the common belief that to be a doctor, engineer, architect or other professional that related to science was a matter of great pride, even perceived as an indicator of success. Upon examination, I came to realise that these values around the power of science ultimately led my life and choices as well as those of other children's lives in my community.

Science is the most important subject in school

In my experience, elementary school teachers always prioritised the teaching of science subjects. My earliest experience was in primary school when my teachers spent time allocated for other subjects on science teaching. Commonly, teachers spend more time in science because they believe that science is a more difficult subject which requires more time than other subjects. This condition leads to the power of the technical interest where children are trained to achieve one goal. It seems simple but it is dangerous when students are able to pass exams without any understanding. In Indonesia, one of the scariest exams which students and teachers work hard for is the National Examination. In the National Examination the government provides tests for what are considered the three most important foundation subjects in schools which are Science, Mathematics, and Language. Since the National Examination sets the standard for students' graduation students can't study to the next level unless they pass the National Examination for these three subjects. Thus, science is seen as one of the most important subjects in school.

Science is one of the dominating subjects in the curricula

The power of science is also represented in the Indonesian curricula. In secondary school, almost 40% of the Indonesian Curricula consist of science subjects. Therefore, this system leads the teachers and students to privilege science subjects. When I visited schools in Western Australia, I saw teachers 'deliver' the curriculum

and noticed how teachers made students love science. However, I also found in Australia that students seem less likely to love science in secondary schools than in primary school. Comparatively, in Australia teachers have more freedom to create different kinds of learning experiences in order to achieve the curriculum goals. In Indonesia, on the other hand, there is pressure to deliver overloaded and detailed curriculum within a limited timeframe. This leads the teachers to focus on the list of subject content rather than their students' understanding. It is important to note, however, that the comparison is not made on a level playing field - in Australia, the curriculum is broader with more allocation time, smaller class sizes of students, and good school facilities. It would be interesting to see if science teachers in Indonesia could make children enjoy science with the conditions that exist in Australia.

Science as a matter of pride

In Indonesian secondary school students in year 10 are selected to enrol in science or social studies classes. It is the students with good academic achievement who are selected to enrol in science classes. The teachers determine enrolment in science classes based on the rank of students in the classroom. For example, students with rank 1 to 30 can enrol in science class, and the remaining students don't have any choice except to enrol in social studies. Therefore, a common belief in my country is that students who study science are cleverer than those who study social studies. The parents are always proud if their children enrol in science class or study a science stream in university, and if they achieve in science lessons rather than social subjects.

However this pride can lead to disaster. From the beginning of my time as a science teacher I faced the reality of scared students who are coerced into enrolling in science classes and becoming doctors, engineers, etc. because of their parents' and the community's values. I felt that many suffered when engaging with science lessons because they really didn't like science. I would always say, "science is not everything; just because students have good academic achievements in science it does not mean they are smart, and similarly just because students achieve well in social subjects, it does not mean they are not clever."

Furthermore in relation to my understanding that science is not everything, I believe in letting children choose their own interests. Give them the opportunity to choose,

without coercion by parents, or pressure from community beliefs that imagine science as the “be all and end all”. But until my vision is realised I believe it is vital that teachers understand how so many of their students are constrained to study science and how they struggle to like and understand this subject.

The journey of becoming a science teacher

In this sub section, I explore my journey of becoming a teacher, from my childhood and teenage years, which relate to my motivation for becoming a teacher, followed by my pre-service teacher education and my beginning teaching experiences.

Childhood: teacher is a perfect job for a woman

I was born in a ‘teacher’ environment. My father and my mother are religion teachers. My grandfather was a teacher, but because the Dutch took his teacher’s certificate he could not follow up his teaching in a formal school after Indonesia achieved independence. Throughout my extended family many others are teachers. These circumstances have influenced me in understanding the lives of teachers however, they have also made me question the idea of becoming a teacher. As a child I was not at all inspired to become a teacher. Truthfully, I saw how my parents struggled because we could not afford a good life on their teaching salaries. Up until now, teachers’ salaries in Indonesia are considered low. Therefore, we had to be very cautious with our money in order to buy food, books, and clothes. My toys were considered an extravagance. This encouraged me to have a better life in the future. Therefore, I always planned to become a doctor, an engineer, or work in a company as there is a common belief that these jobs provide a better salary. However, it is also a common belief in my community that teaching is the perfect job for a woman. My mother always encouraged me to be a teacher.

1989
I was 9 years old

Teaching is the perfect job for a woman

One morning, I played with my mum in front of my house. My mother always has time to play with me before she works in the afternoon. My mother is a primary school teacher; she works from 12 pm to 5pm. I attend the same primary school as where my mother works. As she is a teacher, she always asks about my schooling and she often asks my teacher about my progress.

Mother : "How's school?"

Me : "It is good; I just don't like social studies. I find it difficult to remember the names of provinces, the cultures, and other things. I like science and math which are really challenging"

Mother : "That's ok, I will help you how to remember easily. If you want to be a doctor, you have to remember many things"

Me : "Yes, I know, but that will be interesting, since I love to remember things in science rather than in social subjects"

Mother : "Why would you like to be a doctor?"

Me : " I like the clothes they wear, I want to use a white coat like they do, and it is cool. Doctors are rich, with big houses, cars. I would like to be rich, mom"

Mother : "That's good, but don't you want to be a teacher? That's a good job for women; you can have more time for your family"

Me : "I don't want to teach mom"

Mother : "I saw you yesterday, teaching your sister; that's excellent"
Me : "I did because she asked me, but I just don't like teaching"

Mother : "That's ok, you can choose what you want to be, don't worry about it, let's continue to play"

Me : "Yes, thanks mom"

I remember this conversation with my mother. She always told me that I was good at teaching and later on I realised teaching is actually my passion. However, my perceptions about teaching when I was a child influenced the way I viewed teaching as my future career. I always thought to become a doctor or a scientist because these jobs would lead me into a successful life. Thus, it motivated me to learn science because I realised that if I wanted to be a doctor or scientist I would have to be good at science. Thus, the desire for a prestigious career shaped my love of science throughout my journey as a learner.

Secondary school: the world of chemistry

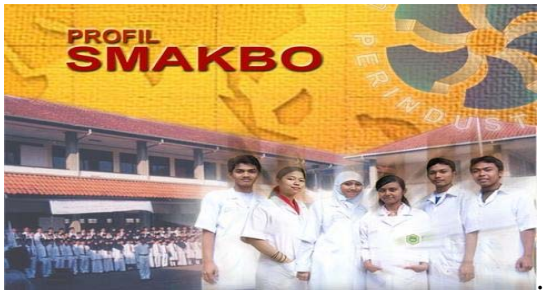
I loved science because I wanted to be a doctor or a scientist. However, when I went to enrol in secondary school my parents told me that they didn't have enough money to pay for a university degree in medicine which is very expensive, even at public universities. Thus, I shifted my passion to becoming a scientist. At that stage, my image of being a scientist meant working in a science laboratory; I chose a vocational school to study chemistry analysis. I chose the school because if my parents were not able to afford to pay for my university degree I would be able to work straight away after graduating from this chemistry analysis degree. Thus, my journey in the world of chemistry began when I began secondary school.

To provide some background on the education system in Indonesia, there are three types of education: formal, non-formal and informal education. The formal education system, which is hierarchical and continuous, consists of basic education, secondary education, and higher education. Pre-school is also included in this formal education. Non formal education is offered outside the formal school through teaching and learning activities, but is not hierarchical and continuous. It includes short-term courses and group learning. Informal education is given by the family and consists of religious, moral, and values education. Basic education (part of formal) is a general education of nine years, which are six years of primary and three years of junior secondary school. Secondary education is for three years and in available to graduates of basic education. The types of secondary education are: general, vocational, religious, and service. Higher education is an extension of secondary education and focuses on specific subjects to develop practical skills. Higher education is divided into Diploma (1-2 years), undergraduate (4-5 years), post graduate (2 years), and doctorate (4-5 years). Figure 1 shows the formal education system in Indonesia.

Table 9. Education System in Indonesia

FORMAL EDUCATION			**NON-FORMAL EDUCATION**	**INFORMAL EDUCATION**
Level	**Stage**	**Duration (years)**		
Higher Education	Doctorate	4-5	Short term course (English and Computer course, etc.) and group learning	Family Education (values, moral, religious)
	Postgraduate	2		
	Undergraduate	4-5		
	Diploma	1-2		
Secondary Education	Senior High School and Vocational School	3		
Basic Education	Junior High School	3		
	Primary School	6		
Kindergarten	Pre-School	1-2		

These education institutions are governed by the Education Department, meanwhile my vocational school was overseen by the Trade and Industry Department. There are only three public vocational schools that offer chemistry analyst courses in Indonesia which are in Bogor, Padang, and Ujung Padang. Since Bogor is the closest place to the capital city, Jakarta, there is a lot of competition to enter this vocational school. I remember that from 1200 applicants only 150 applicants were accepted into this school.



(Haska, 2008)

Figure 7. The Secondary Analyst Chemistry High School Bogor (SMAKBo)

I studied at The Senior Analyst Chemistry High School Bogor (SMAKBo) from 1995-1999. This school is different from other secondary schools in Indonesia. For example, the percentage of chemistry units is significantly higher than any other units (80% are chemistry) and the period of study is longer (7am-6pm every day for 4 years) than secondary high schools which is only 3 years (refer to Table 1.). As a result, the students who graduate from this school have more competencies and skills in chemistry. During my study, I worked almost every day in the analytical chemistry laboratory, physical chemistry laboratory, gravimetric laboratory, chemical industry laboratory, microbiology laboratory, as well as a glass equipment workshop. I would never have found such a range of chemistry subjects at any other secondary school.

As Bogor is quite far from Jakarta I had to rent a room during my secondary schooling and I returned to Jakarta every weekend. All I did was focus on studying, because the course was very difficult. The academic requirements and the learning processes in this school put a lot of pressure on the students. Essentially, I didn't have much social life during my study. Thus, my life journey in secondary school was only about studying and chemistry.

However, I found that the learning experiences in this school provided me with the opportunity to have a deep understanding of the concepts of chemistry. Most of my teachers applied metacognitive approaches which helped students to understand chemistry concepts. Thus, I applied this approach during my own experience as a teacher which I discuss later in the 'mirror of my science teaching' in relation to Habermas' three interests. SMAKBo graduates are recognised as skilled people in industry which is evidenced by many companies following policies to employ graduates. Thus, most graduates from SMAKBo are accepted into the workforce as chemistry analysts. Despite how difficult my learning journey was in secondary school, it equipped me with a deep understanding of chemistry concepts which in turn helped me in my further studies in chemistry education as well in my chemistry teaching.

Pre-service Teacher Education: I Don't Want to be a Teacher

In this part, I tell a story called "I don't want to be a teacher" which relates to my motivation for being a teacher. This story is important as it involves the first decision that led me to becoming a teacher and shaped my teaching practice.

1999

I don't want to be a teacher

Setting: The UMPTN (National Test for Government Universities' Entrance) results have been announced by government in the newspapers. I sat the national tests since the government universities have cheaper fees than the private colleges. I took the science stream in the UMPTN the previous month because I wanted to be a chemist – I had a chemistry background from my secondary school studies. But since I had to provide two preferences for universities I chose two different universities in Jakarta. I chose these two universities because my parents want me to study in Jakarta, not outside Jakarta (where we were living). My first choice was Chemistry school in one of the best and well-known Government Universities and the second choice was Chemistry Education in one of the pedagogical universities. The first choice required a higher mark than the second choice. Due to its lower entry score, studying to be a chemistry teacher obviously gave me a better opportunity to pass the National test than the first university, however I had my hopes set on Chemistry school.

I read through the newspaper, I am really worried as well as excited. Today will come the announcement from the government regarding the result of UMPTN. I don't usually buy the newspaper daily, but since it is very important, I have begun walking since 5.30 am to go and buy the newspaper. Once the paper is in my hands, I scan through the names and the number of people who have passed the test. I have passed several pages, but still haven't found my name and my test number. Suddenly my eyes become stuck on my own name - "Yuli Rahmawati". With heart pounding and hands shaking, my eyes look to the next table for the name of the university that I have gotten into. I find myself spontaneously opening my mouth and saying "What??" I am really surprised; I have been granted a place at the pedagogical university. I was quite confident that my grades were high enough for the first university, because I had compared my test answers with the correct answers (these are provided by several institutions after the tests) and I knew that I had passed the minimum grade requirement. I am shocked and almost crying and my parents approach me to try to calm me down. I feel rejected, I cry, and

keep telling myself, 'I don't want to be a teacher, I don't want to study in that university, I really don't want to be a teacher.'

The story is part of my journey in starting the teacher education program at the State University of Jakarta (Universitas Negeri Jakarta). Becoming a teacher was really not inspiring for me, even though I would be a graduate of a Bachelor of Chemistry Education and both of my parents are teachers I was still very resistant to becoming a teacher. I had none of the influencing factors that motivate people to be teachers, as stated by Richardson and Watt (2005) in Chapter 3, which are social status, career fit, prior considerations, financial rewards, and time for family. I was really hoping to finish studying soon and apply for a high paid job in the chemical industry. The reasons why I did not want to become a teacher were that I had the perception that a teaching career yields a low salary and social welfare. I thought that having a good profession with a high social status and becoming rich were indicators of success in life. As a result, I became the first student in my chemistry department who graduated within 4 years where commonly students finish in 5 years of teacher education. I really didn't want to be spending much more time in my teacher education course because I didn't like the units in pedagogy (20% of the load), even though I liked the units in chemistry (80%). This lack of motivation for being a teacher shaped my teaching practices in my beginning journey and also influenced my beginning teaching.

Figure 8. The Jakarta State University

It is really evident to me now that my teacher education learning experiences were shaped by lack of motivation for being a teacher which was influenced by my lack of understanding of teaching and learning in chemistry. In addition, I could say that my teacher education experiences didn't shape me to be an agent of change in improving education and empowering my students, as Imig and Imig (2006) posit. I think this was due to not only my teacher educators but also to me as I did not have any aspiration to teach. Thus I agree with Hoy (2008) (in Chapter 3), especially in understanding students' aspirations to be a teacher, of the importance of developing student teachers' commitment and professionalism. Henniger (2004) (in Chapter 3) also makes a point that in relevant to my personal experiences, that the love of teaching has two components: passion for the subject being taught and delight in teaching others. This is something I realised later on in my teaching experiences. So it is now clear to me that most of my teaching identity has been shaped by my teaching experiences rather than by my teacher education course.

Beginning teaching: The soul for being a teacher

Becoming a beginning teacher without motivation to be a teacher was a tough journey for me. When I graduated from university in 2003 the conditions were worsening because my first experience as a chemistry teacher was very unpredictable. I had to cope with misbehaving students at the vocational school in engineering (STM) who did not like chemistry and were drug users. However, I could classify myself as a highly engaged persister (as stated by Watt & Richardson, 2008, in Chapter 3) who stays empowered to solve problems. I eventually realised

that I was struggling most in classroom management, as do most beginning teachers (as stated by Doyle, 1975, in Chapter 3).

Shock Therapy for a Beginning Teacher: The Soul for Being a Teacher

My first teaching experiences were very difficult. I taught four classes, with 40 students, and all were boys. On my first day, I came to one class - electricity stream – the students were just smiling in silence. Suddenly one of them threw a lizard at me to frighten me. My face paled but I had to remain calm even though I was very afraid. Then I told them that I was not afraid of the lizard even though it was a lie! I started my lesson by introducing myself, but they did not listen to me. They only talked to each other. I was angry and became silent. I really did not know what I should do. In the end I decided to ignore their action. I just taught the chemistry curriculum according to my lesson plan. I did not care whether they understood or not. I just wanted to get away from the class! Up until the end of the lesson, they just talked to each other. It was my worst experience as a new teacher.

In the second class - mechanic stream - it was very noisy and the students were very badly behaved. Most of them used drugs and often fought with students from other schools. They were real trouble makers. Before I entered this class I already knew that most teachers had serious problems teaching them. When I entered the class, none of the students were in their chairs. They ran around like kindergarten children and threw paper screwed up into balls at each other. Again I was shocked. The chairs were not in order; the class was littered with paper. I shouted but my voice was not loud or forceful enough - they were still noisy. I decided to use a ruler and I hit it on the table. Suddenly they were silent. I started my class without introducing myself. I forgot because I was really shocked. I just told them "I am your new teacher. Would you like to arrange the chairs and clean the classroom?" Some of them replied "we do not want to do that". I knew I had to do something, so I told them "If you do not want to clean this classroom, we will not start the lesson, and you will get a zero for your chemistry lesson". At that time I did not have any other threats besides their chemistry score. After this they started to arrange the chairs and pick up rubbish. I started the lesson even though they were still noisy. Some of them looked sleepy, their eyes looked red and their breath smelt like alcohol. This class really was the worst class. At that moment I just wanted to resign. I really did not want to be a teacher.

Teaching is not simply a job. It is not simply transferring knowledge. It needs passion, love and caring. It needs profound patience and empathy. In teaching, you will see your influence on future generations. Never relinquish, because, as a teacher, you create the future

At home, I thought about my students. How could I deal with them? How could I keep being a chemistry teacher? How could I stay at that school for one semester? At that time I just wanted to quit. Then I talked to my parents and they forbade me to quit. They told me how wonderful being a teacher was. They told me "you will find that this is a wonderful job. You will have wonderful happiness as a teacher, and it is more valuable than money". At that moment I did not understand what they meant. On a different day I talked to a senior teacher. He said that "becoming a teacher is a calling from deep in your heart. Not only do you share knowledge but you also educate and equip students with good values, attitudes, and behaviours to be good people. You will understand this when they change into good people; you will be very happy". I thought about my journey as a volunteer for street children and I remember how I felt when I was able to teach someone to read even one word. That was a wonderful moment. I asked myself, why can't I do the same thing with my students? So I started my day with a promise "I will finish my job, I will do the best, I will change my students"

During the second week, I came to the school with a new spirit but with little experience of how to manage the class. In my own analysis I had already made at least four mistakes. My first mistake was that I just taught my students didactically, with the talk and chalk method. They were bored with the material. They told me that they did not like chemistry because it was very difficult for them. At that time all I was thinking about was how to finish the syllabus considering the high load of the chemistry curriculum. I just wanted to share the material so that they could pass their examinations.

The second mistake was that I used complex language they did not understand. I did not use analogies, metaphors or examples to make it simple or easy to relate to. The other mistake was that I was too serious; I never told a story, a joke or anything to allow them to relax. As a result they were bored, sleepy, and unable to concentrate.

The third mistake was giving punishments. Sometimes, I punished them by making them run around the yard because I found stones in their bag. They used the stones to fight with other students. I was very angry with them, but the punishment did not work because other teachers had already tried even worse punishments to no avail

- they would still brawl with other students. Sometimes they hid the stones in the rubbish bin outside the school. They were very clever and careful about hiding things they could use as weapons to fight. Another day, during my class, some of them were very noisy. I reminded them to be quiet but they went on talking. So, I asked them to leave the class. I hoped that this would deter them but it did not happen. They went to the canteen to eat and chat again. I learnt that punishments no longer worked for them. They were accustomed to enduring punishments from other teachers.

The last mistake I made was that I always arranged difficult questions for their tests. In their curriculum there were competences they had to achieve which were very difficult for them. Of course, low exam scores did not help to raise their morale.

I really tried to solve the problems I was facing in my classrooms. It was very difficult for me as a new teacher. So I tried to come up with some solutions. First, I tried using variations in teaching methods. I chose a demonstration method to explain acid-base material. I used acid-base indicator such as litmus paper to identify acid-base solutions. I used vinegar to identify acid and soap to identify base. They were interested because the colour of the litmus paper changed to a different colour. For example, if I put the blue litmus paper in vinegar it changed to red. They told me that it was like magic. Then I started my lesson because I had captured their attention. I also used simple language which related to their major subjects, for example I told them about the electroplating process in car frames. I used simple electrolyte solution to show them how the process works. I used rings and pens with silver solution. Later, I discovered that some of them used the principle of electroplating process in their work. They told me that they were more interested in chemistry because it was closer to their life. Sometimes they came to me outside the classroom just to ask about something related to chemistry, for example about the dangers of smoking or the chemical compounds in drugs. I was very happy that they showed an interest in study.

Another strategy I used to engage students was giving tests as soon as the material was taught. The questions would always relate to my previous explanations, but there would only be a few. Some students scored well because they could still remember the material. This was also the case when they had to write papers related to environmental problems soon after they had studied the material. I also really tried to relate chemistry with their life.

The other strategy to help them memorise chemistry more easily was using acronyms. For example, referring to the elements in IIA class - Be, Mg, Ca, Sr, Ba, Ra - I told students that they could memorize these using the following words: Be (Besok), Mg(Minggu), Ca (Camping), Sr(Seregu), Ba (Bakal), Ra (Ramai). In English it means "Tomorrow, Camping will be interesting". This strategy not only motivated them to study but also motivated me to come up with creative words. At the end of year I tried to write chemistry textbooks for STM students with simple examples related to their life. One year later I published those books.

The last strategy was to become closer to them by learning their slang words, chatting and hanging around with them in the canteen. I actually became more engaged with the naughty and lazy students. I also tried to remember all of my students' names. They were surprised that I could remember all 160 students when I had taught them for only 2 weeks. But I still had problems with students who used drugs. They still slept in the classroom when under the influence. They were not conscious of their actions. It was a big problem for me that I was not able to resolve.

Eventually I quit teaching in STM when it was time to leave for higher studies in Australia. However, I will always remember my students. They were my motivation. They were the people who gave me 'shock therapy' as a teacher. They gave me the soul to become a teacher, they taught me how to be patient, how to understand differences, how to manage my emotions, how to become a good friend and parent. I am now proud to be a teacher.

I'll never forget the feeling of anger and stress trying to manage my students as a beginning teacher. I had false expectations that I would have well-behaved students who were easy to teach. At that time, I was at the stage of crossing the border from theories of teaching to actual practice – it was a stressful transition. I also realised that caring is important in dealing with classroom management. My passion for being a teacher while I taught in that school really flourished, but my destiny as a teacher was followed by another opportunity to become a chemistry lecturer at the pedagogical university in 2004. After two years teaching in university I had the opportunity to pursue a postgraduate diploma and master's degree in science education in 2007 in SMEC, Curtin University, Australia. I finished the program in 2008 and received another opportunity to start my PhD at the same institution in 2009. The doctoral degree is another challenging journey which provided the

opportunity to do an ARC project as well as auto/ethnographic writing to reveal my teaching identity.

The Mirror of My Past Science Teaching: Reflections on Habermas Three Human Interests

This section portrays my past science teaching experiences. My science teaching journey began after I experienced a passion for teaching during my beginning teaching phase as well as during my teaching experiences as a beginning teacher educator from 2003 to 2006.

During my time as a beginning teacher, I learnt to love science teaching. I realised that teaching is not a simple job which only requires passion but also that skills, knowledge, and being adaptable to any factors both personal and external, including political, social, economic, and cultural factors is important. Thus, when I reflect on my past science teaching, I use several theoretical perspectives outlined in Chapter 3 (Habermas' three human interests, Constructivism, Curricula, and Assessment). Habermas' three human interests as the main theory to reflect on my past science teaching on implementation of constructivist theory, my curriculum and assessment practices.

Habermas' three human interests

Habermas' theory of knowledge constitutive human interests helps me to understand that human action and thinking can be represented by their guiding interests. These three human interests could be applied in any situations, including my science teaching. I have come to realise that most of my journey from being a learner to becoming a science educator was shaped by the technical interest which the technical aspects of teaching, including delivering subject matter and controlling students' learning. I was more focused on their academic performance rather than the learning process itself. This technical interest shaped the power of traditional learning in my early teaching and implied that knowledge is objective reality which should be transferred to my students' minds. I used to ignore the fact that my students had different life experiences and that they constructed knowledge differently. It led me also to the practice of transferring knowledge to my students and ignoring their pre-existing knowledge. I didn't realise, my students could face problems if their

knowledge did not match with the “acceptable” concepts that I taught. The technical interest that shaped my teaching was mostly influenced by the constraints of the standardized education system in my country.

To represent my early teaching practice, I use the two metaphors of war and dance. I realise the power of the metaphor of war on my past teaching practices. For example, in Indonesia, it seems that the students are discouraged from thinking or speaking critically in class. As a result, it is very difficult for students to voice their opinions. This social reality influenced me as a student and a teacher. Teachers become the winners and students become the losers. I remember how I tried to guide my students to have exactly the same ideas as me; the ones I recognised as ‘accepted ideas’. At that time, having different ideas than the teacher was unacceptable. Thus, the metaphor of war applied in my classroom. It also happened when I interacted with my colleagues, as a junior lecturer; I tended to accept uncritically my senior lecturers’ ideas. As a government employee, the structural hierarchy discouraged my voice in the institution. As a result, most of my time as an employee could be explained by the war metaphor. It seems difficult to hold the dance metaphor within the border of institutions. The dance metaphor means allowing everyone has their own performance which is unique and acceptable without attack and win others’ arguments. Thus, I realise it is important to recognise and ‘play with’ my students’ ideas, not only control their voices. Now, as junior lecturer, I need to learn that I have to speak up with my own voice. Therefore, I realise that the dance metaphor will help me to struggle within my professional visions.

Furthermore, as I reflect on the curriculum metaphors and images described by Schubert (1986) (see Chapter 3). I realise how the powerful of the technical interest has shaped my past curriculum practices, as represented in Figure 7. My past curriculum practices were mostly shaped by subject matter, discrete tasks and concepts, cultural reproduction, and planned activities, and much less shaped by experience, *currere*, an agenda for social reconstruction, and intended learning outcomes. I focused largely on delivering the content and tasks to the students, so that students could achieve the curriculum document requirement and the content level. I tended to cover the contents for the examination rather than focus on my students’ understanding. As a result students were bored and slept in the classroom.

The worst effect was that around 70% of my students failed in the National Examination. Although sometimes, I was concerned on students' experiences, they were less important than the subject matter. I never thought that curriculum could be represented as *currere* or an agenda for social reconstruction, since I thought that educating my students was mostly about passing examinations and getaway a good job. Thus, I came to realise, how meaningless was my teaching as for many of my students'.

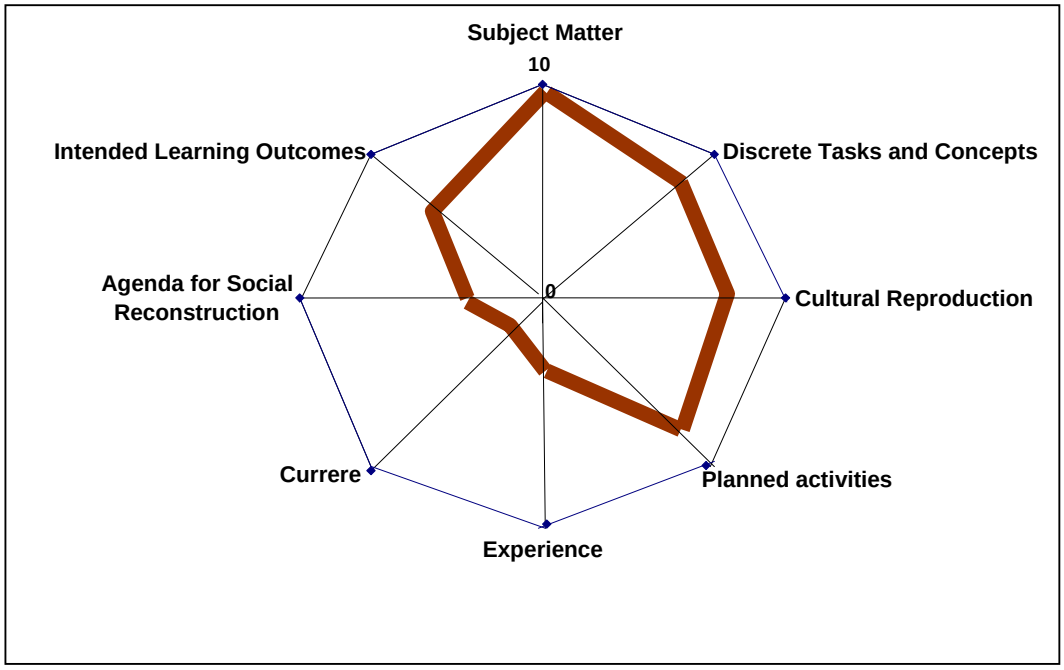


Figure 9. My Curriculum Images

I also came to realise that my past curriculum images were influenced by hegemonic factors that governed curriculum: political, economic, social, cultural, and religious factors. I thought that curriculum was influenced only by political factors, as I remembered that every time my country had a new education minister the curriculum documents changed. In Indonesia, the government used 'lesson planning' (rencana pelajaran) rather than the term 'curricula' (kurikulum) in 1947, 1950, 1958, and 1964 (which means the policy documents were changed four times). The term 'curricula' was used in 1968, 1975, 1984 and 1994. At this stage, our curriculum was very detailed and included the content, outcomes, types of assessment, and teaching strategies, leaving no room for teacher creativity. It was need changed to 'outcomes based' (Kurikum Berbasis Kompetensi), and then changed again to 'KTSP'

(Kurrikulum Tingkat Satuan Pendidikan) which is based on life skills, giving more space for teachers to design, implement, and evaluate their teaching based on school conditions. However, many teachers still tend to use this document as a list of subject matter that they have to teach, since at the end of the process students have to deal with the National Examination which is a mismatch with the outcome based system and the KTSP. This mismatch between assessment and curriculum creates a significant problem in the Indonesian education system. With this political influence, curriculum becomes a powerful text and, under the power of the government, teachers cannot change it. They can only deliver the content within the required time. A major focus of key political players has turned in the direction of globalization. The government wants to prepare the younger generation to compete in a globalized world. A recent government policy has mandated the learning of English language in primary school and that science teachers should teach science in the English language. It is very difficult for teachers and students, because they have never used English as an instructional language. As result of this reflection, I have come to realise my education system seems doesn't have a clear direction and that my curriculum is strongly influenced by political factors.

Furthermore, economic factors influence the curriculum. In the context of my chemistry teaching, for the sake of efficiency and economics, for example practical work has been reduced because it is expensive. Students do less practical work and instead do 'e-learning'. Through e-learning, students' computer skills will be improved and the cost of practical work will be reduced. The problem is that the students' skills in practical work in chemistry become poor, because there is a disparity in their skills when using computer simulation compared with actual laboratory work. Furthermore, related to social factors, IT skills are becoming priority skills for students because there are more employment opportunities for people with good computer skills. The problem is that not all schools have computer facilities, especially some schools which have mostly students from poor families. The difference between the poor students and the rich is becoming wider.

Cultural and religion influences factors also strongly influence the curriculum. My curricula have involved values and culture since primary school, focusing on students knowing and applying social values in their lives. For example, schools

teach the importance of respecting parents and family and women's role in the family. Thus teachers are required to educate students to follow social and cultural norms. And religion is also powerful. In Indonesia, religion is one of the obligatory subjects from primary school until university. Some religious schools involve religious instruction in other subjects such as science. For example, religion determines the teaching of ethical issues in science such as *euthanasia*. Because euthanasia is not allowed in Islam there is no debate in class on these topics because of the power of religion. Therefore, students' ability to weigh moral issues and make moral judgments is restrained in the classroom. To conclude, I have come to realise that the influence of political, economic, social, cultural, and religious factors shaped my curriculum practices.

I also have come to realise the power of the technical interest in governing my assessment practices. I mostly focused on summative assessment which led me to the common practice of controlling students' learning, judging my students' achievement, rather than helping students' learning. I didn't apply assessment as an integrated process for student learning, thereby building the students' confidence as learners. This type of learning ignored my students' motivation and belief. I only gave a single test every semester. I replicated what my teachers did, which meant that I couldn't do anything other than follow the rules of the school. When I assessed students' homework I simply gave them a mark without any feedback to improve their learning. And when I started teaching in university and gave feedback on students' laboratory reports, I noticed that students mainly focused on their grades. As stated by Rust (2002) in Chapter 3, giving a grade doesn't mean very much. In my assessment dilemma, how I struggled with giving grades to my students. The question of the power of numbers in assessment in relation to my students' ability is often something I asked myself about during my teaching experiences. I could not ignore the fact that giving a grade was an obligation in my education system. The feedback became meaningless. As a result, my students seemed to become more focused on their mark rather than their learning. Regarding qualitative feedback, I always made the excuse that the large class size and my heavy workload were too problematic but I now realise that it was important to give feedback in order to help students' to reflect on and improve their learning. Their practice could have helped me to reflect on my pedagogy and look deeply at my students' learning. In retrospect

I realise that I needed to consider different types of assessment that could enable students to represent their learning in different ways, not simply tests. I realise how my assessment negatively influenced my students' learning as well as their self-esteem.

In relation to standardised assessment in my country, which is strongly influenced by the technical interest, the metaphor of 'school as market' represents schools that focus only on producing students who can pass the examination. Such students view their role as simply memorizing the curriculum content for examination. The examination constrains the teachers to view the curriculum as a metal chain that is very strict and inflexible. My assessment practice focused on content knowledge which required students simply to memorise and gain only a surface understanding of the concepts. Assessment tests were multiple choice questions which most of my students chose to not even look at the questions. I felt terrible but I couldn't do anything else since the education system, as well as the school system, didn't allow teachers' creativity in teaching and assessment of student learning. I tried to engage students in their learning through the application of chemistry in their lives and future careers but when the National Examination was administered, the students failed because most of the questions focused only on memorizing the facts. The National Examination applied to all schools across the country and ignored differences among the schools. So when it was applied in my vocational school, which had mostly low achiever students, most of the students failed. These problems are still happening today; most schools with low achieving students have a low rate of students passing the National Examination. At that time, only 10% of my students passed the National Examination which meant they had to sit them again. Thus, standardised assessment is strongly hegemonic in my country and has governed my teaching practices as well as my students' learning.

Furthermore, the power of standardised assessment has negatively influenced the values of my community. As the National Examination is the major standard that students need to pass in order to graduate from school, it leads to several negative effects as the schools, the teachers, the parents, and the students do everything they can to pass. Here I present a story about Alif who was the victim of the National Examination, titled "*When honesty is meaningless*".

When Honesty is Meaningless: Alif's Story

My eyes are stuck to the computer; I always watch television channels streamed from my country. I can't believe the disastrous National Examination, which is happening in my country. Alif, an elementary student from Surabaya and his mother, Siami, reported on mass cheating to the Surabaya Mayor, Tri Rismaharini. The mass cheating started when Alif, a bright student, was asked to share his answers with all his friends during the National Examination. However, Mrs. Siami's neighbour was angry because of her honesty in reporting this coercion, threatening to set fire to her house unless she left the area. The report caused the firing of the principal and two teachers and reductions in the allowances of other teachers. During the news, the reporter investigated that that it is not only happening in Surabaya but also in other areas of Indonesia at all grade levels. I keep watching, alternating between feeling sad and angry. The power of the technical interest in passing the exam has led to the dismissal of honesty in education. I believe in the value of honesty. But behind the veneer of high morality in relation to education in my country, what is the reality? I keep silent and try to process the hectic thinking in my mind.

The story above happened in my country in June 2011. I felt sad when I saw Mrs Siami and her family move from their house because their neighbours didn't want them to stay there as they believed that Mrs Siami and her family destroyed the opportunity for their children to pass the exams. It is terrible when parents do everything in their power to force their children to pass exams, including neglecting honesty. We are always taught by our culture and religion that honesty is an important value and we need to hold honesty in our lives. It is taught since we are children in our family. But when the standardised assessments have such power in our education systems, our values and beliefs are neglected. The lesson from the National Examination in 2011 (in this Alif's story) created an overreaction from the Government. In 2012, the Government created five different types of problems set in one classroom with sit arrangement to avoid cheating happened in the schools. So, in one classroom student will not have the same problem set with other students who sit nearby. As a result, many students became stressed with some of them having go to

hospital and some arrested by the police because they were cheating (from different news sources in Indonesia). It is not only frightening for students and teachers, but also for principals and schools, since the result of National Examination is not only the standard for schools' grades, but also the standard for school funding. Schools that have a good performance once in National Examination receive more funding from the Government. Thus, disadvantaged schools are left further behind, as was my vocational school. Finally, in my country, examinations are becoming more frightening as students and teachers seem to be suspected of crimes, and passing the exams and achieving good results seems to be of overriding importance.

Although unknown to me at the time, practical interest started to shape my past science teaching experiences after I developed passion in my teaching. The negative outcomes of my teaching practice -students' disengagement and failure in the examination- stimulated me to create meaningful learning experiences for my students. I wanted to help my students interpret and understand the new knowledge. I started to recognise the importance of students' lived experiences for engaging them. Curriculum as intended learning outcomes became a part of my past curriculum practices, but not as much as discrete tasks and concepts. I started to recognise the importance of constructivist learning theory by exploring the prior knowledge of my students and using the information to guide students' conceptual development. At that time students' understanding and engagement was my priority. I taught high school and I struggled to deal with students' misbehaviour, however, when I helped them to make sense of chemistry, their behaviour improved. Thus, I came to realise, the importance of students' understanding and engagement in my teaching.

Figure 10. Students' Discussion before Conducting Experiments

My negative experiences in the vocational school as well as my learning experiences in SMAKBo, stimulated me to apply metacognitive approaches in the University. I realise the benefits of metacognitive approaches in constructing meaning and knowledge through self-regulation. Through metacognitive approaches, my teachers in SMAKBo explored my thinking process to help me better understand chemistry concepts. My teachers asked self-regulated questions throughout the learning process in the classroom and laboratory. The questions stimulated me to think about the learning process. Even though it seemed very stressful, it encouraged me to understand chemistry concepts. In fact, I found that I didn't have difficulties when later studying chemistry in the university. I still remember most of the concepts chemistry which help me as an educator to engage with my students. When I taught at the university in the chemistry laboratory, I found that my students followed the practicum procedures without understanding the concepts. They added chemical substances and followed the instructions without understand the purpose of each step in the procedure. As a result, when they made observations during the practicum which were different from the procedures that they followed, they could not solve the problems. Therefore, during my university teaching, I tried to apply metacognitive approaches to explore students' understanding of the concepts. Even though it took enormous time and energy, I asked questions before they did experiments in the laboratory, during their practicum, and after conducting their practicum. As a result, they developed a better understanding. It also encouraged them to ask other questions and they became more curious about understanding the concepts. I realised that to provide meaningful learning experiences within the borderland of standardization requires much effort. However, educators should be more conscious of the importance of their role in encouraging their students to be aware of themselves and their society throughout meaningful learning experiences. Thus, within the context of the technical interest, I realise that it is empowering to engage my students in meaningful learning experiences under the practical interest.

In reflections on the emancipatory interest, it was much less applied in my past teaching practice. I never thought on my roles in emancipatory interest such as helping my students to reflect on their past and present experiences and envision their future experiences. As chemistry teacher educator, I understand the power of education in terms of changing society. But, I never thought and asked my students

to reflect on their experiences to develop a deep understanding of their agency as a teacher in the future. I realise that I don't want my students to have similar experiences with me such as when my teacher education program focused on memorizing the pedagogical content rather than making sense of my experiences to develop my agency as a teacher in the future, but I was doing nothing. Finally, I realise that most of my past science teaching practices were shaped by the technical interest. Even though I implemented green chemistry in my laboratory, I didn't put much emphasis on empowering the students to participate in their current and future roles for creating a better world. However, I realised that the three human interests taken together can help me to identify and envision better teaching in the future.

CHAPTER SUMMARY

Writing this chapter has evoked many emotions; opened up the black box of my teaching journey. I have had to face the reality that I could have been a nightmare for my students, an experience that they may remember and replicate throughout their lives. The reflections from throughout my childhood and teenage years have made me understand the role of family and community in my life decisions. The exploration of the journey of my teacher education helped me to have a deeper understanding of the role of teacher educators in shaping pre-service teachers, not only their knowledge and skills, but also their passion for teaching. I have come to realise that beginning the journey of teaching without any motivation for teaching was challenging. However, it became a starting journey for me to understand the nature of teaching itself.

In my reflections on early science teaching, I have realised that most of my teaching experiences have been shaped by technical interests in focusing on subject matter and students' achievement, even though later I tried to engage my students in meaningful learning experiences. Looking at different features of constructivism stimulated me to realise that I only had a surface understanding of constructivism in my beginning teaching, in which I understood constructivism as focusing on meaningful learning experiences. In terms of curricula, I realised that there are multiple factors and my curricular images are discussed throughout the chapter. Finally, I realised that I can't ignore the powerful factor of assessment which has constrained my teaching practice, and that I need to learn to apply assessment

methods for supporting learning in my classroom that can build self-regulated learning and students' confidence rather than destroy their self-esteem as learners (Nicol & Macfarlane-Dick, 2006; Stiggins, 2001). In reflecting on my past science teaching, I was challenged by the complicated education problems in my country. The problems with teacher quality, teacher welfare, students' engagement, students' and teachers' values and beliefs in teaching and learning, standardised assessment, lack of infrastructure and teaching resources. I have always questioned myself in terms of what way I should start to solve the problems. How can I participate in solving these complicated problems? I close this chapter with a hadith (i.e., Prophet Muhammad narration) which reminds me about the importance of being passionate as a teacher, as well being connected with our soul as a guide for our lives, especially for being a teacher.

The Prophet Muhammad Hadith:

> *Allah's Messenger said, "Richness is not in plenty of provisions; the (real) richness is the richness of the soul" (Hadith narrated by Bukhari and Muslim*)

PART FOUR: REVEALING AND RECONCEPTUALISING MY TEACHING IDENTITY

CHAPTER 5

A BEGINNING JOURNEY OF REVEALING AND RECONCEPTUALISING MY TEACHING IDENTITY: CO-TEACHING, IDENTITY, CULTURAL IDENTITY, AND TEACHING IDENTITY

INTRODUCTION

Open Your Eyes, Look At Your Heart…

Open your eyes
You see the differences
Look at your heart
You see the differences

Open your eyes
Teachers with their pictures
Look at your heart
Teachers with their soul

Open your eyes
There are different powers
Look at your heart
There are different imaginations

Open your eyes
Look at your heart
There is a power shaping their practices
There is a soul drawing their feat
There is a teaching identity
Fluid and growing up
In the eyes of teachers
In the hearts of teachers

This poem represents my journey in engaging with three different science teachers during co-teaching, looking at different teachers with their different practices and beliefs. I came to realise that different dimensions have shaped their teaching practices and beliefs, including their cultural backgrounds and personal experiences. When I look at myself as a teacher, I keep questioning who am I as a teacher? What dimensions are shaping my teaching practices and beliefs? The questions came around in the journey of co-teaching. I have had different levels of experience in collaborative teaching; however I had never deeply engaged in co-teaching, until the ARC project (see Figure 2). My co-teachers came from different cultural

backgrounds and personal experiences, and this stimulated me to think about the differences in our teaching practices. It was a really empowering journey in helping me understand myself as a teacher, and evoked in me deep thinking about my teaching identity.

Part Four focuses on the journey of revealing and reconceptualising my teaching identity, and consists of Chapters 5, 6, 7, and 8. Through critical self-reflection on my journey from being a student, a student teacher, a postgraduate student, and a co-teacher, I came to realise that four major factors have shaped my teaching identity: culture, religion, and personal experiences (according to transformative learning theory and sustainability education). In Chapter 5 I start to reflect on my cultural identity as one of the major factors that has shaped my teaching identity. I found that culture has strongly shaped my teaching identity which was sedimented in my teaching practice. The journey of exploring the power of culture became a revealing process for my teaching identity. In order to help me understand deeply, I used different theoretical perspectives on identity, teaching identity and cultural identity.

When I worked in co-teaching with different teachers in Australian schools, I experienced the power of cultural in shaping our teaching identities. However, I struggled to understand the differences, not only the way teachers delivered the lessons and approached the students, but also the values and beliefs that shaped their classroom culture. I came to realise the power of cultural in shaping my teaching practices and my co-teachers' practices. In order to explore the influence of culture identity on my teaching identity I have divided this chapter into 5 sections.

1. **The Journey of Co-teaching**

   In this section, I briefly consider different theoretical perspectives on co-teaching to help me reflect on my perspective on this concept. This is followed by reflections on my experiences in collaborative teaching, including in the ARC project.

2. **The Picture of My Identity**

   In this section, I consider different theoretical perspectives on identity as well as reflections on my own identity. I portray my reflections on how I understand my identity within different roles in my life, including that of being a teacher.

3. **Framework of My Teaching Identity**

   In this section, I consider different theoretical perspectives and reflections on teaching identity. This becomes the beginning of my journey to revealing and reconceptualising my own teaching which is explored in the next chapters.

4. **Who Am I? : Understanding My Cultural Identity.** In this section, different theoretical perspectives inform my personal reflections on my cultural identity.

5. **Cultural Identity in My Teaching Identity.** In this section, I explore how my culture identity has shaped my teaching identity.

THE JOURNEY OF CO-TEACHING

In early 1973, Miller and Trump defined co-teaching as two or more teachers working together to plan, instruct, and evaluate subject/s (as cited in Bacharach, Heek, and Dahlberg, 2010). Tobin (2006) and Murphy and Scantlebury (2010) recently defined co-teaching as collaboration of two or more teachers in teaching a diverse group of students, at the same time they are learning from each other. I had valuable learning experiences with my co-teachers, not only learning their pedagogical skills, but also their values and beliefs about teaching. Co-teaching has been introduced in different contexts from pre-service-teachers, special education, and elementary, secondary to higher education levels. There is innovative work by Roth and Tobin on integrated co-teaching with co-generative dialogue. Through co-generative dialogue students have opportunities to participate actively in their learning. According to Stith and Roth (2008), involving students in co-generative dialogue will help them to engage and contribute to their learning which leads to classroom transformation. Co-teaching and co-generative dialogue have been used for teacher evaluation (Roth & Tobin, 2001), for classroom praxis (Roth, Tobin, & Zimmermahn, 2002; Martin, 2006), for transforming classroom culture (Lehner, 2007), and for transforming teachers' beliefs and practices (Carambo & Stickney,

2009) because co-teaching and co-generative dialogue provides opportunities for sustaining the transformation process (Martin, 2006). I conducted co-teaching and co-generative dialogue in the ARC project, however in this thesis I only focus on co-teaching.

In my own experience, I have come across different names for collaborative teaching, including peer coaching, peer teaching, lesson study and co-teaching. In Indonesia, I had experience in a Government Grant of doing peer coaching in my university. I worked with my colleagues to improve our pedagogical practices. The focus during this peer coaching was teaching skills; I regularly went to my colleague's classroom to observe her classroom and give feedback for improvement. It required huge effort and time, since we had large classes and teaching overload. Every time I did peer coaching with her I questioned myself – would we willing to do peer coaching once the grant is finished? Is this an effective way to improve teachers' pedagogical skills?

My experience was further enabled by the fact that in the following year (2009) Japan provided a large grant to the Indonesian government to introduce 'lesson study' at the higher education level in Indonesia. My university was one of those that received the grant. My colleagues were busy implementing this concept as it was a large grant. When lesson study was implemented around 7 lecturers who taught Basic Chemistry (including me; I'd just finished my Master's degree) observed one lecturer's performances in teaching Chemistry Kinetical Reactions. They observed mostly the lecturers' pedagogical skills and the student-lecturers' interactions. After conducting the lesson studies my colleagues conducted meetings to generate feedback for improving teaching. I was amazed by the process because I realised collaboration and conversation among my colleagues could improve teaching in my department. However, it only happened during the period that we had the grant; once it was finished the lecturers didn't conduct any further lesson studies. Currently many research papers confirm that lesson study is powerful for teaching improvement, but it is not often implemented.

My journey in collaborative teaching continued when I worked on the ARC project which focused on co-teaching and co-generative dialogue (see Figure 2). I realised

co-teaching as collaborative teaching provides a dynamic structure in the classroom. Based on my experiences, I found teaching collaboratively helped the teachers to improve their pedagogical practices as well as their students' learning. For myself, in co-teaching, I had opportunities to engage in meaningful interactions and reflections with the science teachers (Wassell & Stith, 2007). According to Roth (2005), co-teaching involves co-learning which provides opportunities for teachers to reflect on their practices. During this process, I was able to reflect on my teaching identity when I looked at the different practices of my co-teachers. Thus, co-teaching not only helped me to improve my pedagogical practice but also, most importantly, it stimulated the revelation of my teaching identity. If co-teaching was limited to improving pedagogical skills and students' learning it would be only effective during the co-teaching period, especially if teachers are not being empowered to maintain the improvements. Revealing and reconceptualising my teaching identity as a result of co-teaching was powerful for me to reflect on and transform my pedagogical praxis for my life-long journey as a teacher.

THE PICTURE OF MY IDENTITY

I am Someone

I am Someone
I am a female
I am Indonesian
I am a moslem

I am Someone
I am a daughter and a sister
I am a wife and a mother
I am a teacher and a student

I am someone, who can't
Confine my words to describe myself
Control my lands to explore my soul
Constrain my views to describe my identity

I am someone
Who learns to understand myself
Who discerns to understand others
Within my different roles and dimensions
I shape my identity

The poem portrays my reflection on my identity within different roles. In writing this thesis, I realised that I needed to have a deeper understanding of myself in order to

reconstruct my teaching identity. Understanding my identity is part of my learning process, because "learning is not only a cognitive and social experience, but also an identity experience" (Ligorio, 2010, p. 97). I introduce this section by outlining the interplay of different life roles I have enacted which have helped me to more fully understand my identity.

I am…

I am a moslem

I read my Al-qur'an after maghrib pray (sunset), I read through the meaning of surah, "Allâh will exalt those of you who believe and those who are given knowledge to high degrees" (58:11). Every time I read this surah, I always think of my role as an educator. This surah keeps me motivated to remember that Allah privileges Moslems who always develop their knowledge.

I was born a Moslem and educated in a powerful Islamic environment, since both my parents are Islamic religion teachers. This has shaped my values, beliefs, and practices within my life. I could say Islam is 'my way', in every aspect of my life.

I am an Indonesian

I am going to my friend's house; today she is moving house, so my husband and I come to help her. She and her family already have their stuff packed in the boxes. We try to help to clean her house and put boxes into cars with another Indonesian family. We are living in the same block of units. There are 11 units in the block and 9 of them are occupied by Indonesian families. So, every time one of us needs help others will be ready to help. Every time a family is moving house others will come to help without being asked. The husbands will help to move the boxes and clean the house, and then the wives will help to clean the house and prepare some food. We enjoy the food together with other families who also help my friend.

Since I arrived in Perth, the Indonesian community has always helped me, from finding a house, finding shops, to making other adjustments to the Australian culture. The value of helping others has been internalised since I was a child and was part of five basic principles of Pancasila as foundation values' and beliefs' of Indonesia.

I am a daughter

I call my mother as I am really worried about my father -he is in the hospital for an appendix operation-. He has a complicated medical history, with diabetes,

cholesterol, lung pain, appendix pain and high blood pressure. I ask my mother to put my father on the phone. With a sorrowful voice, my father picked up my call. He is almost crying when I tell him to be strong and I love him so much.

I regularly contact my parents and family during my study in Perth; I miss and love them so much. Even though I enjoy staying in Australia, my family keeps me motivated to finish my study and return to Indonesia. I would like my parents to be proud of me as their oldest daughter for being responsible for taking care of my two younger sisters and for being a role model for them.

I am a wife

I cook food in the morning at 5am after I perform my Shubuh prayer (sunrise time). I prepare my husband's favourite food -stir fried beans with hot chilli chicken. He likes spicy Indonesian food. Even though we have been in Perth for four years he still only likes Indonesian food. It takes more time to cook Indonesian food than Australian food but I am happy because my husband and my daughter love my dishes. I look at the clock; it is already 6am, I need to clean my house and prepare my daughter before going to SMEC.

These are my regular activities in the morning; as a wife, I have responsibilities for the household, while my husband's responsibility is working. Even though my husband also helps me with the household, I have to manage my time between the household and my study. I am happy with my responsibilities, especially when I see they are happy to eat my dishes. The feeling is like when I see my students being successful. My husband is the leader of the house, so he has responsibility for me and my daughter which shapes my role as a wife.

I am a mother

I walk with Faiqa, my 4 year old daughter, to the playground in the afternoon. She is always happy every time I ask her to play with me at the playground. Since starting my doctoral study I hardly ever play with my daughter during the weekdays because every time I come back from SMEC I feel so tired, and so I rarely have enough energy to walk with her to the playground. I try to spend time playing with her at home. I feel sad about it because I always dreamed I would spend more quality time with my daughter.

I feel blessed to be a mother. Compared to being a student and a teacher educator being a mother is more important. I realise that I need to prepare Faiqa as

part of a generation who is aware of their identity and their roles in the future. Therefore, I always feel guilty if I can't spend more time with Faiqa during this intensive study period.

I am a student

I sit in front of my computer at SMEC beginning at 7am. Since my thesis submission date is getting close I spend more time at SMEC. As a scholarship student I need to be aware of having 3 years to finish my study while also doing the ARC project. Three years is really challenging, especially since I am a Thallasemia carrier; I always get sick if I am too tired. My sickness often disturbs my doctoral study. I remember that I was sick for 3 months recently. Uffh, I read all the books and journals and other references, I work hard to understand the content with the limitations of my English language and my knowledge. Then, I keep writing to reflect on my experiences and my understanding in different contexts and references. I realise how tough the journey is as a doctoral student.

I feel fortunate to have opportunities for gaining further study under a scholarship from the Australian government. Therefore, in my role as a student, I realise the importance of working hard and developing my knowledge in my study.

I am a teacher educator

I watch Indonesian television on my computer. I feel miserable when I watch the story of the teacher in the remote village who has to teach in a school with damaged buildings, leaking roof, and no windows. Sometimes, he has to ask his students to go back home because of heavy rain. The teacher has to work another job, such as being a barber, because his teacher salary is not enough for his family and it often comes late because of complicated government bureaucracy. However, in these conditions, the teacher still has passion to teach and love his students. He always uses different teaching methods to engage the students within these limitations. I reflect on myself as a teacher educator. Can I educate my student teachers to be passionate science teachers who are still empowered despite limiting conditions? Being a teacher educator is my way to contribute to my community and my country.

I realise the importance of teachers' roles in improving education and educating the young generation in my country. These educational values motivate me to keep improving my knowledge and skills as a teacher educator.

I wrote the above reflections on my different roles to better understand my identity. In the process I came to realise the influences of my different roles in shaping my identity. According to Gee as cited in Lee and Anderson (2009, p. 184), there are four different ways to understand identity: *nature identity:* a "natural" state of being, given from forces in nature (e.g., being biologically "Asian"); *institution identity:* a position authorized within institutions (e.g., being a student or a teacher); *discourse identity:* an individual trait recognised in interactions (e.g., as a result of interaction, either passively or actively taken on); and *affinity identity:* a set of shared experience in practices of "affinity groups" (e.g., being a "tech geek"). In this sense, I can understand how identity can be developed and maintained through dynamic and social interactions (Lee & Anderson, 2009). I struggle with the various roles of being a mother, a wife and a student, however the values and beliefs in each role have shaped my thinking and actions in my life. Of all my roles, when I look at my role as a teacher educator I realise that I can do something to help make a better future for education in my country, especially in the context of my student teachers' education. These reflections have involved personal emotion which I couldn't ignore, especially the feeling of discomfort and disempowerment. According to Geijsel and Meijers (2005), identity is a learning process; it is something that is constructed with the involvement of emotions. In the journey of exploring my identity, exploring my mixed emotions has helped me to understand who I am at both the personal and social levels; who I am in various roles.

Identity is interpreted in different ways in daily life, psychological theory, and educational theory (Geijsel & Meijers, 2005). There are several uses of the concept of identity: (1) a basis for social and political action, (2) a specifically collective phenomenon, (3) a core aspect of selfhood (both individual and collective), (4) a product of social and political action, (5) a product of multiple discourses (Brubaker & Cooper, 2000). Here I use the concept of identity as a core of selfhood which is derived from Erikson and Vygotsky. Erikson (1968) pointed out identity as a balance of self-understanding and understanding the social and cultural. Later, Vygotsky (1978) focused on identity as socially constructed in social/cultural contexts, including shared beliefs, relationships, customs, symbol system (language), knowledge, physical settings, and objects. These two references are relevant to my critical self-reflections; as I have found my religion and my cultural identity

contribute greatly to shaping my identity. Castells (2010) points out that cultural attributes contribute more to identity. People learn to understand their identity as part of their actions to characterize their belonging to a group and to understand who they are (Gómez-Estern, Amián, Medina, & Macarro, 2010). According to Palmer (2004), identity involves all forces that constitute our lives, including genetic makeup, our parents, culture, experiences (bad and good, love and suffering), and identity is also a moving intersection of inner and outer forces that make who we are as human beings. Therefore, I realise that within different roles my identity has been shaped by both personal and collective values, beliefs, and practices which are strongly influenced by my religion and cultural identity.

To understand my identity within the power of personal and collective values, I also came across the culture studies concept of essentialist and non-essentialist theory. According to Lee and Anderson (2009), essentialist views developed in 1950s and 1960's are related to psychological definitions of identity by (e.g. Erikson, 1968) and with the nature and self-development of the self. According to Ashcroft, Griffiths, and Tiffin (2000, p.77), "essentialism is the assumption that groups, categories or classes of objects have one or several defining features exclusive to all members of that category". Lee and Anderson (2009, p. 185) point out that criticisms of the essentialist/Eriksonian/psychological approach mostly come from social constructionist views in which identity is a process in a social practice and not a given or a product. Essentialist theory helped me to understand aspects of my identity that are fixed, such as my biological sex, my skin colour, my ethnicity and my religion. Meanwhile non-essentialist theory helped me to understand that my identity keeps changing as I interact with different social contexts. According to Cerulo (1997, p. 387), anti-essentialism promotes "the social construction of identity as a more viable basis of the collective self". Indeed, I have experienced the power of social construction in my identity. At that stage I applied dialectical thinking to navigate these theories. According to Lee and Anderson (2009, p. 186), "a general understanding of essentialist and social constructionist views of identity places them at opposite ends of an ontological continuum, with identity being (a) fixed, internal, and in direct correlation with measurable characteristics at the essentialist end and (b) fluid, social, and variably related to contestable and constructed categories and contexts at the social constructionist end". Understanding my identity as both fixed

and changing has helped me to integrate these two concepts within my different roles. I have realised that people could have plural identities, such as within different roles, which could be a source of stress or contradiction between self-representation and social actions (Castells, 2010). Therefore, I didn't want to be trapped by the idea of the separation of the personal and the collective, as essentialist and non-essentialist respectively, in understanding my identity.

In addition to my experiences during co-teaching, I have realised how powerful it is to understand one's identity, how this leads us to becoming more intelligible to oneself and to others (Wetherell, 2009). I never thought that working within differences would stimulate my reflections on my own identity. Whilst I was in my home country, I realised that there are differences between ethnic groups and religions, however I became much more aware of the differences while staying in Australia. According to Cilliers (2010, p. 12), "identity is the result of diversity" and these two (identity and diversity) are mutually each other in an open dialectic. If there is not an open dialectic the diversity becomes a threat because each person will not appreciate the others' identity. Each individual would think that their identity is better than others. Therefore, I agree that we need to appreciate diversity for revealing our own identity.

FRAMEWORK OF MY TEACHING IDENTITY

Who Am I as a Teacher?

I walk along the way
I see myself in the classroom, keep talking, and keep writing
I see my students in the classroom, keep listening, and keep writing
My classroom is quiet, my classroom is silent
It is really the perfect classroom
It is really the perfect picture of my role

I walk along the way
I see myself at home, planning lessons and preparing students' exam
I see my students at home, working on their homework, and studying for exams
My role is just perfect, my students are just great
It is really the complete picture of my teaching
It is really the complete portrayal of my students

I walk along the way
I see myself repeating similar activities
I see my students following the recipes
I am a trainer, my students are the followers

I walk along the way
I see my other students fighting each other with knives and stones
I see my other students drinking in the street and selling drugs
I see my other students in hospital
I see my other students in jail

I walk along the way
It is not the perfect classroom
It is not the perfect picture of my role
It is not really the complete picture of my teaching
It is not really the complete portrayal of my students

I walk along the way
Who am I as a teacher?
Am I a controller?
Am I a trainer?
Within the black tunnel of questions, I can't see
Within the endless journey, I can't walk
I am stuck in the middle of my journey, who am I as a teacher?

This poem portrays my critical reflection on my beginning journey as a teacher to reveal my teaching identity. Who am I as a teacher? What do I look like as a teacher? What is my teaching identity as a teacher? I can see myself as the replication of most, of my own teachers' teaching identities. I learnt from my personal experiences what a good teacher looks like without doing any self-reflection on my identity as a human being who has been developed by different important factors. I realise that each individual identity is different and unique.

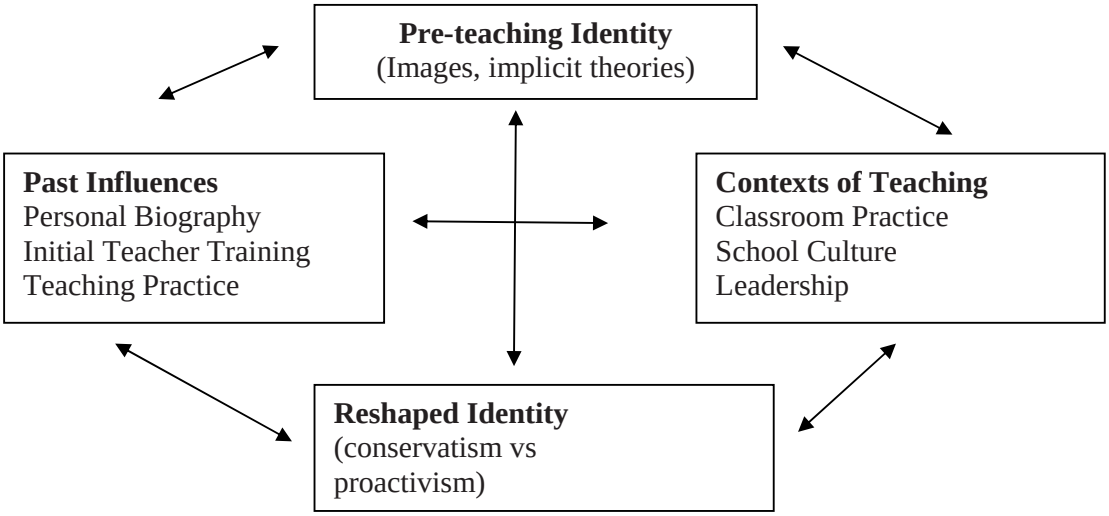
I have realised that teaching is holistic; it is not only the technical and cognitive aspects. It involves personal, social, and emotional factors. In exploring my teaching identity, I came to understand how these aspects exist in myself as a teacher. I am exploring my teaching context and my teaching culture as well as my relationship with others such as colleagues and students. This has empowered me to educate my student teachers so that they better understand their teaching identity, as stated by Olsen (2005, p.5) below:

> Teacher identity is a useful *research frame* because it treats teachers as whole persons in and across social contexts who continually reconstruct their views of themselves in relation to others, workplace characteristics, professional purposes, and cultures of teaching. It is also a *pedagogical tool* that can be used by teacher educators and professional development

specialists to make visible various holistic, situated framings of teacher development in practice

According to Rodgers and Scott as cited in Hammana and Gosselin (2010), research in teaching identity has become an important research area with relevance to diverse teachers' beliefs, attitude, life history, and personal narrative which share similar basic assumptions about identity: (1) identity is influenced by context, (2) identity is formed through relationships, (3) identity is changing, and (4) identity involves meaning making. Hammana and Gosselin (2010) point out that it is important to understand teachers' professional identities to understand essential aspects of teachers' professional lives such as career decisions, motivation, job satisfaction, emotion, and commitment. Thus, I realise the importance of teacher identity for my teaching as well as for my student teachers.

Vonk, as stated in Flores and Day (2006, p. 220), identified two distinctive phases in beginning teachers' professional development: the threshold and growing into the profession. "The identities of the new teachers in this research had been strongly personally embedded at the beginning of their teaching careers, but destabilized by the negative school contexts and cultures in which they worked" (Flores & Day, 2006, p. 230). For these new teachers, then, identities were deconstructed and (re)constructed over time according to the relative strength of the key influencing contexts of biography, pre-service programs and school culture (see Figure 11). However, "the meanings, values, images and ideals of what it meant to be a teacher with which they entered teaching were challenged and, for many, teaching became more routine, more rule governed and less creative" (Flores & Day, 2006, p. 230).



(Flores & Day, 2006, p. 230).

Figure 11. Key Mediating Influences on the Formation of Teacher Identity

Danielewicz (as cited in Witt, 2010) points out that for becoming a teacher an individual needs to have an identity. Identity as all the forces that constitute someone's life influences teachers to be good teachers. According to Palmer (2007, p. 13), good teaching comes from teachers' identities and integrity which are as "much to do with our shadows and limits, our wounds and fears, as with our strengths and potentials". Teachers need to know the multi-dimensional issues that shape their lives and then integrate these dimensions in order to be a good teacher. According to O'Connor (2008), teaching identity has a reflective and active dimension. Thus, teachers should reflect on and develop their identity to engage with their work.

According to Palmer (2007), good teachers share one trait which is a strong sense of personal identity that infuses their work. For example, such a teacher would be enthusiastic when she's teaching. The notion of our teaching identity is shaped by our experiences in the classroom (Shapiro, 2010). Therefore, every time I reflect on my teaching identity, I consider my classroom teaching experiences in order to have a clear picture of myself as a teacher. During my experience as a beginning teacher becoming a teacher educator I could see my teaching identity changing. According to Erikson (1950, 1963, 1968, 1975), identity is not fixed, it can be revised and transformed through ongoing experiences and historical circumstances. Therefore,

my current identity and my teaching identity could change in the future. I remember as a beginning teacher I had the experience of floating expectations between my ideal theoretical teaching practices and the real school context. During my teacher education, I already had an idea of what a teacher should look like, but when I had to deal with real classroom practices I was shocked. However, my values, beliefs, and practices helped to deal with those realities.

As expressed in my perspective above, I can see that teaching identity influences personal and collective values, however these are also influenced by professional practices and politics, as stated by Hoffman-Kipp (2008, p. 135) below:

> I define teacher identity as the intersection of personal, pedagogical, and political participation and reflection within a larger socio-political context. I see teacher identity as a mix of values, beliefs, attitudes, approaches to interaction, and language that has been developed in personal realms (life history, family, community of origin) combined with understandings, pedagogical commitments and approaches, and routines of professional practice developed in teacher education programs and on the job

I have come to realise how the power of my religious and cultural values and beliefs is shaping not only my personal identity but also my teaching identity. I have realised also how professional requirements and political aspects have shaped my teaching identity. For example, I place value on students' empowerment but when I have to deal with school-driven politics of objectives, I need to renegotiate this value which is shaped by my teaching identity.

In relation to my co-teaching experiences, I have come to realise how co-teaching helps me to reveal and reconceptualise my teaching identity. Co-teaching has been a learning process for me in different teaching contexts. As I worked with experienced teachers I learned from them about their values and beliefs in teaching as well as how they deal with complex problems. Thus, I agree that co-teaching as learning to teach is a process of developing a teaching identity in the system of relations which

involves learning about ourselves and making personal choices about who we are as a teacher (Tobin, 2006; Smagorinsky, Cook, Moore, Jackson & Fry, 2004; Green as Cited in Witt, 2010). However, I didn't only follow my co-teacher as an experienced teacher I have realised that I also have my own teaching identity that I need to negotiate or not to negotiate during co-teaching.

WHO AM I? : UNDERSTANDING MY CULTURAL IDENTITY

In the Rainbow of Different Theoretical Perspectives

The concept of culture, from the language of *cultura,* was first developed in the 17th and 18th centuries and focused on the cultivation of human lives. This was followed in the mid-19th century by the emergence of culture as social development (Schech & Haggis, 2000). The concepts of culture have emerged from different perspectives, including anthropology, linguistics, and psychology. According to Begaye (2007), from an anthropologist perspective (Clifford Geertz) culture is a system of symbolic forms of expression for people to communicate, to perpetuate, and to develop their knowledge and attitudes toward life. Meanwhile, from a linguist perspectives (Edward Sapir), culture is social science utilisation which embodies in human life both material and spiritual aspect. In a psychological perspective, Wierzbicka (2005, p. 580) defines culture as "ways of living, speaking, thinking and feeling widely shared in a particular society". Cobb and Hodge (2011, p. 181) also point out that "culture as a *way of life* that is characteristic of a bounded community...[which] passed on from one generation to the next". Within these perspectives, culture consists of behaviours, values, beliefs, knowledge, and practices that are embedded through interactions to become local or traditional cultures. In deeper perspectives of culture, Sewell, (1999, p. 39) argued that culture has two fundamental concepts, (1) "A theoretically defined category or as an aspect of social life that must be abstracted out from the complex reality of human existence", and (2) "a concrete and bounded world of beliefs and practices". Bocock, as cited in Schech and Haggis (2000, p. 16), defined culture in five terms based on the history of the term emergence: (1) cultivating land, crops, animals, (2) cultivation of mind, arts, civilisation, (3) process of social development, (4) meaning, values, ways of life, and (5) practices in producing meaning. Tobin and Roth (2007, p. 3) proposed that another way of understanding culture is as a dialectical approach, both "a system of structurally

related symbols and artefacts and a system of patterned actions (i.e., practices)". Drawing on these theoretical perspectives, the concept of culture used in my research focuses on the values, beliefs, practices, and related symbols of a culture which have been shaping my way of life within my different roles.

In relation to studies of cultural identity, Gómez-Estern, Amián, Medina, and Macarro (2010) point out the debate on whether cultural identity should be attributed to the individual or the group. Meanwhile, Sussman (2000) relates cultural identity as coterminous with national identity. In understanding these perspectives, I have come to realise that sometimes I recognise myself as part Javanese, Bimanese, and Indonesian. My mother comes from Bimanese culture, my father comes from Javanese culture, which one both ethnic groups in Indonesia. These different groups have different values and beliefs that shape each group identity, however they are related to each other. I recognise that understanding cultural identity is part of a reflective process. As Gone, Miller, and Rappaport (1999, p. 381) stated, cultural identity as "a form of conscious, reflexive and evaluative self-understanding pertaining to that facet of the self which knowingly commits itself to the shared values and practices of a particular cultural group". However, cultural identity is a problematic concept, not only the concept of culture but also the concept of identity itself which has no clear boundary (Drichel, 2008). One of the examples from a psychological perspective Gómez-Estern, Amián, Medina, and Macarro (2010, p. 233) points out that cultural identity is a construction process through mediation of semiotic tools such as symbols, myths, and social languages, and is socially situated and influenced by genetics. Thus, I agree that there are influences of both genetics and social setting in constructing my cultural identity.

I believe that understanding cultural identity is important because as Usborne and Taylor (2010, p. 885) point out, "we posit that it is an *individual's perception* of the clarity of his or her cultural identity that is important for personal identity clarity and both self-esteem and well-being". At this stage, I feel fortunate that I am experiencing an exploration of my cultural identity in this thesis, something that I have never thought about throughout my life journey. I believe that narrative and reflective writing is the best way to understand my cultural identity. The narrative writing in this chapter has allowed me to discover the silent values, beliefs, and

practices of my culture as part of myself. As Gone, Miller, and Rappaport (1999, p. 384) point out, studying past personal narrative is a way to investigate cultural identity, because personal narrative provides unique opportunities to represent the self in the construction of personal meaning and to "capture the co-constitution of individual agency and cultural durability". Usborne and Taylor (2010, p. 882) point out that "a clear cultural identity represents a coherent narrative, a clear subjective knowledge and understanding of a group's values, norms, and characteristics, no matter how complex these shared elements might be". I have come to realise my struggle to deeply understand myself emanates from various cultural perspectives. Initially When I looked at my parents who come from different cultural backgrounds, and I looked at Jakarta as the place where I was born which has its own culture, I became confused about who I am within these three different cultural backgrounds. Then, when I reflected on my 6 year journey living in Australia, I couldn't ignore the values, beliefs, and practices that have emerged in my cultural identity. I understand that my cultural identity is not fixed; it will keep changing throughout my life. The following paragraph discusses my journey between three different main cultures (Javanese, Bimanese, and Australian) that I recognise has shaped my cultural identity.

In the Power of Three Different Cultures

I am in the line of Javanese and Bimanese

1991
I am 11 years old

I Don't Understand Their Languages

Today, we are happy because we are waiting for my uncle, grandmother and grandfather from Bima, West Nusa Tenggara. We hardly ever meet since Bima (near Lombok), my mother's village is far from Jakarta. We also don't have much money to visit them regularly in Bima. Therefore, today is really exciting.

I once visited Bima, when I was 9 years old, since we didn't have much money we travelled via the cheapest mode of transportation - bus and ship - which took us three days. The travel was really tiring rather than exciting, perhaps because I was so young; I just didn't enjoy it. My family needed to arrange to have a long holiday and

save the money first before we decided to visit my mother's family. Meanwhile my father's family live close to Jakarta (Central Java) which was not really expensive to travel to, so we visited my father's village once a year. This made me much more familiar with my father's family and their culture. My memory is flying until we hear my grandmother's voice.

Grandmother : "Assalamu'alaikum"

My mother : "Wa'alaikumussalam"

My grandmother, mother, father, grandfather and uncle all hug each other. After expressing their happiness they take a seat and keep talking in Bima Language. It seems my grandfather, grandmother, and uncle talk about their exciting travels but I don't understand much of what they are saying. My mother translates for me –

Grandfather : "Yuli, you are already a big girl now"

Grandmother : "Yes, she looks like her mother (with her smiley face)"

My mother : "Yes, she is already 12 years old now. She will be going to junior high school next year"

My uncle : I hope you're a good student Yuli!

They keep talking to me but I don't understand the language, not even a single word, except for my name. Bima language is really different from Bahasa and Javanese language (my father's language) so it is difficult for me to predict the meaning of the words. Every time they talk my mother and my uncle have to translate the Bima language into Bahasa to help me understand the conversation. At that time, I just did not feel comfortable since I could only use body language or signals to communicate with my grandmother and grandfather. Sometimes they talk about funny things and laugh, but because I don't understand I should ask the meaning first before I start laughing. Now that I understand the importance of language and culture, I feel sad and terrible because I've realised that if I don't understand my parents' cultures, then how about my daughter? How about future generations in my family? Our cultures could be extinct and lost; we could lose our cultural identity. The questions keep running in my head, and it makes me feel miserable.

I was born in Jakarta, the capital city of Indonesia. My mother and my father come from different cultural backgrounds. My father was born and grew up in Central

Java, while my mother is Bimanese and is from Bima. Currently they are living in Jakarta, I have had experiences similar to those I have described above every time my grandmother and grandfather visited my family, even as an adult. When I was a child, I never thought it a big issue that I didn't understand my parent's language and culture. I thought it was simply because we were from different generations. But when I learnt the value of culture during my thesis journey, I came to realise how valuable my culture and language really are, especially when I realised that various cultures within Indonesia are becoming extinct. Only a small number of the younger generation understand their family culture. I discovered that many can't speak their mothers' languages, can't perform traditional dances, and don't know their traditional musical instruments. In terms of language, many can only speak Bahasa Indonesian, like me. Even in Australia most Indonesian children, especially those who were born and schooled in Australia, can't speak Bahasa Indonesian. They can only speak English and most of their parents are proud of it. Therefore, I challenged myself within my different roles to create an understanding and empowerment of the importance of cultural identity to my community, especially my student teachers.

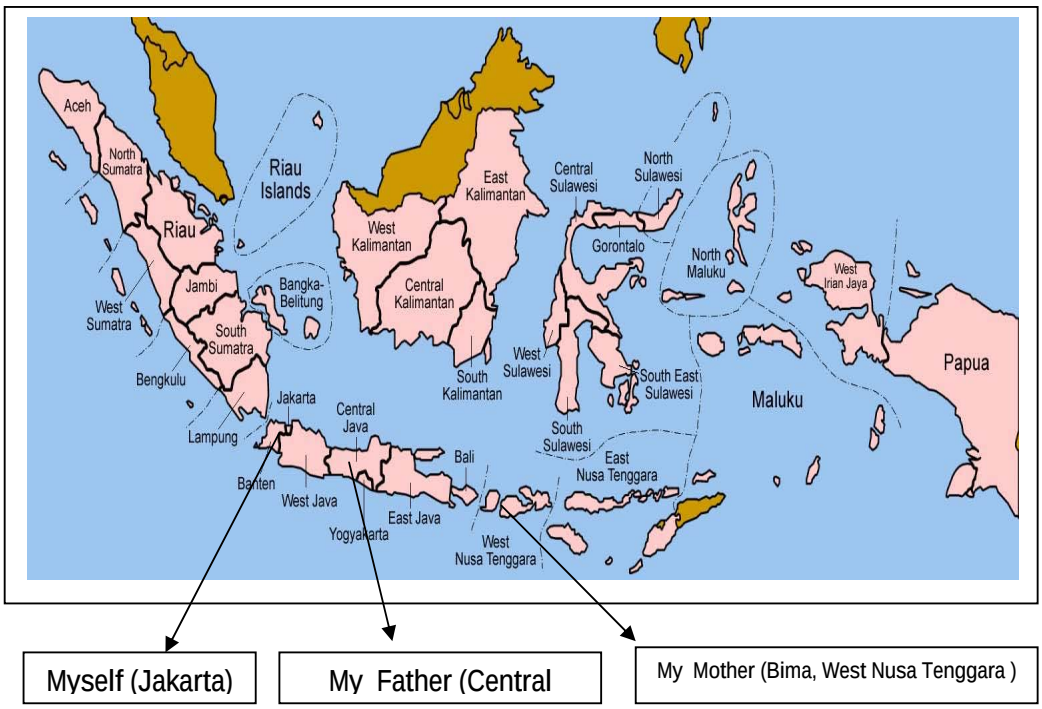


Figure 12. My Family Cultural Background

As I have described above, I grew up with different cultural backgrounds which influenced my cultural identity. I have seen how two different cultural backgrounds merged and influenced my values and beliefs. It is also common to other Indonesian generations where they grow up influenced by different cultures, because Indonesia has many different cultures. According to Leom, Acedo, and Utomo (2002), Indonesia consists of more than 17.000 islands, with around 6000 of them inhabited, and has five major islands (Java, Sumatera, Kalimantan, Sulawesi, Irian Jaya islands). Indonesia is one of the most populous countries in the world with 224 million, with 60% lives on Java, the smallest of the five major islands. Indonesia also has 300 ethnic groups that speak more than 250 dialects, with Bahasa Indonesia as the national language. These ethnic groups have different cultures which influence the way they think and behave. Being a child who grew up with different cultures, I have realised where the set of values and beliefs that I hold come from. The process of cross cultural interactions among ethnic groups in Indonesia creates different cultural identities that could be represented as the products of cultural identity. However, even though Indonesia was colonized by the Dutch for 300 years, for several years by the Japanese and for a short time of Portuguese (before Dutch) occupation during World War II, Indonesia gained independence in 1949 (Maralani, 2008), I didn't have experience of the significant influence of Dutch and Japanese values and beliefs on my cultures. The influence of Dutch, Portuguese, and Japanese are mostly in terms of language, education system, law and architecture. For example in language, *koki* (Indonesia) with *kokkin* (Ducth) means chef; prangko (Indonesia) with *franco* (Dutch) means stamp; *meja* (Indonesia) with *mesa* (Portugis) means table. The education system, law, and architecture were mostly influenced by the Dutch which shaped the social structures of the Javanese into three levels of social status: kaum buruh (labour), priyayi (employee/staff), and pedagang (trader). However, currently these three levels of social status have disappeared in Javanese culture. In addition, some parts of the education system and some of the building architecture was also influenced by the Dutch. Therefore, the influence of colonisation became part of Indonesian culture.

In this writing, I have learnt to understand the influence of two different cultures on my cultural identity. As my father is Javanese, according to Sartiso (2006, p. 448), "Javanese culture here is a complex of ideas, values, norms, regulations, and others;

or a complex of patterned behaviour activity of people in a society. I experience these complex norms that have shaped my cultural identity. For example, women are followers of men, so women have to obey what men say, especially in marriage. It is not good for women to be married at an older age. These two values have influenced me in thinking and acting as a woman. Sartiso (2006, p. 450) also points out that most the teachings consist of philosophical values giving a moral basis for Javanese people's lives, particularly in responding many different phenomena, such as: how to position themselves in relating and communicating with God as the Creator, with other people, with other different creatures as well as with their environment". Meanwhile, Subandi (2011) describes the values of the family as the centre of life for Javanese. So, even though the family members separate, they maintain close emotional ties with their family, including regular contact and visits. Thus, as I stated previously in my role as a daughter, family is central to my life and I have always maintained a close emotional relationship with them. On the other hand, I have realised within this reflective writing that the influence of my mother's culture is not strong enough in shaping my cultural identity. Probably because my father is labelled as the leader in our family, has culture influences strongly the values, beliefs, and practices of our family. I remember that many things which are allowed or not allowed in my family come from my father's culture. Bima is near Lombok where most of the people have Islam as their religion, so that many of their values and beliefs are influenced by Islam. For example, Bimanese will do anything, including selling their house to afford going to Hajj pilgrimage which is very expensive. Even though you will not have much wealth left when you return from Hajj, your social status is higher. I remember because it happened with my grandfather and my grandmother. They sold everything and their child also supported the fund so that they can go to Hajj. It is a part of their pride.

Finally, even though I have tried to explore these two different cultures, sometimes I am confused about how to answer questions about who I am from a cultural perspective. According to Usborne and Taylor (2010), bicultural individuals could experience distress in the challenge in integrating different cultural identities, however clarifying their identity might help them to better understand themselves and establish their self-esteem or psychological well-being. Sussman (2000, p. 362) also points out that "culture might be part of the self, but cultural identity is not

explicitly recognised. Like a fish in water, culture surrounds an individual, albeit its impact is seldom a salient feature of an individual's self-concept; individuals rarely recognise the imprint of their own culture and its ubiquitous nature". Thus, as I stated before, I have only started to understand during my doctoral study the influence of these cultures on my cultural identity. I have realised that clarifying ones cultural identity is a subjective and individual experience (Usborne & Taylor, 2010). It is difficult for me to say that I am Bimanese because I don't have a good understanding of their culture, especially because I can't speak their language. But, also I can't say that I am Javanese. Although I have a greater understanding of their language, I don't have a deep understanding of their culture. I also can't say I am Betawi. Although I was born in Jakarta, I don't interact much with Betawi culture which is also extinct. So, I ask myself -- who am I?

I am in the space of Australian culture

People would have both negative and positive experiences when they interact with other cultures which have distinctly different values, beliefs, and practices. One of the negative experiences is called 'culture shock'. I experienced the culture shock when I arrived in Perth, even though AusAID (the Australian Government Program which provided the scholarship for my master's degree) provided a culture preparation program on understanding Australian culture and dealing with culture shock. According to Van Leeuwen (2008, p. 153), "the term 'culture shock' was coined in 1960 by the cultural anthropologist Kalervo Oberg to describe a totality of symptoms that *may* result from exposure to another culture…[and] the core features of culture shock are confusion, uncertainty, depression, anguish and interpersonal discomfort". Noesjirwan and Freestone (1979) pointed out similar characteristic feelings of confusion, alienation, hostility, and anxiety. Sussman (2000, p. 355) describes "culture shock is an intense, negative affective response, both psychological and physiological, experienced by new expatriates when faced with unfamiliar symbols, roles, relationships, social cognitions, and behavior". In my experience, culture shock plays through my experiences of crossing cultures in Australia. For example, when I arrived in Australia, I had recently been married, and my parents had been asking me to have a baby soon because I was already almost 26 years old when I was in 25 years old, I was not married and my parents were worried and asked me to marry soon because they didn't want people say bad things about

me. In my culture, it is a very sensitive issue whether women are late married, not married, or divorced. People would think negative about those women. In my culture, we really care about what people say about us; it seems we can't live without thinking about other people's thinking, even though we realise that is not good in our lives to always care about other peoples' thinking. In Australia, I experienced different ways of thinking I perceive that many Australians don't really care about what people say about their lives, especially their personal lives. I started to realize that when I lived in Indonesia I really cared about what people would say about my life, but during my stay in Australia these values decreased I do care what people think and say, but I not really as much as before. I have recognised this change as the process of my cultural adaptation. According to Sussman (2000, p. 360) "cultural adaptation refers to the outcome in which individuals modify their cognitions, behaviours, and interpretations of behaviours to match the new cultural environment better". Sussman (2000) describes the situation of self-construal, emotion, and motivation in individuals, and that it might be that their cultural identity will emerge during cultural transition, which in labelled as subtractive, additive, affirmative, or intercultural. I experienced these three processes within my cultural transition. The process of cultural transition is ongoing, even though I have been living in Perth for almost 6 years. I still experience culture shock in some ways. In the following paragraph I portray my experience cross culture in conducting co-teaching. The experience stimulated my reflective thinking to deal with cultural difference.

During co-teaching with teachers and students from different socio-cultural backgrounds, I learnt to understand differences in awareness, empathy, rapport, relationship, sharing, control, power, negotiation and understanding. During my journey I transformed from a state of apathy as a beginning teacher to an empowered teacher enlightened enough to realise the value of challenges for transforming my professional self. The journey became very challenging when I struggled to stay empowered while conducting co-teaching in Australia with three different teaching characters from different socio-cultural backgrounds. The following discussion represents some of my self-critical reflections during my personal journey in this research.

2010
I am a Co-teacher

Because She is Asian

I come to the classroom with my co-teacher (Ms Tina). We have planned to do an experiment on the influence of heat on different metals. Conversations with students have shown that they enjoy experiment in the classroom; we try to often integrate experiments into the science topics. Today, before starting the class, we discuss several misbehaving students who usually create problems in the classroom. We plan and hope that the experiments will change their behaviour. We come to the classroom and manage the students. Mrs Tina starts the lesson and explains the experiment. I ask the students to take the equipment from the front table. Most of the students take their equipment and start the experiment. I notice there is one group, Mike and Kylie, who keep talking to each other and ignore the instruction. I am aware that Mike and Kylie are often disengaged in the classroom. I walk slowly to their desk and ask them to take the equipment. After a short discussion, they finally take the equipment hesitantly. They start the experiment, but it does not take long until they start to chat and disturb other students. Once again, I walk to their desk and try to talk to them. I try to engage with them instead of judging them. As Mike and Kylie decide to continue to disturb the classroom, I take the initiative to take them out of the class to have a conversation. I start to explore their reasons for disrupting the class and why they choose to disengage. Mike says he does not like Ms. Tina's teaching method which is "boring". Kylie does not like Ms Tina's "annoying voice" because "she is Asian". Since I am also Asian, I am quite surprised by Kylie's answers but I stay calm and composed and try to find more reasons for their disengagement in the class. The conversation takes about 10 minutes before I ask them to re-join the class.

That was one of my experiences when conducting co-teaching in one of the schools. I was quite surprised with the students' answers, but I tried to think and act positively because I understand why people behave differently. According to White as cited in Fitzpatrick (2012, p. 55), "research shows that teachers who differ from their students in terms of racial and ethnic background can nonetheless share values and assumptions that help them better relate to their students". I learnt to develop 'difference awareness', not for perpetuating division but for developing my understanding of diversity. I also realised as a teacher educator, that I need to equip my students to understand cultural differences as pointed out by Griffin and Jackson (2011, p. 1), "as the world becomes increasingly diverse at the intersections of age, gender, sexual orientation, class, region, religion, race, ethnicity, ability, and nationality, students need to be equipped with the knowledge and skills to engage in communication across multiple identity differences.

WHY WE SHOULD BE ONE?

Why should we be one?
If God creates in us the differences
Why should we worry about differences?
As if we have different cultures, different religions, and different values

Why should we be one?
If all national identities depend on someone's culture
If all values rely on personal experiences
If all beliefs care for the value of truth

Why should everything be in one colour?
Why should everything be one picture?
Why should everything be one shape?
Why should everything be one measurement?

If difference is more colourful, if multicultural is more powerful
If understanding difference is more valuable,
If appreciating personal values is more imperative
Why should we be one? If we have opportunities to be different
Why should we overlook difference? If we feel that's more prevailing

We need to accept difference
We need to celebrate harmony
Under a multicultural layer
Worlds should be more colourful, powerful and beautiful
Humans should be more empathic, caring and understanding
So, why we should be one?

I came to realise that diversity can influence people to think and act in different ways. According to Palmer (2007), by embracing diversity, we realise connectedness with others which is empowering for transforming our lives. In embracing difference I also learnt how to be more empathetic. Empathy helps me understand how others

are feeling and why it is they behave in particular ways. During my co-teaching I gradually began to notice a similar response from the co-teachers I worked with when they saw me, a stranger, taking their role in the class and promising to improve their classroom. Another important way of conducting co-teaching is rapport relationship. For the first couple of months, I worked intensively in developing a connection with teachers and students as a passive observer in their classrooms in order to understand the classroom culture and social interactions. This helped both teachers and students to become familiar with me and not see me as a stranger. Later on, this relationship-building was important for successful co-teaching. During the process, the rapport relationship between teacher, researcher and students was maintained in the process of collaboration, dialogue, and critical reflexivity within the classroom. The rapport relationship amongst me, the teacher and the students influenced the way we co-taught in the classroom. Students seemed to be happy about the change in the classroom during that time (illustrated by the comment below). But this did not occur over a short period of time; the change happened after I had engaged in the classroom for almost a year.

> *It is important to work as a team. Working as a team (you and Mrs. Emilia) will accomplish more, and give us more of an understanding. We learn more; seek more knowledge that will stay in our brains. We became motivated and interested in science study, after you have showed us the different ways of learning science. Also when one teacher is absent the other already knows what we are doing in class therefore we can continue with our work and not waste time*
> *(Student interview, September 25, 2010)*

Teachers not only learnt to share the workload but also shared control and power of the classroom with me and their students. This method was quite challenging as it was not a common practice in their past experiences. During the study, every member of the classroom learnt to share their control and power; we learnt to accept the roles of each person in order to improve teaching practices and student learning. This sometimes made teachers wary about surrendering control. I was grateful when two of the teachers (Emilia and Tina) allowed me to co-teach in their classroom. Students seemed to be happy because the teachers' collaboration contributed to their learning and helped them engage more with the teacher, as illustrated by the following comments.

I have no problem sharing control of the class with you. I think two heads are better than one. The students in my class find difficulty in staying focused, and are easily distracted. I can only give them a small amount of control, otherwise there will be chaos. However, if they perform well, I will definitely consider giving them more control of their activities
(Tina, teacher interview, November 7, 2010)

I think that sharing the power between two teachers is very beneficial to both students and the teacher. It benefits us as students because we have an extra teacher to help us in lab work and class work. It benefits the teacher because she has the help of an extra teacher to help her learn more teaching skills. Both can learn from each other
(Student interview, September 23, 2010)

In my research, studying the process of understanding and negotiation played an important role; my co-teachers and I developed an appreciative understanding towards each other and co-developed ideas for improving classroom teaching and learning practices. For example, when the teachers received feedback from students regarding improvement in their teaching practices, the teachers came to better understand students' feedback and learned how to negotiate changes in their teaching style.

It is always important to know how your student is feeling and how you can improve it and make things better for the student, and the class. This may improve the student's knowledge/understanding
(Student interview, September 25, 2010)

However, I found that co-teaching was not very successful when I worked with high achieving students and a very enthusiastic teacher. I noted that co-teaching had not been really useful in this classroom, as the teacher (pseudonym) stated.

My teaching beliefs have not changed greatly
(Tony, teacher interview, December 15, 2010)

Working in Australia with the three science teachers from three different schools was really challenging, not only in managing my time and focusing on the transformational process in each classroom, but also the challenges in dealing with cultural differences.

The experience of living in Australia provided me a learning journey in coming to understand deeply my culture. I remember one of my reflections during a celebration

of a multicultural day at SMEC. During reflection, I came to realise the influence of Australian culture on my cultural identity.

2012
I am a PhD student

Understanding myself and others

Today will be my last day in celebrating a harmony day at SMEC. After 5 years of staying in Australia within a different colour of culture, I learnt different ways of life. This morning, three of us, my husband, my daughter, and myself are celebrating a harmony day, really a busy day. Since yesterday, thinking about the clothes that my daughter can wear and thinking about the food that represents our culture.

In Australia with a multicultural life, I enjoy the differences and I learn to understand different values, beliefs, and practices. I remember the first time I ate Biriyani rice I felt strange. How can the rice be cooked in yoghurt or milk with different spices, because I only know fried rice. When I ate fish and chips I felt strange because we used to cook fish with so many ingredients, not only salt and pepper. Now, Biriyani rice and fish and chips are my favourite foods which I will miss when I return to my home country. Not only the food, I also learnt different practices of other cultures. I felt not polite if I called our teachers without using "Sir" or "Mam", saying instead Peter, Rekha, Bill , David, and other names, only using their first names. In differences, I leant to adjust, to understand, and to appreciate others, and I really enjoyed it, something I had never realised before I came to Australia.

I also have come to realise since staying in Australia, that a multicultural life stimulates me to think about my culture. What are the values, beliefs, and traditional practices that represent my culture? I have become more aware that I don't have a deep understanding of my culture. Both of my parents come from different ethnic backgrounds, so I am confused about representing my own culture. I can't speak my mother's and father's languages, I can't perform traditional dances, or remember most the traditional practices of my parents. I can only speak Bahasa, our national language, that's all. In my way of thinking about multiculturalism, I realise that it is not simply about understanding others and the ways they are, it is also about understanding my own culture which I realise I have started to lose. I close my reflections with thanks to everyone at SMEC, in our differences; I learnt to understand

more deeply others and myself. I have learnt to understand that my life has become more colourful within differences.

The story represents my valuable journey in living in this country. Since I was born in Jakarta, I had never lived for a long period of time anywhere except Perth, Western Australia. I stayed in Jakarta for almost 26 years, then moved to Perth to do my master's and doctoral degrees for almost 6 years. In my reflections, I realise how living in Australia has influenced my cultural identity. I have learnt to accept the differences and to speak up wish my silent voice. Even though I am a woman with the role of a wife and a mother, I have the same opportunity to participate in society. I have learnt not to think overly about what people say and think about me because it is my life and I have the responsibility for that. In addition, I also have learnt that understanding other cultures has helped me to understand my culture.

Am I a Hybrid?

After my critical reflections on the influence of different cultures on my cultural identity, I am thinking now of my 'hybridity'; could I say I am a product of cultural hybridity or is it just a normal process of cross cultural mixing? In this section, I portray different theoretical perspectives on understanding the term hybridity and how I implement it in understanding my identity. According to Ackermann (2012, p. 6), "the word 'hybrid' was developed from biological and botanical origins: in Latin it meant the offspring of a tame sow and a wild boar, and hence, as the Oxford English Dictionary puts it, 'of human parents of different races, half-breed'". Clothier (2005) points out several important points on hybridity: heterogeneity (diversity in constitution), multiplicity (mixtures of elements) and unique authenticity. In my context, I could say that I am the product of a mixture cultures. Moving to the term of cultural hybridity itself, Ackermann (2012) states that the term occurred during the 1980s in the area of so-called post-colonial studies with the most prominent scholars being Edward W. Said (1935–2003), Gayatri Chakravorty Spivak (1942) and Homi K. Bhabha (1949) They were concern with cultural hybridity since there is no culture that has been left untouched by the global circulation of people, artefacts, signs and information. Davis (2010) points out that these three thinkers concern about cultural hybridity is not simply a matter of multiple cultural origins, but in a cultural newness, new meaning and new identity. Ackermann (2012) stated

that post-colonial theory relies heavily on the ideas of the Russian linguist and philosopher Mikhail Bakhtin (1895–1975), who distinguished between intentional and organic hybridity. Intentional hybridity describes two points of view which are not mixed, but set against each other dialogically. Meanwhile, in organic hybridity the mixture merges and is fused into a new language, view world or object. Then in the early Twentieth Century the concept of cultural hybridity moved into various disciplines, particularly sociology, anthropology and history (Ackermann, 2012).

When I look at the different cultures within myself, I now experience a dialectical tension amongst them. The values, beliefs, and practices in these cultures are empowering and disempowering. However, as Islam is the main guideline of my life, I will not merge cultures that are not allowed by Islamic values, beliefs, and practices. In relation to Bhaha's work on cultural hybridity, Homi Bhabha (1983) views hybrid identities as challenging essentialist assumptions in a discourse of difference. Ackermann (2012) points out that Bhabha took up Bakhtin's concept of intentional hybridity, shifting it as a means of subverting authority in the colonial situation. Mahalingam and Leu argued that (2005, p. 841) "hybridity has been proposed to negate dominant, unitary modes of thinking about social differences". According to Simone (2008, p. 605), "Bhabha states explicitly that hybridity 'is not a third term that resolves the tension between two cultures' but rather is one that holds the tension of the opposition and explores the spaces in-between fixed identities through their continuous reiterations. In my context, I realise that there is a third space which in the result of tensions between different cultures my cultural identity. Even though it is not clear line, I could say it helps me to understand my cultural identity as a mix of different cultures.

I recognise that "new hybrid forms are significant indicators of profound changes that are taking place as a consequence of mobility, migration and multiculturalism" (Pieterse, 2001, p. 221). According to Shoshana (2011, p. 166), "What may help us reach a more complex understanding of the concept of hybridity is the current interest in the different kinds of hybridity that appear under specific cultural conditions, or at different levels of hybridity". Pieterse (2001) has provided varieties of hybridity which allow me to understand that different practices could be the product of hybridity, including religion itself.

Table 10. Varieties of Hybridity

New hybridity: Recent combinations of cultural and/or institutional forms	Existing or old hybridity: existing cultural and institutional forms are translocal and cross cultural combinations already.
Dynamics: migration, trade, ICT, multiculturalism, globalization	Dynamics: cross cultural trade, conquest and contact.
Analytics: new modernities.	Analytics: history as collage.
Examples: Punjabi pop, Mandarin pop, Islamic fashion shows.	Examples: too many.
Objective: as observed by outsiders.	Subjective: as experience and self consciousness.
As process: hybridization.	As discourse and perspective: hybridity consciousness.
As outcome: hybrid phenomena	

Source: Pieterse (2001, p. 222).

The table provides an explanation of the mediation of hybridity itself, including globalisation, migration and ICT which is experienced by individuals in self-consciousness. I realise that the process of multiculturalism is powerful in constructing my cultural identity. Even though, there could be general perceptions between Asian and Western countries on basic cultural value orientation, such as the research conducted by Trommsdorff, Friedlmeier and Mayer (2007, p. 285) that investigated four cultural groups (Germany, Israel, Indonesia, and Malaysia) in assuming that they differ from each other. They assumed "individual-oriented" (for Germany and Israel) and "social-oriented" (for Indonesia and Malaysia) differences in values. Individual-oriented values include individuality, independence, autonomy, and self-realization, with the focus on the person him/herself; social-oriented values include interdependence, relatedness, and loyalty to the group with the focus on group connectedness. However, there have been the influence of globalisation in cross cultural Indonesia is really powerful. For example, shifts in some values and beliefs in the Indonesian community on humanity and respect; according to Sairin (2004, p. 152), "the sense of humanity that Indonesian people adore and pay respect to gradually degrades and disappears". Globalization is held responsible for the reigning consumptive culture in Indonesian society….[thus] the Indonesian culture,

which is deeply rooted in communality bound by a frame of moralistic spirit, should serve as a filtering mesh for the upsurge of materialistic orientation inherent in the process of globalization (Sairin, 2004, p. 155). Although I was aware of the influence of globalization on my culture, I had not realised that I had lost my culture. I recognise that it is difficult for me to recognise other cultures' influences unless I understand my own culture.

However, I still put the question of hybridity because if there is a hybrid, there must also be a purity. Is there any cultural purity for my generation when cross cultural interaction become a natural process in human interactions? Ackermann (2012) explained that hybridity was described by Robert Young (1950) to denote, the 'crossing' of people of different races only since the second half of the nineteenth century which created a wholly negative connotation by referring to impurity. Ackermann (2012, p. 22) also points out that "one question we started with was, which culture is not hybrid – and have 'original' cultures ever existed? Using the distinction established by Bakhtin, we can now say that 'original' cultures did exist in a way, since their hybridity was an 'organic' one, where unintentional, unconscious, everyday mixing and fusing of diverse cultural elements took place more or less unnoticed, thus allowing for an imagined homogeneity". Pieterse (2001) provided a summary of the debate between the pros and cons of cultural hybridity: (see Table 11.)

Table 11. Arguments For and Against Hybridity

Contra hybridity	***Pro hybridity***
Hybridity is meaningful only as a critique of essentialism.	There is plenty of essentialism around.
Were colonial times really so essentialist?	Enough for hybrids to be despised.
Hybridity is a dependent notion.	So are boundaries.
Asserting that all cultures and languages are mixed is trivial.	Claims of purity have long been dominant.
Hybridity matters to the extent that it is a self-identification.	Hybrid self-identification is hindered by classification boundaries.

Hybridity talk is a function of the decline of Western hegemony.	It also destabilizes other hegemonies.
Hybridity talk is carried by a new cultural class of cosmopolitans.	Would this qualify an old cultural class of boundary police?
'The lumpenproletariat real border-crossers live in constant fear of the border'	Cross border knowledge is survival knowledge.
'Hybridity is not parity'	Boundaries don't usually help either.

Source: Pieterse (2001, p. 225)

I don't want to be trapped in the debate on the concept of cultural hybridity. Similar to my experience of understanding identity using the concepts of essentialism and non-essentialism, I use my dialectical thinking to implement these concepts in my context. Hybridity is a natural process in multicultural lives which has enriched my cultural identity. In the confusion of understanding myself from a cultural perspective, I have learnt to identify myself as a cultural hybrid. I can't say, that I have a pure cultural identity because I realise that it will continue to grow up throughout my life journey. According to Pieterse (2001, p. 220), "recognition and difference are a function of the existing identities and boundaries that are available on the social and cultural maps. Recognition is part of a process of struggle over cognition". Hybridity is a journey into the riddles of recognition". Sussman (2000, p. 359) also stated that cultural hybridization is "a result of ever-increasing cultural connections and re-combinations of cultural practices and forms". Finally, hybridity helps me to understand different integrations of different cultures which are associated with the third space as a negotiation between identities (Lee & Anderson, 2009). I realise that the complexities of my identity influences my cultural identity, I am Bimanese, Javanese, and Indonesian, I have lived in Jakarta and Perth, and I practice these different cultures along the lines of Islam. Thus, it is difficult to say that I have a pure cultural identity in the process of being cross cultural.

CULTURAL IDENTITY IN MY TEACHING IDENTITY

Teachers bring their culture, which is shaped by their history and personal experiences, to the classroom. Their cultural identities influence their values and beliefs in teaching and are part of their teaching identity. Each teacher has their own history and personal experiences, therefore each teacher has their own cultural identity which influences their teaching identity. According to Ashcroft, Griffiths, and Tiffin (2000, p. 60), "cultural difference suggests that cultural authority resides not in a series of fixed and determined diverse objects but in the process of how these objects come to be known and so come into being". Thus, I understand how Australian culture shaped my co-teachers' identities. The narrative below portrays a picture of one of my Australian teachers, Tony. As a young male teacher who has a passion for providing the best learning experiences, this translates to him as being very energetic in front of his students, even though when I met him for the first time, he seemed really calm.

May 27, 2010
Classroom Observation (Co-teaching)

Can we drink it?

I sit in the back of the classroom, it is the second time I am conducting a classroom observation, after carrying out a survey on teacher-student interaction and environmental education. Since the very first time I came to this class I always learn something new. I realise that this academic extension class is an outstanding picture of a science classroom with such an enthusiastic teacher and highly motivated students. The teacher, Tony, is really well organised and always tries to find different ways to engage his students. Therefore, it seems that co-teaching and co-generative dialogue would not necessarily work well in this classroom. However, I always learn a lot from observing Tony and share it with other teachers (Emilia and Tina) in other schools. Today, he is explaining acids and bases. He starts by exploring students' understanding and experiences in the topic. Then he gives explanations to clarify his students' understanding as the nature of the concepts change. He provides examples of acids and bases in everyday life. Then he distributes worksheets to help students' understanding of the concepts of acids and bases. The students work on the sheet for 10 minutes. Tony is good at managing time; he is very punctual and there is no wasting time during his teaching. After ten minutes he

begins exploring students' ideas about the worksheet and he gives opportunities for students to explore their ideas. I am really surprised because almost all students put their hands up to explain their ideas. The class is noisy, not because of their behaviour but because of their curiosity to learn. The students put their hands up after the teacher chooses one of them to explain his ideas. The discussion runs really well; there is no room for students not to pay attention. Students become more interested when Tony demonstrates acid and base characteristics. He doesn't start by giving the chemical formula as I and most other chemistry teachers in my country do. He shows them the reaction between magnesium and hydrochloric acid which gives products of magnesium chloride and hydrogen gas. He puts the Petri dish on the overhead projector and uses it to help the students who sit at the back see the chemical changes because it is quite a large class -- about 32 students. The students look interested and pay attention. He starts to explain acid and bases reactions and gives a simple example:

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Base + acid → salt + water

After he writes the formula on the whiteboard, just as he is poised to explain, one of the students has already put their hand up.

Mark: If the product is water, can we drink it?
Tony: That's a good question Mark. It is correct that H_2O (water) is the product of this reaction which is the same formula as the water that we drink. However, in this chemical reaction we can't ensure that the product of this reaction is only salt and water without any excess of HCl or NaOH which is dangerous for our health. What do you think?
Mark: Yes, that makes sense
I am quite surprised at Mark's question but I reason that it must be common in Australian schools for students to keep asking questions. As a chemistry teacher I always waited for my students to ask this very question every time I taught acid-base reactions. But it never happened during my teaching experiences or when observing other classroom practices in my country. Most of the students in Indonesia are silent while the teacher explains and stay silent during the lessons, until the teacher asks questions and the students choose to answer them. I am still sitting in the back of the classroom continuing to write my notes while my thinking is floating and wondering -- is this Australian Culture?

This is a common picture in my observations of Tony's classes. He is a very energetic teacher with a passion for engaging students in their learning, evidenced by this statement:

> *. I aim to do the best I can with them and give them the opportunity to benefit from activities I provide. Ideally being able to think critically and abstractly, as well as respecting others in group situations is a priority. I believe the students should always do their best and never give up, or if they feel they don't understand something – they are empowered to find out*
> *(Tony, teacher interview, September 15, 2010)*

Compared to in Indonesia, the culture of engaging students' critical voices and best opportunities for learning in Australia is common. When I read the Eulie (1987) article of comparing American and Indonesian schools and educators from the voices of four educators who studied in America (Four educators from Indonesia who are studying at the State University of New York's College at New Paltz, N.Y., recently reflected on education in the United States and Indonesia), I could see the similarities of America and Australia when compared to Indonesia. For example: student-centred teaching approach, well-organised schools, well-trained teachers, well-equipped facilities, more freedom for schools and teachers to implement curriculum, then more freedom for students to express their opinions. This article also describes that teachers are respected in Indonesian society, even though it is different between urban and rural areas. In Indonesia there is a proverb of 'Guru harus digugu dan ditiru' (The teacher must be obeyed and imitated in all aspects of life), even though currently it seems to be shifting to less obedience.

> *The presentations are very interesting, using colourful pictures and sound effects. The pictures help the students to understand the concepts and characteristics of the gas itself and also the process. The students focus on the teacher's explanation because they already have the handout. Sometimes, when the teacher explains the topic, the students ask questions. Even though the teaching approach is teacher-centred, the students actively ask questions and the teacher gives opportunities for students to ask questions*
>
> ***Other Experiences of Classroom Observation (Trinity College, Perth, Chemistry Classroom, 2008)***

Referring to my personal experiences in observing Australian classrooms and interacting with several Australian teachers, I could see the influence of their cultural identity in their teaching identity. For example, how Australian teachers seem to give more opportunity for students to express their ideas. Another example, Australian teachers seem to be more

friendly in their relationships with students. However, I don't want to dichotomise these two cultures (Indonesia and Australia) because I realise there are other elements that shape teaching identities, including autobiographical backgrounds and teaching experiences. In Australian schools I learnt that teachers play important roles in creating meaningful learning experiences by giving opportunities for students to explore issues in society. I believe that Indonesian teachers could do similar things within their limitations.

I explored my other experiences working with two Asian teachers in two other schools during my co-teaching. Even though they teach in Australian schools with a similar education system to Tony's school, I see the differences between these two Asian teachers and Tony. According to Fitzpatrick (2012, p. 55), it is important to be thoughtful about how our [teachers] own backgrounds might affect our expectations of our students and our interactions with them. Delphit as cited in Fitzpatrick (2012, p. 55) also stated that "research shows us that teachers who come from different racial, ethnic, and socioeconomic backgrounds than their students often consider their own behaviors to be "normal," while they interpret the behaviors of their students as being "deficient" or "abnormal." In these different cultures, I can see myself reflected in these two teachers, focusing mostly on content knowledge and students' achievement. Even though there are many factors that cannot be isolated, every time I worked with these Asian teachers I felt like I was teaching in Indonesia because we were more focused on asking students to finish up their homework and do the standardised test.

I See the Mirror Image of myself

I see the mirror image of myself
When she focuses on students' grade
I see the mirror image of myself
When she relies on students' performances

I see the mirror image of myself
When she keeps talking and writing
I see the mirror image of myself
When she keeps explaining and ignoring

I see the mirror image of myself
When she is irritated because students failed in the exams
I see the mirror image of myself

When she is annoyed because students didn't do their homework

I see the mirror image of myself
When she asks questions because the classroom is silent
I see the mirror image of myself
When she asks students to answer the questions because they are silent

I see the mirror image of myself
When she spends classroom time being angry with students' behaviour
I see the mirror image of myself
When she spends classroom time being furious with the trouble makers

I see the mirror image of myself
When she gives punishment to the students
I see the mirror image of myself
When she gives detention to the students

I see the mirror image of my self
In the deep feeling of sorrow
In the deep feeling of misery
In the deep feeling of soreness
I see the mirror image of myself

The poem above portrays some of my experiences working with Asian teachers as my co-teachers. When I was in their classrooms I realised that I incorporated similar values, beliefs, and practices, especially focusing mostly on students' achievement and behaviour. It is good to consider these two aspects, but when teachers really focus on them and ignore students' engagement and empowerment that would be dangerous. As a chemistry teacher I can spend almost the entire class time being angry because of students' behaviour. Every time my students misbehaved, spontaneously, I would think to myself that they should respect me as their teacher. I realised that it is typical in Asian culture that the teacher is someone that we have to respect. It is a common belief that teachers play the role of parents in school. We believe that students should obey teachers, although as I stated before, currently the value of respect for teachers is decreasing. We believe teaching is a profession which educates people about how to be good. Therefore, people in society respect teachers. If teachers do bad things there will be big issues since everybody expects teachers to do good things. In some ways, it is good that teachers are so highly regarded, but if their sense of authority becomes too exaggerated this could lead to students'

disengagement, students' disrespect, and the teacher being seen as the total controller of the classroom.

As I have stated, I don't want to distort my perspective by assuming a clear border between Asian teachers and Australian teachers, so I have tried to explore my experiences with other Australian teachers during co-teaching. One of them was an Australian, who was a relief teacher that had agreed to work with me while the main teacher in School Ardross was sick (then passed away). Most of her teaching time was asking students to summarise book chapters, and if a student misbehaved she would escalate to anger quite easily. Even after I tried to build a relationship with her she didn't want to accept feedback from me or the students. At that time I decided to step back and cease co-teaching with her due to her resistance to collaborating with me. That experience gave me more evidence that nationalities and cultures can shape teaching identity, despite there being many other factors that shape someone's teaching identity.

Another example of the influence of culture on teaching identity is in my own family. Both of my parents are teachers. My mother and my father have different cultural backgrounds. When I talk to them I realise how much their respective cultures influence their teaching methods, values, and beliefs. I was taught by my mother when I was in primary school because she was a religion teacher at my school. However, at home I preferred to be taught by my father because of how his approach to teaching differed from my mother's. As a Javanese my father placed more value on the relationship with his students compared with my mother's approach. As a Bimanese my mother placed more value on her role in transferring knowledge. If my father discovered his students were doing something negative he would try to develop a relationship with them, whereas my mother would directly tell the students to behave properly. This is because in Bimanese culture it is common that if you don't like something you should say it directly to the person. However, in Javanese culture it is not polite to reprimand people directly. If a Javanese person feels the need to do it they are expected to use polite and indirect language. According to Williams (1991, p. 28), one message he gave loud and clear was that most Indonesians, but particularly the Javanese, will rarely communicate negative judgements or evaluations openly or candidly. They make such judgments; but will

not express them, as many Americans are used to doing. Javanese as the biggest ethnic group in my country strongly influence Indonesian culture. Other influential factors could be Dutch colonization and the history of kingdoms in my country, wherein it is not allowed to disobey the rules and speak our voice. In Javanese culture, which shaped my national culture, "women were thus held responsible as both the manager of family morality and symbols of national and familial vulnerability" (Adamson, 2007, p. 31). In understanding the influence of my parents' cultures and my co-teachers culture which I consider as part of my cultural identity, I have come to realise the power of cultural identity in my teaching identity. For example, I was a teacher who found it difficult to say something directly to my students if they misbehaved, I will find a way to tell them politely. I also have come to realise that sometimes I think so much about what my students or my colleagues might think about my actions that I keep my voice silent. These two examples exemplify the influence of Javanese and Indonesian practices.

Working with co-teachers in Australia stimulated me to learn to give more opportunities to my students to express their voice. I also learnt to develop a more caring relationship with students. However, when I look at the power of the technical interest in my country (see Figure 9), I should learn when to negotiate or not negotiate my identity within my teaching context, such as dealing with standardised assessment and rigid curriculum. According to Agee (2004), teachers should have a unique identity and re/negotiate their identity in their workplace. Teachers who have a deep understanding of their identity will not be disempowered by the limitations of working within the system. Teachers also have to be aware of the importance of continuous learning and being self-directed in their professional practices (Graham & Phelps, 2003). Finally, I realise the importance of cultural identity in my teaching identity. Different culture tensions have shaped my teaching identity and influenced my teaching practices and beliefs. The journey of revealing the cultural identity in my teaching identity has not been easy because I have needed to open my eyes and look at my heart, as illustrated by my first poem in this chapter.

CHAPTER SUMMARY

The journey of writing this chapter elicited in me a deep understanding and richer perspective on co-teaching, identity, and teaching identity. Different theoretical perspectives stimulated me to think about my personal experiences. I became more aware that co-teaching without critical reflection will not stimulate me to think about my teaching identity. The journey of working together with different teachers from different backgrounds and experiences was very empowering. I have realised that teaching identity is not the only term that could describe the powerful factors that shape teachers' professional practices. However, I personally have been engaged in the journey of opening my eyes and looking at my heart in understanding the power of teaching identity in my own practice. The power of culture was unspoken and unseen in my teaching practice. In addition, I have learnt that my cultural identity itself is not fixed and nor is my teaching identity. Reflective writing has been evocative for me in terms of my own identity at both personal and social levels. I have come to realise that I can't separate myself into these two perspectives, especially in the context of my various roles.

I have come to realise how the powerful factor of culture has shaped my personal identity as well as my teaching identity. Before, I started my doctoral thesis I had never realised how valuable is my cultural identity. Working in cultural differences in co-teaching helped me realise that I am unique and that I have my own cultural identity. Although, I am still in the learning journey of constructing my cultural identity, the concept of cultural hybridity has helped me to understand myself as a hybrid. At this stage, I think that cultural hybridity in a natural process of human interaction in multicultural lives and globalisation. Finally, I have realised, that as a beginning journey to understand myself and cultural identity in my teaching identity, the journey will not end, instead it will be a continuous process of a life-long journey. I expect that exploring my cultural identity will help to reconstruct my teaching identity at the end of my doctoral journey, and I realise that my teaching identity will keep changing, especially when I return to my home country.

CHAPTER 6

I BELIEVE IN THE TRUTH: RELIGIOUS BELIEF IN MY TEACHING IDENTITY

INTRODUCTION

1986
I am six years old

Why should I? Why should we?

I shake and kiss my mother and father's hand after we perform Jama'ah (together) Maghrib salat (praying). We always perform Jama'ah in Magrib and Isya salat when my parents arrive home. I follow my parents movements (from standing up, ruku, to sujud), and because I can't remember all the do'a during prayers, I just follow my parents. During praying it is important to concentrate, therefore, I just keep looking at my parents to see what they are doing. After my father performs do'a, and finishes praying, my mother prepares dinner for us. Then my mother asks me to go to my neighbour's house to give food to them. I walk to my neighbour's house, and see that my neighbour looks happy and she thanks me for the food. Then, she tells me to wait, because she also would like to give me some food to take to my family. I wait at the front of the house for a while, until she comes with a plate of food. I don't understand why my mother always gives dishes to our close neighbours. I just obey her, because my parents have always told me that Islam encourages us to be kind to our neighbours, because the prophet set the example of giving food to his neighbours. There are also other practices that my parents have taught me that I don't understand: why I should perform prayers, why should we give food and be kind to our neighbour? Why should I obey my parents? Why should I? Why should we?

(Effendy, 2011)

The above story is a snapshot from my life journey. I was born into a Moslem family and was raised in a good Islamic environment, especially since my father and my mother were Islamic religion teachers in primary schools. My parents had taught me to pray (Salat) since I was 3 years old. Even though I didn't remember or understand all the words of the prayers, they always encouraged me to perform Salat. My parents also always asked me to give food and to be kind to others, especially our neighbours. If we gave food, our neighbours also always gave us their food. I lived in an area that housed a mix of middle and low economic status families. The houses were really close to each other and cars couldn't enter the street in between the houses. However, I was really happy because we all had very close relationships; we cared for and helped each other. My parents always taught me good practices, values and beliefs in Islam. Even though sometimes I didn't understand why I should do certain things, my parents always explained that these were Islamic values and that they should be upheld. My parents also always explained to me the reasons for performing Islamic practices. For example, Islam teaches Moslems to be kind to everyone, especially neighbours. My parents taught me that because our neighbours are people who live really close to us, we need to create harmony with them. Even now, in Australia, I still uphold the practice of giving food to my neighbours who are from other countries and religions. I first ask my Australian (Jewish and Indigenous) and Pakistani (Moslem) neighbours whether they are happy to accept the food, because we come from different cultures. We have all become good friends, and our children always play together. Therefore, I believe that even though we are different, if our interactions are shaped by good values then we will have good relationships. When I was a child I didn't feel engaged with Islamic practices. I was simply obeying my parents. However, when I grew up a little more and began receiving religious education as part of my formal education (religion is taught in public schools), I realised the benefit of the values, beliefs, and practices within my parents' education, particularly the idea that Islam teaches Moslems to be kind to everyone and every living thing, including animals

Figure 13. Faiqa and Our Neighbours

and plants. I really feel how Islamic values and beliefs have shaped my way of life from thinking to making decisions in my life and in my different roles, including being a teacher.

During co-teaching, critical reflection and writing my doctoral thesis, I discovered the power of religion in shaping my teaching identity. Therefore, in this chapter, I reflect deeply and critically on my religious beliefs in order to understand what Islamic values and beliefs have shaped my teaching identity and how they have shaped my teaching. In this context, I figure out how Islam corresponds with my beliefs about the nature of science and how it influences my science teaching. Therefore, I have divided this chapter into three sections:

1. ***In The Realm of Islam: Understanding Islamic Values and Beliefs***. In this section, I provide an overview of my Islamic values and beliefs to help the reader understand Islam as my way of life as an individual and as a teacher.

2. ***The Dance of Religion and Science: The Picture of Science in Islam.*** In this section, I explore a critical analysis of the role of religion in science followed by an integrated picture of science in Islam, which helps me to identify its role in my science teaching.

3. ***The Power of Islam: Islam in My Teaching Identity.*** In this section, I portray the power of Islam in my teaching identity and reflect on the Islamic values and beliefs that have shaped my teaching identity.

IN THE REALM OF ISLAM: UNDERSTANDING ISLAMIC VALUES AND BELIEFS

Am I wrong to be a Moslem?

Setting One:

I run in the middle of the weapon
I run in the middle of the dead body
I run in the middle of the tears
I run in the middle of death

I run in the middle of dust
I run in the middle of explosion
I run in the middle of fire
I run in the middle of blood

I keep running and crying
I keep running and fighting
Why do you have to kill us?
Why do you have to fight us?
Why do you have to kill our women?
Why do you have to put tears on our children?

Is it because we are Moslems?
Is it because we believe in Allah
Is it because we trust in the Prophet
Is it because of Islam?
Why….
Am I wrong to be a Moslem?

Setting Two:

I sit in the comfortable chair
I am sad to see a dead body on the street
I am miserable to see blood on the street
It pains me to see the crying child on her mother's dead body
I am sad to see the parents cry over their child's dead body

I see another picture of sadness
The explosion, the dead body, the blood
The tears, the sadness, the anger

It is not Islam
Islam is not teaching us to kill, to destroy
Islam is not terrorism
Please don't say it is Islam
Please….
Am I wrong to be a Moslem?

Setting Three:

I walk in the street
In a beautiful country
With Moslems as a minority
Walking slowly, soundlessly
Feeling happiness,
Until they shout
"Bloody Muhammad"
"Go to hell Moslem"
Stopping still
Feeling shocked, sad, and angry
I can't say anything
I can't….
In the depth of my heart
Am I wrong to be a Moslem?

The poem represents my feelings about being a Moslem in relation to different controversial issues about the realities and perceptions of Islam. The issue of terrorism, poverty, and corruption in most Islamic countries evoke my emotions because it is not the way of Islam's teachings. According to Yuksel as cited in Haddad and Khashan (2002, p. 815), "today's Islam has little to do with Muhammad's original message. It has become a concocted by scholars who traded the teaching of the Qur'an with fabricated narration and medieval Arab culture. They promoted vicious and oppressive laws, misogyny, hatred, error and aggression". In my opinion, if there is something wrong with what Moslems are doing, it is because of certain individuals themselves, not because of something wrong with Islamic values, beliefs, and practices.

I realise my response to these controversial issues is influenced by my personal values and experiences. According to Akhavi (2003), Moslems' reactions to the West depend on their experience of the West. In my context, my reactions to the West are mostly influenced by my own values and beliefs rather than my experiences of the West. Australia is the only Western Country that I have visited, and even though I have had some negative experiences, especially as I described in setting three in my poem, I have never thought to generalise my responses to Australia or other Western countries. I have always thought that everyone in different countries within different

cultures and religions are human beings who have similar expectations of how they wish to be treated.

There are conflicts that are happening between Moslem countries (such as Afghanistan, Iraq, Libya and Iran) and Western countries (mainly America), because of religion, even though some Moslems believe it is because of economic factors (oil). I think Moslems respond to Western countries because of infiltration. According to Haddad and Khashan (2002, p. 825), “more than eight decades after Bury's (1919) declaration, most Arabs and Muslims continue to see militant Islam as a consequence of Western incursions against them, as well as a result of the abuses of local political elites whom they installed in power against public will”. My personal emotions were evoked when Peter showed us in project class a TED video on the subject of empathy. The American presenter spoke of America’s invasion of other countries, especially Moslem countries and those who are suffering including an American soldier who died because of the war. The video was really engaging; I felt anger, sadness and empathy to the point that I almost cried. It really made me question my beliefs and ask “is this actually because of oil, not religion, that this suffering is happening?” Even after watching the video, I was still thinking that if religion was not the main factor, it was still a more important factor than the social and political factors that shaped the American assessments and responses to other countries (Smidt, 2005). The question is still playing in my mind until the time of writing, “is oil America’s main reason for interfering in Moslem Countries?”

I don’t want to close my eyes and my heart to the ways people perceive Islam. I realise people could say that I am wrong, but in this thesis I write my truth, which I realise could be different from others. Therefore, I have chosen this type of research as it allows me to freely express my opinions and my feelings. At this stage, I can say there has been no coercion for me in following Islam. The main reason I have chosen Islam is not because I was born a Moslem, but because I believe the truth of Islam is an integrated way of life for me. Therefore, it is important for me to write the basic values, beliefs, and practices in Islam in the following paragraph which becomes one of the foundations of my teaching identity.

In this section, I outline the basic principles that shape the values, beliefs, and practices of Islam. I integrate my understanding of Islam from different Islamic resources and my life journey in informal and formal Islamic education, including the Qur'an and Hadith as the main resources. According to Horvatich (1994), there are different ways of knowing Islam and learning Islam, from the traditional way to modern education, but there is an over-arching principle that Moslems should go back to the Qur'an and Hadith to understand Islam.

Islam comes from an Arabic word which means peace and submission. Islam teaches that peace can be achieved by submitting to Allah in our hearts, souls and deeds. As a religion, Islam is about the acceptance of and obedience to teachings of God which He revealed and to His last prophet, Muhammad (Ibrahim, p.45).

Faith is that thou believe in Allāh and His angels and in meeting with Him and (in) His messengers and that thou believe in being raised to life (after death).

Abū Hurairah said, The prophet says "Every religion has a distinctive characteristic, and the characteristic of Islam is modesty" (Hadith narrated by Ibn Majah and Malik).

I hold Islam as an ideology to create a broad understanding of Islam. Islam is not only a religion; Islam is a way of life which shapes my practices. According to Akhavi (2003, p. 546), different from the minimalist view, the maximalist view of Islam will says that Islam should be integrated in all aspects of lives, including economic, social, and political aspects, not only "affirming the unity of God and Muhammad's prophecy, congregational prayer, fasting during the month of Ramadan, pilgrimage to Mecca, and paying poor dues". Therefore, I don't separate Islam from any aspects of my life, including my teaching.

There are two main things that we need to explore, in attempting to understand Islam. These are firstly the six basic Islamic beliefs and secondly the five pillars of Islam. In the explanations of the basic values of Islam, I give some examples of the way I have integrated Islam into my teaching practices. However, I only did so when I co-taught at the Islamic school (co-teaching) and in my previous teaching experiences in Indonesia when I knew that all of my students were Moslems. Even though Islamic values, beliefs, and practices have shaped my own teaching identity, I

would not integrate science topics with Islam if I was teaching students who are not Moslem; even if there was only one non-Moslem in the class.

In Islam there are two foundations of values, beliefs, and practices which are ***Rukun Iman*** (***Six basic Islamic beliefs) and Rukun Islam (five pillars of Islam)*** which I explore below:

Six Basics Islamic Beliefs

There are six basic Islamic beliefs:

1. **God**

   Moslems believe in one God, Allah, who has no son or partner. In the Qur'an it is stated:

   He is God, the one, god, to whom the creatures turn to their needs. He begets not, nor was he begotten, and there is none like him (Qur'an, 112:1-4)

   Allah is the only one who created the universe and all creations, including human, animals, plants, angels, etc. Therefore, his knowledge encompasses all things; he knows what has happened, what will happen, and how it will happen (Ibrahim, 2007). In the context of my science teaching and my teaching identity, I always integrate the belief that Allah is the only God who has created and knows everything.

2. **Angels**

   Moslems believe in the existence of Angels. Angels worship Allah alone. They obey and act only by Allah's command (Ibrahim, 2007). Allah gives certain duties to the Angels. One of the angels, Gabriel, is the one whose duty it is to bring down the Qur'an to Muhammad.

   Whoever is the enemy of Gabriel, surely he revealed it to thy heart by Allah's command (Qur'an, 2:97)

3. **God's revealed books**

   Moslems believe that Allah revealed the books to His messengers as proof for mankind and as guidance for them (Ibrahim, 2007). The Qur'an was revealed to Muhammad, then God guaranteed that the Qur'an would be protected from any corruption or distortion.

Indeed, we have sent down the Qur'an and surely, we guard it from corruption (Qur'an,15:9)

4. **The prophets and messengers of god**

Moslems believe in the prophets and messengers of God, starting from Adam, including Noah, Abraham, Ishmael, Isaac, Jacob, Moses, and Jesus. Allah sent Muhammad as the last prophet.

Muhammad is not the father of any one of your men, but he is the messenger of God and the last of the prophets (Qur'an, 33:40)

Mohammad is the role model for Moslems in their lives. Therefore, what he says, the way he acted or gives tacit approval is Hadith -one of Moslems' guidelines.

5. **The day of judgement**

Moslems belief there will be a day of judgement, according to their beliefs and deeds. Therefore, as a Moslem, I do my best to guide myself to do good things in my life by Islamic standards, including teaching which is the best way for me to express kindness during my life.

6. **Al-qadar**

Moslems believe in Al-qadar or divine destiny, but it doesn't mean humans don't have free will. We can choose to act rightly or wrongly and be responsible for our acts on the day of judgement. This belief leads to Allah knows everything; Allah records all that has happened and will happen. Allah creates everything. Allah asks Moslem to do their best, but if their willingness is not there, Moslems should believe that Allah knows the best for them. This belief leads to a sense of peace for me, since I believe that everything that happens to me is the best thing for me, even when negative things happen.

Five Pillars of Islam

Islam is built on five (pillars), the bearing of witness that there is no god but Allah and that Muhammad is the Messenger of Allah and the keeping up of prayer and the payment of zakat and the pilgrimage and fasting in Ramadhan (Hadith narrated by Muslim)

As a Moslem, I should believe in these basic principles:

1. **The testimony of faith** (*shahada*: "*la ilaha illa allah. Muhammad rasul Allah*") which means I believe that Allah is the only God and Muhammad is Allah's messenger. Someone can convert to Islam by stating this creed. However, this creed leads to the consequence of integration with belief in Allah and Muhammad in every activity. It becomes the main core belief in Islam which guides Moslems' lives. Therefore, in the context of my teaching, when I integrate science with Islam it is framed by this creed. For example, when I taught creationism in the Islamic school I emphasised that Allah is the only god who created the universe and all the creations on the Earth. That is one example of a belief that I hold as a Moslem.

2. **Salat (praying).** Moslems perform Salat five times a day which is stated in the Qur'an and Hadith. The Qur'an provides the big picture of Moslems' core beliefs, and Hadith (a saying, an act or tacit approval of the prophet Muhammad) provides more detailed explanations of the Qur'an. Therefore, the Hadith guides Moslems to understand the Qur'an. For example, Allah asks Moslems to perform Salat (in Qur'an), then Rasulullah provides examples of how to perform Salat (in Hadith). Relating to my teaching identity, I integrate the idea of the benefits of Salat which is not only for a sense of peace, but also for discipline and healthiness. Salat is performed at certain times and in certain ways. Interestingly, there is some research that shows the benefits of Salat for health, such as improved blood circulation and reduction of cancer risks.

3. **Sawm (fasting).** As a Moslem, I perform different types of fasting which are classified as obligatory fasting and Sunnah (non-obligatory fasting). Obligatory fasting is performed by Moslems during Ramadhan for one month. The power of religious beliefs is challenged in this way. As a Moslem, I feel happy and it is not difficult to perform fasting, since Allah provides great rewards for fasting. During fasting Moslems learn empathy for poor people. In the context of science teaching, I often integrate the idea of the benefits of fasting for health, for example for our digestion processes.

O you who believe! Fasting is prescribed for you as it was prescribed for those before You, so that you may guard (against evil); ..... and those who find it hard to do so may effect a redemption by feeding a poor man (Qur'an, 2:183-184)

Whoever observes fasts during the month of Ramadan out of sincere faith, and hoping to attain Allah's rewards, then all his past sins will be forgive (Hadith narrated by Abu Huraira)

4. **Zakat (giving).** The original meaning of Zakat is purification and growth (Ibrahim, 1997). Moslems (who already have a certain level of economic security) provide a certain percentage of their property each year (2.5%) for needy people. It is training for Moslems for develop empathy to others.

(Zakat) charity is only for the poor and the needy, and the collectors appointed for its collection, and those whose hearts are made to incline to truth, and the ransoming of captives, and those in debt. and for the way of Allah, and (for) the wayfarer (Qur'an, 9:60)

Abu Musa reported that the Prophet, peace and blessings of Allah be on him, said: The faithful treasurer who pays what he is ordered with a willing heart is one of those who give charity

5. **Hajj (pilgrimage).** Hajj to Makkah is performed if Moslems are physically and financially capable. About two million Moslems go to Mekkah each year from around the world (Ibrahim, 2007).

Surely the first House appointed for men is the one at Makkah, blessed and a guidance for the nations.....And pilgrimage to the House is incumbent upon men for the sake of Allāh, upon everyone who is able to undertake the journey to it (Qur'an, 3: 95-96)

Guidelines in Islam

There are three main guidelines in Islam: The Qur'an, the Hadith, and the Ijtihad. The Qur'an is the first main guide to Islam, providing the integrated core beliefs in Islam.

The Holy Spirit has brought it down from thy Lord with truth (Qur'an,16:102)

However, the Qur'an provides general core beliefs. Therefore, a Hadith is a saying or narration of the Prophet's speech, deed, or approval or disapproval whether spoken or tacit about something. For example, for doing obligatory Ramadhan fasting in the Qur'an how to do it is explained, referring to Hadith as the ways which Muhammad performed Ramadhan fasting. In addition contemporarily issues that might not have

happened in the time of Muhammad are explained in Ijtihad. For example, euthanasia is one such issue. Ijtihad expresses decisions in Islamic law made by Mujtahids who are scholars with a good understanding of the Qur'an and Hadith. Therefore, as a Moslem, I refer to the Qur'an, Hadith, and Ijtihad to solve the problems in my life.

IN THE DANCE OF RELIGION AND SCIENCE: THE PICTURE OF SCIENCE IN ISLAM

Religion and Science

Figure 14. Galileo before the Holy Office
(A 19th century painting by Joseph-Nicolas Robert-Fleury in Wikipedia, 2011)

The conflict of science and religion has gone on since the disagreement between Galileo and Church in 1601 with their differing cosmologies and geocentric and heliocentric positioning. Currently, the conflict continues because there are still different perspectives on religion and science. Seng (2006) points out that the conflict between religion and science is because of differences in ideology in basic belief and understanding that God, which is part of religion, is under the ideologies of idealism and theism while science is under materialism and atheism. Furthermore, in term of differences, according to Seng, (2006, p.188), "religion was regarded as a pre-scientific phenomenon; its relationship with science was thought to be zero-sum. It was believed that with the advancement of science and improved opportunities for education, religion would soon be reduced to empty cathedrals, mosques and temples". Arkoun (2003, p. 38) points out more on the differences between religion and science:

> Scientific knowledge is divided into separate, technical, highly specialized disciplines. Religions, on the contrary, have provided global, unified, and unifying systems of beliefs and non-beliefs, knowledge and practice, as well as pragmatic solutions to the fundamental problem of human destiny: life, death, love, justice, hope, truth, eternity, transcendence, and the absolute. The nostalgia for a unified vision explains the re-emergence of religion

I realise the differences between the nature of science and religion can result in conflict or conformity depending on our views of these two perspectives. According to Guessoumn (2010), science and religion have four different ways of relating, which are: (1) Ian Barbour (conflict, independence, dialogue, and integration), (2) John Haught (conflict, contrast, contact, and confirmation), (3) Freeman Dyson (Complementarity (with separation) between Science and Religion), and Stephen J. Gould (the NOMA (Non-Overlapping Magesteria) principle), and (4) Staver (cousinly, mutually respectful, non-overlapping, competitive, proximate-ultimate, dominant-subordinate, and opposing-conflicting). According to Guessoum (2010, p.68) "science and religion are two worldviews. They claim to describe ''reality'' and to explain our existence and that of the world; hence they often come to compete for humans' minds… (because) each claims to be a source of knowledge—or sometimes the source of knowledge". We need to understand the differences between these two concepts to help us to understand the overlap and interaction between Islam and religion (Guessoum, 2010). I agree with Loo (2001) that there is no doubt that culture and religion have contributed much to science. Kuhn (as cited in Loo, 2001, p. 71) points out that "science is a subjective construct of our understanding of the physical world negotiated amongst the scientific, religious and cultural communities. Therefore science is not as objective as it seems and science knowledge is no more than constructions of fictions (Loo, 2001). Even though I prefer to the post-modernist theory of science, I need also to consider the role of scientific interpretation in establishing accepted knowledge.

The dialogue between religion and science for almost two centuries (Seng, 2006) has stimulated me to think about my own perspective on the relationship between religion and science. I believe that religion and science shouldn't have to contradict each other, because these two concepts have correlations. As stated by Loo (2001) the philosophy of science is divided into four areas of inquiry - ontology, epistemology, logic and ethics. Ethics in science has been integrated from scientific, cultural, and religious communities. According to Hefner (2006), there are four roles of religion in the engagement with science which are reflective, defensive, practical-moral, and spiritual. It means there is a religious factor in understanding science. I also found that currently there are several movements for the relationship between religion and Islam, as well as other religions. As stated by Loo (2001, p. 48), "the

relationship between the present day Catholic Church and science has largely improved after it reconciled religious aestheticism and sentiment with the modern scientific viewpoint (based on the Copernican position but subsequently refined by Johannes Kepler)", even though the church and science still debate on the theory of evolution and creation. I realise my views on the relationship between religion and science are influenced by Islam. I don't have any deep understanding of other religions and I haven't found any conflict in understanding the relationship between science and Islam. Therefore, it's possible that my view could change once I understand how other religions view science phenomena.

Islam and Science

Are those who know equal with those who know not? (Qur'an, 39:9)

Truly fear Allah those among His Servants who have knowledge(Qur'an, 35:28)

The ink of the scholar is more sacred than the blood of the martyr (Hadith)

Seek knowledge even in China (Hadith)

An hour's contemplation (or study) of nature is better than a year's worship of God (Hadith)

The quotes above are from the Qur'an and suggest the importance of knowledge in Islam, including that of scientific knowledge. According to Golshani (as cited in Guessoum, 2010), there are 780 times where the Quran provides the word of knowledge, which could refer to science, religious knowledge, and knowledge of God. Since I was educated by my parents, I was always taught that Islam is the truth, no matter if we learn a variety of concepts during our lives. Therefore, when I learned science I didn't find it contradictory to Islam. If there are differences, I put it down to the fact that science has been developed by human beings and Islam was developed by Allah (God) which means humans have limitations in their knowledge whereas Allah's knowledge is vast as he created the universe and all of the creations in the world. For example, previously scientists didn't know that the universe is expanding, but Allah revealed it in Qur'an. After scientific knowledge developed humans found that the universe was expanding. Therefore, I believe in relation to Islam that there is no separation between religion and science as I believe that there is no contradiction between Islam and science. Interestingly, the Qur'an was revealed

1400 years ago and 1000 years ago there were Moslem scientists who contributed to scientific and technological development.

There are several concepts that are used to understand the relationship between Islam and science which the following references express. Guessoum (2010, p. 67) provides the principles of the philosophy of science in Islam from the Qur'an:

> (a) the importance of the systematic study of nature and of the cosmos *(e.g. ''Behold! in the creation of the heavens and the earth, and the alternation of night and day, there are indeed signs for men of understanding, Men who celebrate the praises of Allah, standing, sitting, and lying down on their sides, and contemplate the (wonders of) creation in the heavens and the earth, (With the thought): Our Lord! not for naught Hast Thou created (all) this! Glory to Thee!'' 3:190–191; ''Say Travel through the earth and see how creation (was) started (by Allah)'' 29:20);* (b) the exploration of nature, from mere observation to full scrutiny, should clearly point out the order and purpose of the cosmos; and (c) the study of nature should point to a certain unity and thus lead to a (greater) faith in the Creator.

Sardar (as cited in Loo, 2001, p. 54) uses the language of Islamic science to describe the relationship of science and Islam. He states that "Islamic science is a science whose processes and methodologies incorporate the spirit of Islamic values" and divides the relationship of Islam and science into four categories:

1. *Islamic science as modernist science within the Muslim polity*

   Islamic Modernism in science is led by Salam who received the Nobel prize in 1979. He pointed out that religion and science are complementary and not contradictory to each other

2. *Islamic science reveals truth and knowledge*

   This form is developed within the movement of Bucaillism and focuses on the Qur'an as the sources of all scientific knowledge. Therefore it is attempts to shift the ontological foundation from empirical validation of scientific truth to literally interpreted scientific revelations from Islamic Holy Scripture.

3. *Islamic science as novum novum organum*

   This view is based on a Nasrist approach which is that the truth can only be discovered by involving dual structures in human reasoning (rational and intuitive). Therefore knowledge in Islam under this epistemology will lead scientists to embrace theologians and clerics.

4. *Islamic science as a science guided by environmental ethics*

   Sardar has developed the idea (which also involves the concept of khilafa) that humans have a social responsibility towards the total environment (biophysical and socio-cultural). Therefore, knowledge in science should promote social justice and construction of environmental ethics.

Exploring these has enabled me to see the power of each category and how they relate to my beliefs in Islam and science. It is my belief that Islam and science should be complementary to each other (category one), because science helps to develop my faith in Allah, I also believe that the Qur'an is the truth (category two), therefore scientific knowledge can be proved by the Qur'an. However, I realise the limitations of human interpretation, therefore, it is important for me to have a deeper understanding of the Qur'an while I learn science. Further, as a human being, I also have rationality and intuition, which also applies to my understanding of science and Islam (category three). In relation to category four, I believe scientific knowledge helps me to understand humans' role as khilafa (humans as leaders for universe) that Allah referred to in the Qur'an. Therefore, in relation to Sardar's framework it is clear to me that Islam and science do not contradict one another.

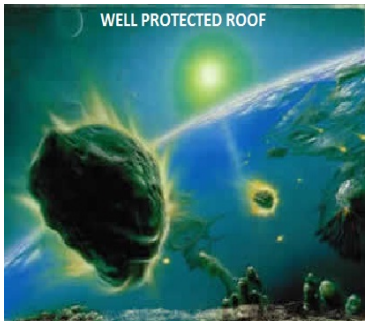
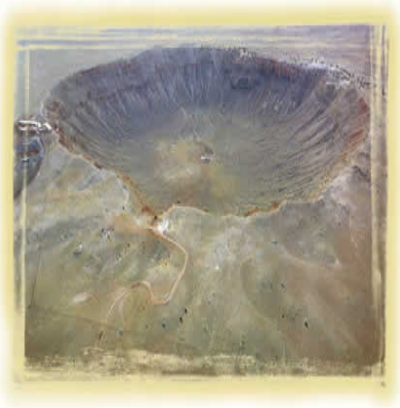
In addition to Islam in my science teaching, I can see that I privilege Islam over science which is consistent with research results by Mansour (2010). He conducted research on Egyptian science teachers' views of how science and religion are related, and showed that there are four categories: (1) conflict with the science side (such as Darwinian theory), (2) independence with religious dominance (two different disciplines), (3) dialogue under the authority of religion (science has limitations), and (4) integration with science as part of an Islamic body (science can prove religious beliefs). The fourth category shaped teachers' key visions on religion as their priority over science. I realise that it is probably because we are shaped by Islamic religion first before we learn science, however I can't ignore my belief in my own truth

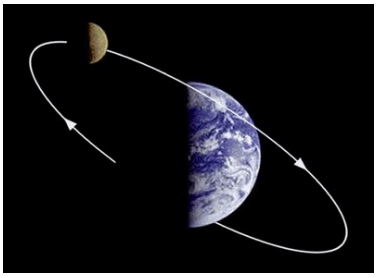
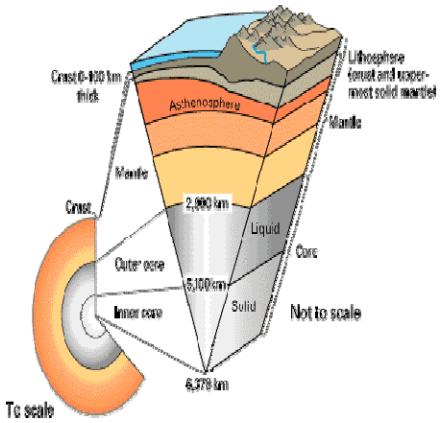
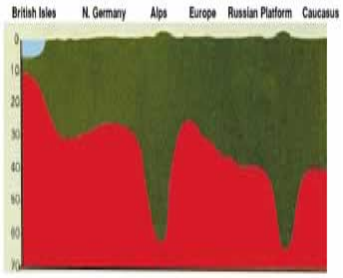
related to Islam. Again, I write of the values and beliefs that I hold without ignoring other views which enrich my perspective of Islam in my science teaching. To enable my understanding of how I integrate Islam in my science teaching I have explore several topics in science which can be related to Islam and come from several references, the Qur'an, and my own experiences.

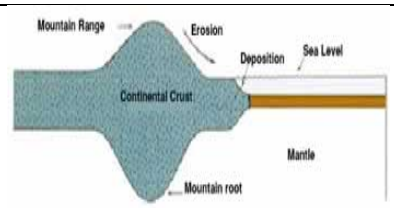
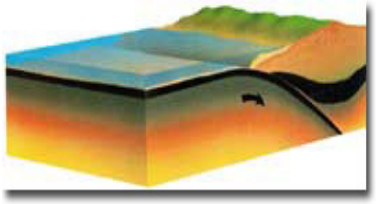
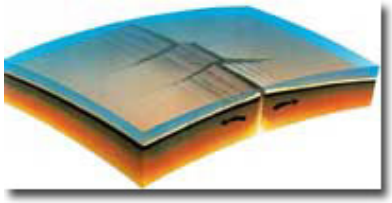
Table 12. Science Topics and the Qur'an

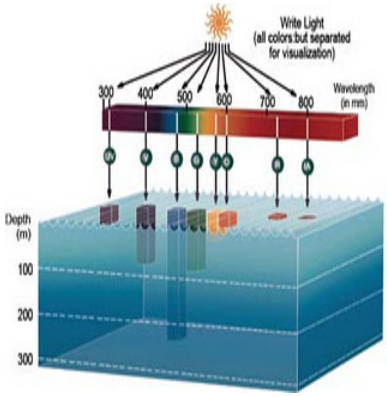
Earth And Beyond

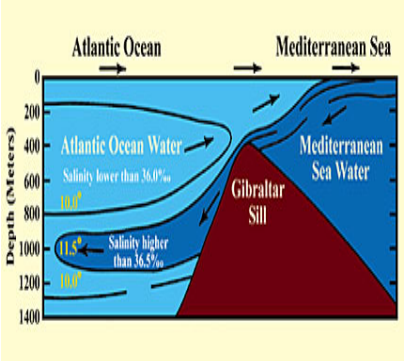
TOPICS	**DESCRIPTION**
The Origin of Universe  (Yahya, 2001)	*"then he turned to the heaven when it was smoke (Qur'an, 41:11)* *"Have not those who disbelieved known that the heavens and the earth were one connected entity, then We separated them (Qur'an, 21:30)* The universe was nothing but a cloud of smoke, then separated as with the "Big Bang theory"
The Expansion of Universe  (Yahya, 2001)	Until the 20th century, there was a powerful theory that the universe was constant and that it had existed since infinite time. However, research shows that the universe is expanding all the time and had a beginning. According to Ahmad (2010), Yahya (2001), and Ibrahim (1997), the expansion of the universe is stated by Allah in the Qur'an: *With the power did we construct the heaven? Verily, we are able to extend the vastness of space thereof." (Qur'an, 51:47)* In addition, CNN reports that there are three Physics scientists (Saul Perlmutter, Brian P. Schmidt, and Adam G. Riess) who won the Nobel Prize 2011 for studying the expansion of the universe (CNN Wire Staff, 2011) which shows the relevance with Qur'an statement of this theory.

The Perfect Equilibrium in The Universe  (Yahya, 2001)	*He Who created the seven heavens in layers. You will not find any discrepancy in the creation of the All-Merciful. Look again-do you see any gaps? Then look again and again. Your sight will return to you dazzled and exhausted! (Qur'an, 67:3-4).* *And the sun runs on its fixed course for a term (appointed). That is the Decree of Almighty, the All-knowing. And the moon, we have measured for it mansions (to traverse) till it returns like the old dried curved date stalk. It is not for the sun to overtake the moon, nor does the night outstrip the day. They all float exact in its orbit (Qur'an, 36:38-40)* The billions of stars and galaxies (200-300 billion stars) in the universe move in perfect equilibrium in the paths set out for them as an integrated system (Yahya, 2001).
The Ozone Layer as The Protective Roof   (Yahya, 2004)	*Until he reached the rising of the sun and found it rising on a people to whom We had not given any shelter from it. (Qur'an, 18:90).* *We made the sky a preserved and protected roof yet still they turn away from Our Signs. (Qur'an, 21:32)* The Arabic word "*sitran*" in verse 90 of Surat al-Kahf means "cover, shelter, curtain or screen." The term "*lam najaal lahum min dooniha sitran*" describes an environment devoid of any shelter or protection against the Sun. In light of present-day knowledge, this is suggestive of the hole in the ozone layer which diminishes its ability to protect living things against harmful solar rays.

The Earth Movement  (Abduldaem, 2011)	The Earth rotates and revolves which influences time, day and night, and induction as a centrifugal force (Ahmad, 2010) which Allah refers to in the Qur'an: *And you will see the mountains and think them solid but they shall pass away as the passing away of clouds. The work of Allah, who perfected all things, verily He is Well-Acquainted with what you do (Qur'an, 27:88)*
The Earth's Layer  (USGS, 2011)	*It is Allah who created seven heavens and of the Earth the like thereof (i.e. seven). His command descends between them (Heavens and Earth) (Qur'an, 65:12)* According to Ahmad (2010), the earth is like a ball with seven layers: 1) the atmosphere, 2) the hydrosphere, 3) The sial (Silicon and Aluminium in Earth's crust, 4) The Sima (Silicon and Magnesium) in the cover, 5) the layer of iron-rich Sima, 6) the layer of Nife from nickel and iron), 7) the nuclear ore.
The Shape and The Roles of Mountains  Schematic section. Mountains, like pegs, have deep roots embedded in the ground	According to Yahya (2001), 1/3 of mountain height is above the surface of the earth and 2/3 is below the surface of the earth and most ancient books explain mountains as piles of rock or wrinkles in the earth crust. The Qur'an is the only ancient book that defines the shape of mountains as Pegs. *Have We not made the earth as a bed and the mountains its pegs?(Qur'an, 78:6-7)* Ahmad (2010) also asserts that mountains as pegs are buried in the earth to establish the earth. In 1956, Dr. Farooq Baz, a specialist in Earth Science affirmed that scientists' findings on the mountains being pegs about 4.5 times in height above the earth surface for stabilization and equilibrium is relevant with the Qur'an (Ahmad, 2010; Ibrahim, 1997). As Allah stated in the Qur'an:

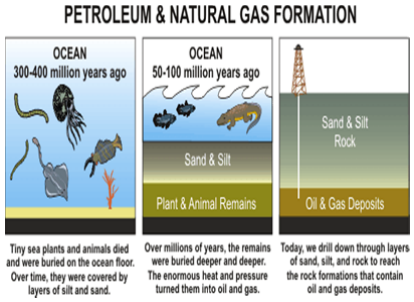
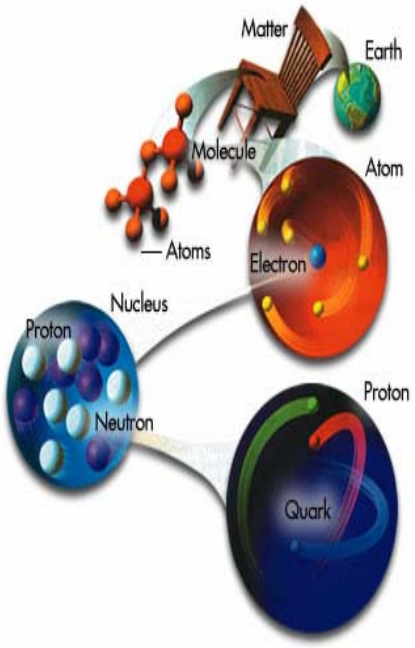
 Another illustration shows how mountains are peg-like in shape, due to their deep roots. (Yahya, 2001)	*We placed firmly embedded mountains on the earth, so it would not move under them...(Qur'an, 21:31).* *And He has set up on the earth mountains standing firm, lest it should shake with you; and rivers and roads; that ye may guide yourselves (Qur'an, 16:15)*
The Earth Which Splits, Subduction Zone and Decrease of Land   (Yahya, 2004) The above representative pictures show the fragmented structure of the Earth. The magma layer under the Earth's crust is allowed to escape to the surface by this fragmented structure. This significantly reduces the temperature of the Earth.	*And the Earth which splits (Qur'an, 86:12)* According to Ahmad (2010), the rocky layer of earth (lithosphere) is divided into 12 plates which move each other. Additionally, land is decreasing due to the movements of tectonic plates (Yahya, 2001). *Don't they See that We gradually reduce the land from its outlying boundaries? Where God commands, there is none to put lack His command (Quran, 13:41).* *Indeed we gave the good things of this life to these men and their fathers until the period grew long for them; don't they see our ability in reducing the land from its outlying borders? Is it then they who will win? (Quran 21:44)*
Water and Rock Colours	*See you not that Allah sends down water (rain) from the sky, and we produce therewith fruits of various colors, among the mountains are streaks white and red, of varying colour and (others) very black. And likewise of men and Ad-dawabb (moving living creatures, beasts), and cattle are of various colour. It is only those that have knowledge among His slave that fear Allah. Verily, Allah is Almighty, Oft-*

	Forgiving (Qur'an, 35:27-28). According to Ahmad (2010), the colour of rocks are the result of the colours of the minerals they are composed of, and the colour of minerals results from the environmental interaction with water as a critical agent for the coloration of the rocks.
Darkness in the Oceans and Seas  (Ceccarelli, 2011)  (The Key to Understanding Islam, 2011)	The darkness in deep seas and oceans is found at around a depth of 200 meters and below. At this depth, there is almost no light. Below a depth of 1000 meters there is no light at all. (Elder, Danny; and John Pernetta, 1991 as stated in Yahya, 2001) *Or like the darkness of a deep sea which is covered by waves above which are waves above which are clouds, layers of darkness, one upon the other. If he puts out his hand, he cannot see it (Qur'an, 24:40)*
The Seas Not Mingling With One Another	*He has let loose the two seas, converging together, with a barrier between them they do not break through (Qur'an, 55:19-20).* *It is He Who has let free the two bodies of flowing water: one palatable and sweet, and the other salt and bitter; yet has He made a barrier between them, a partition that is forbidden to be passed (Qur'an, 25:53).* *Who has made the earth firm to live in; made*

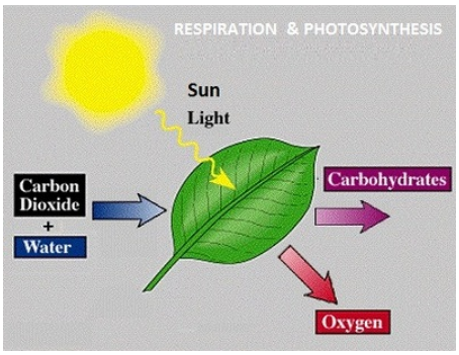
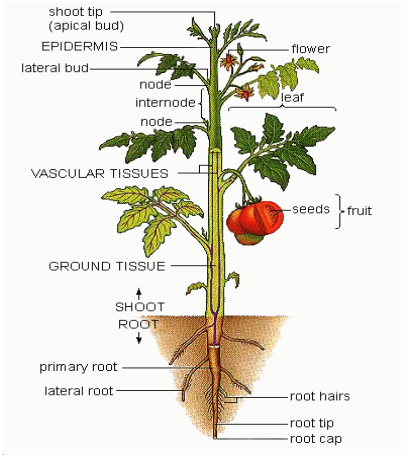
 A satellite photograph of the Strait of Gibraltar (Yahya, 2004)  (Yahya, 2004)	*rivers in it; set thereon mountains to stabilize it, and made a separating barrier between the two bodies of flowing water? Can there be another God besides Allah? Nay, most of them know not (Qur'an, 27:61)* There are the properties of seas that come together but that do not mingle each others. For example: There are large waves, strong currents, and tides in the Mediterranean Sea and the Atlantic Ocean. The Mediterranean Sea water enters the Atlantic by Gibraltar. But their temperature, salinity, and densities do not change, because of the barrier that separates them (Yahya, 2001; Ibrahim 1997)

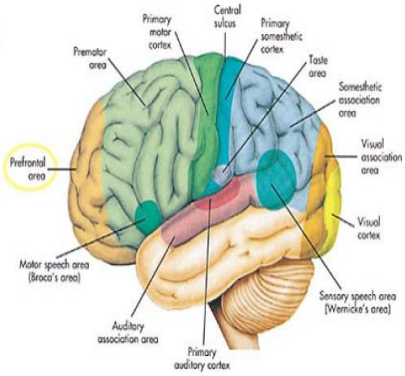
Chemistry

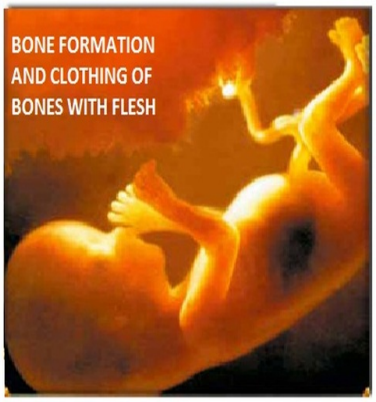
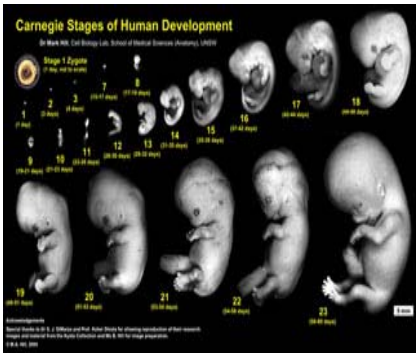
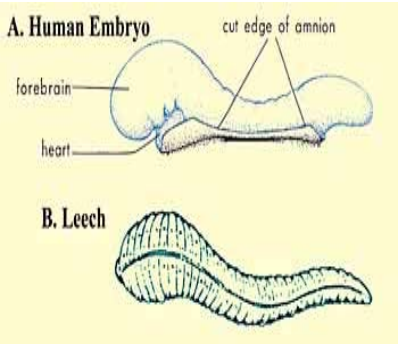
TOPICS	DESCRIPTIONS
The Miracle of Iron  (The Religion of Islam, 2011)	Iron is one of the elements highlighted in the Qur'an. In Surat al-Hadid (meaning Iron), Allah stated: *…and We also sent down iron in which there lies great force and which has many uses for mankind… (Qur'an, 57:25).* The word "*anzalna*," translated as "sent down" which the literal meaning of "being physically sent down from the sky," as in the case of rain and the sun's rays. Modern astronomical findings show that the iron in our world has come from giant stars in outer space (both iron on Earth and in the solar system) and the sun's temperature (6000 ºC) is inadequate for the formation of iron; when a star's temperature exceeds one hundred

	million degrees there is an explosion (Supernova), and the iron is given off into space (Yahya, 2001). In modern society, iron is a basic material of all sectors of industry and a basic component of most living things. According to Ahmad (2010), humankind didn't realise the uses of iron until the 18th century when they discovered its extraction.
The Formation of Petrol  (The Levin Institute, 2012)	*Glorify the Name of your Lord, the Most High: He Who created and moulded; He Who determined and guided; He Who brings forth green pasture, then makes it blackened stubble. (Qur'an, 87:1-5).* Oil is formed from the plants and animals in the sea after million years. According to Yahya (2001), the animals and plants decay after a million years and turn into the oil and gas which come out as a result of the movement of earth's crust or mining.
Sub-atomic Particles  (Yahya, 2004)	*He is the Knower of the Unseen, Whom not an atom's weight eludes, either in the heavens or in the earth; nor is there anything smaller or larger than that which is not in a Clear Book. (Qur'an, 34:3).* *… Not even an atom's weight eludes your Lord, either on earth or in heaven. Nor is there anything smaller than that, or larger, which is not in a Clear Book (Qur'an, 10:61).* The recent development of atomic theory shows that there are particles even smaller than the atom. According to Yahya (2001), there are sub particles in atoms called quarks which are 10^{-18} (0.000000000000000001 of a metre). The word "mithqal," ("*mithqali tharratin*") in the Qur'an refers to the expression of an atom's weight) which means protons, neutrons and electrons in the atom give the atom its weight.

Biology

TOPICS	DESCRIPTIONS
The Chlorophyll and Photosynthesis  (The Islam Show, 2011)	Chlorophyll produces food. According to Ahmad (2010), chlorophyll is the only factory on Earth that produces food which converts Sun's energy to CO_2 and H_2O for food for living things. As stated in Qur'an: *It is He who sends down water (rain) from the sky, and with it We bring forth vegetation of all kinds, and out of it we bring forth green stalks (every green thing) from which We bring forth thick clustered grain (Qur'an, 6:99)*
The Feeding Organs of Plants: The Roots  (Ygraph, 2011)	*And the gardens of vines, and green crops (fields, etc.), and date-palms, growing out two or three from a single stem root, or otherwise (one stem root for every palm), watered with the same water, yet some of them we make more excellent than others to eat. Verily, in these things, there are Ayat for the people who understand (Quran, 13:4)* The Qur'an states the importance of roots in the plants' growth. According to Ahmad (2010), roots as the first feeding organ dissolves the nutrients from the earth via osmotic pressure to help plants grow, and roots also hold the plant in the place and keep them in an upright position.
Fertilizing Winds  (Abdallah, 2011)	*And We send the winds fertilizing (to fill heavily the clouds with water), then caused the water (rain) to descend from the sky, and We gave it to you to drink, and it is not you who are the owners of its stores (Quran, 15:22)* According to Ahmad (2010), winds have important roles in the process of pollen transfer in plants which don't have fragrance or nectar to attract insects.

Breathing Gets More Difficult as You reach Higher places  (Power Breathe, 2011)	According to Yahya (2001), when we reach higher places, we find it difficult to breath and feel that our breath is constrained, because the air has less and less oxygen. *And Those Whom God wants to keep astray, He makes their breast close and constricted, as if they had to climb up to the skies; this is the penalty of those who refuse to believe (Quran 6:125)*
The Region That Controls Our Movements  (Peer Usman, 2011)	The motivation and the foresight to plan and initiate movement occurs in the anterior portion of the frontal lobes -- the prefrontal area (Yahya, 2001 & Ibrahim, 1997). Many anatomy and physiology books state this it is the region of association in the cortex which is involved in motivation and the prefrontal area is also thought to be the functional centre for aggression (Seeley, Rod R.; Trent D. Stephens; and Philip Tate, 1996, Essentials of Anatomy & Physiology as stated in Yahya (2001) and Ibrahim (1997). This concept is referred to in the Qur'an below: *No indeed! If he does not stop, We will grab him by the forelock, a lying, sinful forelock (Qur'an, 96:15-16)*
The Sex of the Baby  (The Islam Show, 2011)	According to Yahya (2001), there were several assumptions about the sex of babies such as that a baby's sex is determined by the mother's cells or it was believed that the sex was determined by the male and female cells together. Recent modern science found the sex of baby is determined by the sperm (male's cells) as stated by the Qur'an below: *He has created both sexes, male and female from a drop of a sperm which has been ejected (Qur'an, 53:45-46)*

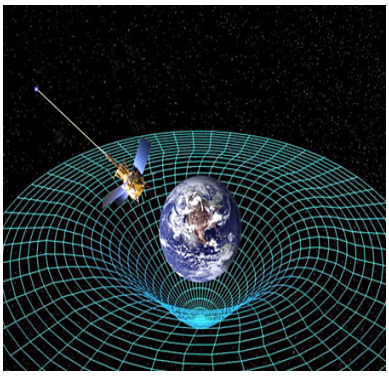
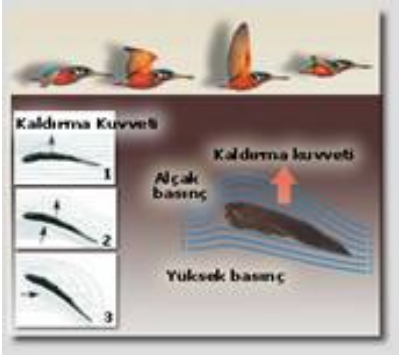
The Order of Formation of the Human Body  (The Islam Show, 2011)	*We then formed the drop into a clot and formed the clot into a lump and formed the lump into bones and clothed the bones in flesh; and then brought him into being as another creature. Blessed be God, the Best of Creators!(Qur'an, 23:14)* The Qur'an refers to the formation of bones and muscles in the human body's development and similarly as Yahya (2001) points out, embryologists assume that the bones and muscles in embryos develop at the same time. Recent research proves that during the seventh week, the skeleton begins to spread and the bones take their shape, then at the end of the seventh week and during the eighth week the muscles take their positions around the bone forms (Moore, 1998 as stated in Yahya 2001).
Stages of Baby Formation  (UNSW Embryology, 2011)  	We did create the human from a clay product; Then we placed a drop of sperm (Nutfah) in a place firmly fixed; Then we made the sperm into a leach structure ('Alaqah); *Then of that leach we made a chewed-like structure; then we made out of that chewed-like structure bones and clothed the bones with flesh; then we developed out of it another form of creation (Quran, 23:12-14).* According to Yahya (2001) and Ibrahim (2007), this verse from the Qur'an identifies the stages of pre-natal development as stated in many books and research findings as follows: 1. Nutfah, which means "a drop" or "small amount of water"; 2. 'alaqah,which means a "leech-like structure"; 3. mudghah, which means a "chewed-like structure"; 4. 'idhaam, which means "bones" or "skeleton"; 5. kisaa ul idham bil-laham, which means the clothing of bones with flesh or muscle, 6. al-nash'a which means "the formation of distinct fetus".

(Ibrahim, 1997)	This development has been stated also in "The Developing Human" by Moore as Professor Emeritus of Anatomy and Cell Biology at the University of Toronto, Canada (Yahya, 2001)
Three Veils of Darkness  (Alkaheel, 2011)	It was not until the 1970s when the experimentation with test-tube babies started that scientists discovered that if mixing of the sperm and the egg took place in light, the resulting fetus would become deformed and die. *Allah Created you in the womb of your mothers, one form of creation after another, in three veils of darkness (Quran 39:6).* The three layers are understood as the abdominal wall, the uterine wall, and the membranes.
Fossilization and Iron Content  (Shepherd, 2011)	*They say, 'What! When we are bones and crumbled dust, will we then be raised up as a new creation?' Say: 'It would not matter if you were rock or iron or indeed any created thing that you think is harder still!' They will say, 'Who will bring us back again?' Say: 'He Who brought you into being in the first place'... (Qur'an, 49-51)* The above surah is a reference to peoples' dead bodies petrifying and turning into iron. After living things die, they can be preserved for years by fossilization, when their bodies turn into stone under the ground and iron is preserved undamaged in the body as it fossilized (Yahya, 2001).
Oxidation in The Blood	*No indeed! Rather what they have earned has rusted up their hearts. (Qur'an, 83:14)* According to Yahya (2001), the term 'rusted' in Surah al-Mutaffifin refers to biochemicals reaction in the heart, as rust is the result of iron reacting with oxygen – oxidation. The oxygen that we absorb from the air helps to oxidize the iron in our haemoglobin. This

 (SingurityHUB, 2011)	constant process of rusting happening in the blood, thus the heart becomes the centre of the circulation system.
The Formation of Milk  (Yahya, 2004)	*There is instruction for you in cattle. From the contents of their bellies, from between the dung and blood, We give you pure milk to drink, easy for drinkers to swallow (Qur'an, 16:66).* The Qur'an refers to the formation of cow's milk for humankind to drink. According to Yahya (2001), the milk comes from the process of digestion through the wall of the intestine into the blood stream.

Physics

TOPICS	DESCRIPTIONS
Shadows and the Refraction of Light Rays  (Ayiomamitis, 2008)	According to Ahmad (2010), shadows refer to the implication that the night is from the Earth's shadow. Allah has made the sun as a mark for the shadow as his statement in Qur'an *Have you not seen how your lord spread the shadow? If He willed, He could have made it still when We have made the sun its guide (ie. after the sunrise), it (the shadow) squeezes and vanishes at midnoon and then again appears in the afternoon with the decline of the sun, and had there been no sun lights, there would have been no shadow (Qur'an, 25:45)* Then the shadow formed due to sun rays which Rays emanating from the sun travel in space in straight lines to the atmosphere with

	a particular angle which caused the gradual withdrawal of shadow as stated in Qur'an *Then We withdraw it to Us a gradual concealed withdraw (Qur'an, 25:46)*
The Earth's Gravitational Force  (Khan, 2005)	*Did we not make the earth a receptacle? (Qur'an,77:25)* According to Yahya (2001) and Ahmad (2010) the word "Kifatan" in Suart Al-Mursalat comes from the root word "kafata," which means "to collect, gather toward one, close embrace". This refers to the way the earth pulls human beings and everything else with its gravitational force, living or inanimate, toward its centre thus the use of the verb meaning "to pull toward one" refers to this force of gravity.
Aerodynamic Forces and Flight Programmed in Birds   (Yahya, 2001)	*Do they not see the birds suspended in mid-air up in the sky? Nothing holds them there except Allah. There are certainly signs in that for people who believe. (Qur'an, 16:79)* Birds are able to resist gravitational forces when they fly. According to Ahmad (2001), all details in birds, from their feathers to their lungs, from the arrangement of their feathers to the shape of their wings, are equipped with a special feature and order intended to enable them to fly.

Radio Receivers on Mountains  (Yahya, 2001)	*O mountains and birds! Echo with him in his praise!" And We made iron malleable for him (Qur'an, 34:10)* The word "echo" has relevance to the ways radio work. According to Yahya (2001), radio systems consist of a transmitter and a receiver and the transmitter (sinus waves) takes the message to be sent, then the receiver takes in the radio waves and deciphers the message sent on the sinus wave. In this way, the message is received in exactly the same form as it was sent. The word "awwibi," translated as "echo" in the above verse and meaning "sound being repeated or returned", may very well be a reference to the transmission of these radio waves.

In terms of integrating science topics with Islam in the classroom, I shared my understandings with my co-teacher, Mrs Emilia at the Islamic School. She did not have any problems integrating Islam within science teaching which she expressed in her statement:

> *For me religion is science -- when we co-taught last year, we found that it was so easy to teach science by incorporating Islam. Do you remember when we taught chemistry and physics in science? In chemistry, we looked at the topics of the separation of the sea and iron. And in biology, we taught that the umbilical cord is smaller than a straw; how amazing that Allah created it to separate food and waste, so that the child doesn't get sick. Scientific knowledge proves the greatness of Allah and the existence of Allah. It is impossible to have the changes of night and day without the existence of God (Mrs. Emilia, teacher interview, October 14, 2011)*

Exploring Islam within science provides me with the opportunity to reflect on my own understanding of Islam. I realise my limitations in understanding Islam, as I don't have any formal background in studying it, apart from the traditional way of learning Islam from family and Ulama (people who specialise in Islamic religion). However, I don't close my eyes to other interpretations about incorporating Islam with my science teaching. I believe that scientific knowledge changes over time, depending on what is accepted scientific knowledge in science communities, but that the Qur'an can't be changed. Therefore, if there are differences between current science knowledge and Islam, there will be a scientific methodology to find scientific knowledge in the Qur'an in the future. Thus, I also believe that Islam should contribute to creating dialogue between science and religion. According to Loo

(2001), Islam as one of the world's major religions and will continue to play an important role in mediating interactions between philosophical and social/cultural/religious environments of science, especially when science is often constructed in value-laden environments.

HERE IS THE POWER: ISLAM IN MY TEACHING IDENTITY

The Power of Religion in Teaching Identity

This poem in the name of Allah represents the power of my religion in my teaching identity. I had never realised religion played such an important role in my teaching identity until I conducted co-teaching and self-critical writing during this doctoral study. I realised that the most powerful energy in my motivation for being a good teacher comes from my religion. Geertz's position is relevant here as he holds the essentialist view of religion which is that it's "a system of symbols which act to establish powerful, pervasive, and long-lasting moods and motivations in men by formulating conceptions of a general order of existence and clothing these conceptions with such an aura of factuality that the moods and motivations seem uniquely realistic" (Limberis, 2000, p. 374). Meanwhile Asad as (cited in Limberis, 2000, p. 375), a post-colonialist proposes another definition of religion:

IN THE NAME OF ALLAH

In the name of Allah
I follow the pathway
I follow the guidelines
I obey the conventions
I obey the rules

In the name of Allah
I can't see
But I can feel
I can't tell
But I can sense

In name of Allah
Feelings of peace
Feelings of calmness
Feeling of spirit
I just can't tell

In the name of Allah
Proud of being a teacher
Proud of being useful to others
Proud of developing knowledge
Proud of loving my students

In the name of Allah
Here it is: my teaching
In Your ways
In my faith
In my belief
I will survive

Religion is not just that religious symbols are intimately linked to social life (and so change with it), or that they usually support dominant political power (and occasionally oppose it). It is those different kinds of practice and discourse that are intrinsic to the field in which religious representations acquire their identity and their truthfulness. From this it does not follow that the meaning of religious practices and utterances are to be sought in social phenomena but only that their possibility and their authoritative status are to be explained as products of historically distinctive disciplines and forces

According to Reiss (2007, p. 144), “a person can have more than one worldview and there are many worldviews other than religious ones but the religious worldview is a powerful and important one for many people”. However, I use dialectical thinking to understand the roles of religion in my teaching identity, because I realise my religion is not simply a symbol, it is a representation of my identity which gives me enormous energy to guide my life’s journey. Therefore, I have tried to summarise the concept of religion by Howert (1903) which I found relevant to my opinion on the power of energy in religion. According to Howert (1903), religion manifests as beliefs, feelings, and actions within individual consciousness and desire which involves infinite and external energy. Bruce (2011, p. 112) also points out the substantive definition of religion: “religion, then, consists of beliefs, actions and institutions which assume the existence of supernatural entities with powers of action, or impersonal powers or processes possessed of moral purpose”. Of all the different references for understanding religion as a power aspect of identity, I have found that Woodhead (2011) provides the five most integrated concepts of religion:

1. Religion as culture (religion as belief and meaning, religion as meaning and cultural order, religion as values, religion as discourses, religion as ideology and mystification, religion as tradition and memory)
2. Religion as identity (religion as community-creating and boundary-forming, religion as identity-claim, religion as organizational belonging)
3. Religion as relationship (religion as social relations, religion as super-social relations, religion as experience)
4. Religion as practice (religion as ritual and embodiment, religion as quotidian practice, ‘popular’ or ‘folk’ religion)
5. Religion as power (religion as ‘compensator’ and ‘capital; religious resource; religion, economic and political power; religion as status and recognition; religious power and status at micro-, meso- and macro-level)

These different views of religion (religion as culture, identity, relationship, practice and power) provide an integrated picture for me to understand how religion has

shaped my teaching identity. According to White (2009), religious experiences will interplay with teachers' views on their professional practices. In addition, according to White (2009), religion is one aspect that helps to define culture and build peoples' professional identities. Thus, I understand how religion with its values, beliefs, and practices shape my teaching values and beliefs, my teaching approach, and my interactions with students.

I came across the distinction between religious identity and spiritual identity via Kiesling, Sorell, Montgomery, and Colwell (2006, p. 1269) who define spiritual identity as "a persistent sense of self that addresses ultimate questions about the nature, purpose, and meaning of life, resulting in behaviours that are consonant with the individual's core values". Furthermore, Sinnot as cited in Kiesling, Sorell, Montgomery, and Colwell (2006) distinguishes spirituality from religious practices by explaining that religious practices are signs of a spiritual orientation from a set of culturally cohesive practices, beliefs, and habits. However, in my personal experiences, my religion *is* my spiritual identity and this shapes my core values and my way of life.

However, I can't ignore the socio-cultural influences upon my understanding of Islam. According to Mansour (2010), socio-cultural factors play important roles in creating teachers' understanding and interpretation of Islam in science. When I came to Australia, I met Moslems from different countries and I saw several differences in the way they practiced Islam. However, in Islam the differences are related to only minor Islamic practices, not core or fundamental values and beliefs, such as believing in Allah and the Prophet. Throughout both my interactions with other Moslems and reading different references, I have found that the most foundational values and beliefs which shape Moslem teachers' teaching identity are constant across cultures. Therefore, I have described my understanding of Islam in relation to its values, beliefs, and practices and I also write about how Islam's core beliefs, which come from the Quran and Hadith, guide and motivate me to give the best performance that I can in my teaching.

The Islamic Values and Beliefs Grounded In My Teaching

Teaching

Teaching is helping others to develop their minds, to change their 'negative' behaviour, and is most important to equip the younger generations to create a better future for the world. Therefore, I believe teaching is a way of being blessed by Allah, once Allah gives his blessing, He will provide me with happiness, calmness and peace. Even when I have problems, He will show me the way; He will never leave me. Therefore, I perform my best within my role as a science teacher educator. Below are several Hadith on the importance of teaching, which guide me:

The Prophet, peace and blessings of Allâh be on him, said: Whomsoever Allâh intends to do good, He gives right understanding of religion. And Knowledge is maintained only through teaching

Abû Mûsâ said, The Messenger of Allâh, peace and blessings of Allâh be on him, said: "There are three persons for whom there is a double reward: . . . the person who has a slave-girl, and he brings her up and trains her in the best manner and he educates her

A good word is charity (Hadith, narrated by Muslim and Bukhari)

Allah will give rewards for all the good things that we have done

I believe Allah will give rewards for all good things that we do, as my parents always taught me to be a good Moslem who does good things in my life, including being a teacher. I don't have any doubt that teaching is a way to do good things. There are several Qur'an and Hadith quotes below on doing good things:

That day mankind will proceed in scattered groups that they may be shown their deeds. So whosoever does good equal to the weight of an atom (or a small ant), shall see it (Qur'an, 99:6-7)

The most perfect of the believers in faith are the best of them in moral (Hadith, narrated by Ahmad and Tirmidzi)

"God doesn't judge you according to your appearance and your wealth, but He looks at your hearts and looks into your deeds" (Hadith, narrated by Muslim)

"There is a reward for kindness to every living animal or human" (Hadith, narrated by Muslim and Bukhari)

The most powerful Moslem is the one who can be useful to others

Since I was a teenager, I have known from the Hadith that the most powerful Moslem is the one who can be useful to others. It has shaped my thinking and action;

I always try to find ways to help others. From when I was in middle school until now, I have always joined social organisations. Every time I can contribute to others, I feel happy and at peace.

The best of those that thou canst take into service is the strong one, the faithful one (Qur'an, 28:26)

Giving knowledge to people, Allah will give you rewards

In teaching, I not only give knowledge to others, but I also develop my own knowledge, which is encouraged in Islam. Allah encourages Moslem to develop more knowledge and this is stated in different resources of Qur'an and Hadith. Therefore, Islam becomes a source of energy for my teaching.

Therefore knowledge follows faith (Hadith, narrated by Bukhari)

The Messenger of Allâh, peace and blessings of Allâh be on him, said:
The seeking of knowledge is obligatory upon every Muslim (Hadith, narrated by Anas)

And whoever is given knowledge is given indeed abundant wealth (Qur'an: 2:269)

Allâh will exalt those of you who believe and those who are given knowledge to high degrees" (Qur'an: 58:11)

There shall be no envy but (emulate) two: the person whom Allâh has given wealth and the power to spend it in the service of Truth, and the person whom Allâh has granted knowledge of things and he judges by it and teaches it (to others)." (Hadith, narrated by Abdullah ibn Mas'ud)

The Messenger of Allâh, peace and blessings of Allâh be on him, said: People are mines, like mines of gold and silver; the more excellent of them in the days of Ignorance are the more excellent of them in Islâm when they attain knowledge (Hadith narrated by Bukhari)

The Messenger of Allâh, peace and blessings of Allâh be on him, said: He who goes forth in search of knowledge is in the way of Allâh till he returns (Hadith, narrated by Anas)

There are three things that will be useful once we passed away

As a Moslem, I believe that there will be a day of judgement when I have to be responsible for my behaviour in this world. Then, I will leave everything that I have in this world, including my family, friends, and property. As a Moslem, I believe that I will not bring anything except three things (charity given to others, knowledge given to others, and my child's prayers) as stated in the Hadith below. Therefore, in

Islam, it is important to be good to others, teach others, and educate our children. Thus teaching is a powerful way to give knowledge to others and be true to Islam.

There are three things, however, which may continue to benefit a person after death: charity given during life which continues to help others, knowledge from which people continue to benefit, and a righteous child who prays for him or her (Hadith, narrated by Ibn Majah)

I shared my values and beliefs in relation to Islam in my teaching identity with my co-teacher in the Islamic school and she agreed with me, as per her statement below:

I believe religion is an important element in teaching identity, because if we are God-centred people, we will do our best because we know that God is watching us. So, every job, every career becomes something that will be accountable in the eyes of God. So, we don't work for money, but because that responsibility will be accounted for, not accountable in the eyes of human beings, students or parents, but in the eyes of God first, then that is the great accountability. So, God conscious people will do their very best, to fulfil this. God conscious teachers must be good teachers, because they must be "amanah" (keep their promises to do good things) for developing "umaah" (society) (Mrs. Emilia, Teacher Interview, October 14, 2011)

Therefore, I can see for me and my co-teacher as Moslems that Islam plays an important role in shaping our teaching identity.

The Picture of Islam in My Science Teaching

In this section, I provide the picture of Islam in my science teaching to understand how it has shaped my teaching identity. Based on personal experiences, I found ways to integrate Islam in my science teaching when I conducted co-teaching in the Islamic school. The story below is one of my experiences when I taught the science topic of diversity.

2010
I am a Co-teacher

Is This Important For Them?

Today, I come to the school with the great enthusiasm. I have already prepared a PowerPoint presentation for teaching biodiversity with interesting pictures of animals, plants, and other living things. I have also prepared a video by Harun Yahya on the Creation of different living things which relate to Allah as the creator. I come to the class and the students are ready to face the whiteboard. They look enthusiastic, since they are used to just summarising their textbook, listening to the teachers, and

answering questions. So, using the computer or experiencing a PowerPoint presentation is really exciting for them. After preparing the computer, I open the lesson with an introduction to the topics that we will learn this term (term 2). I explain that we will incorporate different ways of teaching within different topics to help their science learning. Their teacher also explains different assessments that we will use to help them reflect on their learning. After the introduction, I give them several pictures of different living things. All of them take the presentation seriously which didn't often happen during term 1, before I began co-teaching. I explain the characteristics of different living things, followed by detailed explanations from the teacher. The students ask questions because there are some animals that they never knew existed. The questions from the students keep coming until I put on the video by Harun Yahya.

Me : "Do you know Harun Yahya?"
Anisa : "I don't know"
Me : "He is concerned with the relation between Islam and science. You can have a look at his works on his website"

Aisyah : "Oh yeah, I think I know him, I watched some of his movies"

Me : "That's good Aisyah, we can watch it together now to relate our topic on diversity with Islam itself"

I play the video and the students watch intently. They see how Allah created the beautiful animals and plants and gave them the ability to survive. All the narration about science and living things in the video relates to what the Qur'an states. Then I stop the video to ask students' opinions.

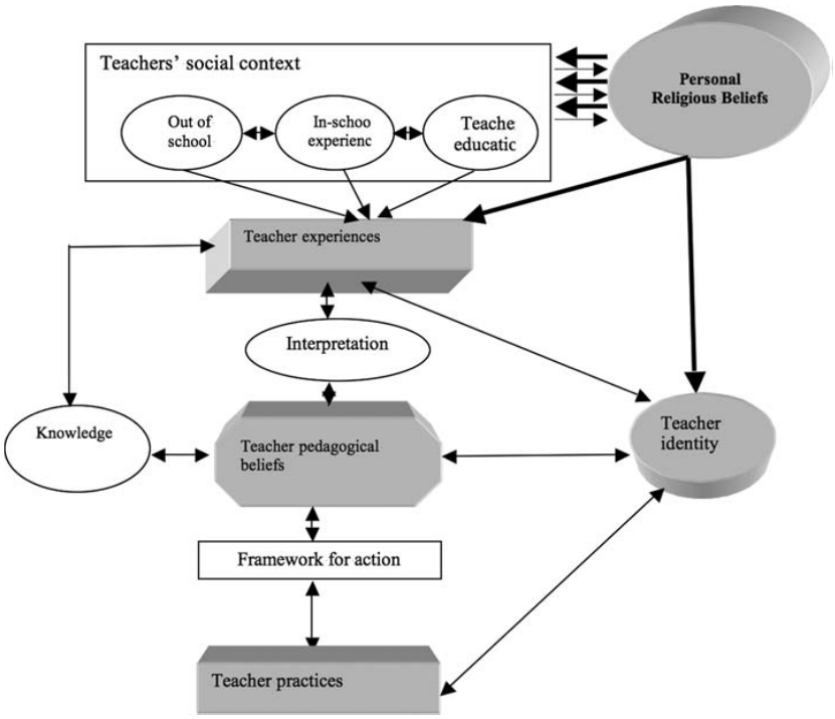
Me : "What do you think about the video?"
Anisa : "I think it's good; Allah creates beautiful living things"
Aisyah : "Yes, animals and other living things with the ability to survive"
Me : "Yes, Allah does. It is good isn't it? When we are learning science, we also learn about our religion"

Anisa : "Yes, I think so"

I am happy with students' responses, even though I keep questioning myself because most of the students are silent. Are they silent because they already know

about the relationship between Islam and science or they are silent because they understand? Compared to other Australian schools, the students in this Islamic school are considered passive students. The teacher has to encourage them to ask questions otherwise only two or three of the same students will ask or answer questions. I also keep questioning myself, is Islam useful in science teaching? Is it important for them to know about the relationship between science and Islam? Or is it just my own values about integrating Islam in my science teaching that are influencing my teaching decisions?

That was one of my experiences in integrating Islam in my teaching. Since becoming a science teacher I have felt compelled to integrate Islam into my teaching. Mansour (2009, p. 127) argues that "teachers' personal religious beliefs are among the major constructs that drive teachers' ways of thinking and interpretation of scientific issues related with religion". Mansour (2009, p. 132) also points out that "teachers with different views of the relationship between science and religion (conflict, dialogue, independence, integration), teach science by using different approaches that fit their views about science and religion". Mansour (2009) provides a model for the influence of teachers' personal religious beliefs which shape teaching experiences and teaching identity in relation to science and religion issues. He suggests that teachers need to create their own knowledge through the interaction of their existing beliefs and basic knowledge, and new ideas which could empower this practice.



Personal Religious Beliefs (PRB) Model (Mansour, 2009, p. 136)

Figure 15. Personal Religious Beliefs (PRB) Model

The opportunity to integrate science and religion was wide open when I had the opportunity to conduct co-teaching in the Islamic school. However, I questioned myself often -*is this important for the students?* Are they actually engaged in integrating Islam with science? Or do they just store it in their minds as information? I always think that if I am integrating Islam with science, students could have a deeper understanding of Islam as well as go deeper into their own faith. If they have a better understanding of Islam, they can then perform good things in life, which is Islam's way. However, I don't want them trapped them into rote learning the relationship between Islam and science. Integrating Islam with science teaching is about transformative learning, which should result in empowering learning experience. Thus, the students could be empowered to be good Moslems and good human beings.

The importance of integrating religion with science teaching is corroborated by my co-teacher in Islamic school:

In Islamic school integrating science and Islam is very useful, because students become more God-conscious and God-centred people. Once students become God-centred people, they will grow up to be civic minded people who have universal values, because no God-centred people misbehave people, (unlike) the uncivilised people who are not contributing to society and community rather they are civil people, they are polite people, because they are God-centred (Mrs. Emilia, Teacher Interview, October 14, 2011)

Therefore, both of us believe that Islam is a good way to educate our students within our science teaching by integrating Islamic values and beliefs with science. It is not only simply integrating the topics themselves, but the values and beliefs also. The students should have deep understandings that there is a power (God) that guides them in their way of thinking and their practices. I agree with my co-teacher -if the students have good faith in Islam, good understanding of values, beliefs, and practices in Islam, they will be a good and empowered future generation. In Islam, we are taught to always develop our knowledge, since Allah loves Moslems who develop their knowledge and Allah also gives rewards to those who develop their knowledge. These beliefs will lead students to always have the motivation to be lifelong learners. In Islam, we should respect teachers; it will lead students to appreciate and obey teachers' roles and they will manage their behaviour. In Islam, we believe that the best Moslems are the ones who can be useful to others which means those who can help others, make contributions to others, and participate in community or social activities that should lead students to be empowered future generations.

However, I can't ignore sometimes that there are misinterpretations of Islamic values, beliefs and practices, therefore as a teacher within my role, I need to develop a good understanding of Islam as part of my teaching identity. I knew I had been successful when during my co-teaching in the science classroom, one of my students actually stated the values and beliefs in Islam.

2010
I am a Co-teacher

Just Pray to Allah

I sit on the grass in the school gardens with my co-teacher, Ms Emilia, and the students who are seated in a circle. Today, we plan to conduct a dilemma story

teaching approach on climate change issues. The students look enthusiastic, not only because they are happy to have a different learning environment which is outside the classroom but also because we are using a different teaching approach -- dilemma story. I start by giving some guidance on how the dilemma story teaching approach will run. The students listen and focus on what I am saying and my co-teacher also gives some explanations of the purpose of the activity. My co-teacher asks the students to divide into 4 groups, but rather than us choosing them, we ask students to decide on their own groups. They spontaneously divide into two groups of female students and two groups of male students. I tell them that they don't have to work with the same gender, they can work in mixed groups. Then one of students says that they feel more comfortable working with the same gender. At this stage, I realise the influence of Islamic values and beliefs, in the sense that the students have been taught in their families and at school that they need to manage their interactions with the opposite gender. For example in classrooms, the students sit in different rows of female and male. Female students sit on the right side, and male students sit on the left side. Islam allows female and male interactions, especially in education, health, and other social activities, but there are still some requirements that they manage their interactions, such as, they are not allowed to have intimate relationship until they are married. Therefore, sometimes to create a healthy balance, my co-teacher and I require that the students work in mixed gender groups on other activities, such as laboratory activities. But for today, we decide to allow the students to choose their own groups. After the students have divided into the four groups, the teacher starts to read the first dilemma story of climate change (see Appendix 5) which has been developed by (Settlemaier, 2003)

Your family are farmers living in Western Australia's wheatbelt region. They currently grow cereal crops such as wheat and barley and also raise sheep for their wool. The closest town is Tammin which is 30 kms from your farm. Tammin is 300 kms from Perth. Your family has been here for four generations and the 'land' is in the blood. You would like to pass the farm onto your children when you retire.

1987
You are a teenager living on the Tammin farm with your parents and your brother and sister. Life on the farm is reasonably good, rainfall over the last few years has only been average but Dad and Mum have managed to make a profit each year by adopting new farming techniques. Dad is worried about 'the long dry spell' but is convinced that next year's rains will be better. You have just completed high school with a good academic record and have the opportunity to enrol at Muresk Agricultural School in Northam to learn more about farming. There is also the opportunity to pursue a university course in Perth which would lead to a career away from farming.

Q1. What do you decide is the best course for your future career?

The students listen to the story carefully. After they listen, they look at the worksheet and discuss ideas with the other students. Most students share their own opinion and as some are still learning to have opinion, some of them just listen. After discussing their opinions, they need to decide what their decision would be in this context and so they practice negotiating their ideas. The story keeps going and the students begin to face different dilemma situations, which they have to make decisions about, until the last story:

> You currently owe the bank $3 million for outstanding loans. Your farm and your farm machinery have been valued at $3.5 million by the bank though you believe it is worth a lot more. Your income last year was less than $150,000. Your total expenditure, including school fees, last year was more than $300,000. You made a net loss of $150,000 and were not able to make any repayments to the bank. Your plantation trees have not grown as fast as they were meant to and cannot be harvested for another five years. You have been able to collect some eucalyptus oil this year and hope to be able to double your production next year for which you expect to be paid approximately $100,000. You will have to borrow another $150,000 for stockfeed and water this year if you don't receive substantial rains in August. Your bank Manager has indicated that he will provide you a further $150,000 but he has stated that this will be the final loan as your total debt is now approaching the sale value of your farm. The bank Manager has also stated that he will have to sell your farm to clear your loan if you are not able to meet your monthly repayments. You have considered the selling the farm now and moving to Perth and getting a normal job. You know that if you sold the farm now you would have enough money to buy a comfortable house. Being with your children is also attractive as is saving nearly $30,000 in boarding schools fees. You know that if you wait another year and it doesn't rain your then decide to sell the farm you will only receive enough to pay off your debts. You will have nothing left.

(Settlemaier, 2003)

The students I have been observing directly look confused; they keep discussing their opinions, but they are finding it difficult to make decisions in this situation. I look at a different group of students who keep talking to each other. I am happy as they look engaged in the activity, until one student from a male group raises his hand.

Ahmad: Sister Yuli, can we just say "Pray to Allah"? Because may be when we pray to Allah, Allah could give us the rain and the way to solve our problems.

Other students laugh and my co-teacher and I smile.

Me : "I agree with you Ahmad, prayer is important, but we need to try first, and pray, then let Allah decide the best things for our life. So the most important thing is we have to keep trying and do our best. Imagine in real situation, what would you do if this dilemma was real?"

Ahmad : "I just would like to sell the farm"
Me : "Well, you can discuss that with your group then"
Ahmad : "Ok"

After the students of each group shares their opinions, we finish up the activities as we have run out time. We plan to discuss and debrief the activity in the next lesson.

This is one example from my co-teaching where I can see how Islamic values and beliefs are integrated in our students' thinking and practices no matter what topic is being taught. I am empowered to integrate Islam in my science teaching, however I need to realise that my students also have their own understanding of Islam which influences the way they interpret Islam in my science teaching. According to Reiss (2007, p. 135), "Science educators and teachers need to take account of religious worldviews if some students are better to understand the compass of scientific thinking and some of science's key conclusions". Thus, it is important for science teachers to be respectful of their students' worldviews, including in relation to religion. My students and I shared the same foundational values, beliefs, and practices as I described before. We agree that we need to be good Moslems within our different roles in life, because we would like get Allah's blessing. Once Allah blesses a Moslem, we believe that Allah will give more of his love which motivates us to keep persevering within life's various problems.

Finally, I realise that there are critics of this relationship between science and Islam in regard to different people's interpretations of the holy texts. People think that there is not a singular truth from Islam, but rather different Moslems' interpretation of the Qur'an and Hadith. I can't ignore this view, however, I am compelled to believe in Allah and the Prophet. There is a wisdom that always evokes me to acknowledge Islam as my way of life; there is a soul that always calls me to bring Islam into my teaching. I can't describe this power; I just feel it as a part of myself and my teaching identity.

CHAPTER SUMMARY

This chapter has invoked my spirituality, as I was born as a Moslem and it seems that there is no reason to reject the truth in Islam. When I was growing up, I had my own understanding of why I chose Islam and why I believed in Islam. During my writing, I have felt the importance of understanding the truths in my religion; it has not only given me a deeper understanding of my religion, but it also has given me the opportunity to explore and reveal my religious identity within my science teaching. At this stage, I could say that Islam plays an important role in my teaching identity and I believe also in other teachers' teaching identities. I have come to realise that Islam not only provides the values and practices that shape my teaching identity, but also the energy and power that guide me to stay on my pathway of being a good and professional teacher. I believe that for all Moslem teachers, when they become religious-centred teachers in any field of teaching, they will perform their best teaching in their pedagogical practices, because they believe that God loves His humankind to be useful and kind to others, to share their knowledge, and to educate good people for a better future for the world.

CHAPTER 7

IN THE CLOUD OF EMPOWERMENT AND DISEMPOWERMENT: TRANSFORMATIVE LEARNING IN MY TEACHING IDENTITY

INTRODUCTION

In this chapter I explore other important elements that have contributed to my emerging teaching identity during my transformative learning journey at SMEC. My personal experiences in transformative learning during my postgraduate studies have been empowering and engaging, which I realise have become part of my teaching values, beliefs, and practices, especially when I conducted co-teaching. These transformative learning values also were reconceptualised throughout the journey. I begin my reflections with a short story about my first class in the Master's Research Project unit in 2007 when I tried to make sense of 'what is transformative learning?' 'What is the importance of transformative learning? It was in this first class that I realised my journey will be challenging.

2007
I am a Master's Degree Student

The Butterfly

Peter began the lesson in the first Research Project Unit class with a colourful PowerPoint presentation. I noticed a symbol on the corner of his presentation, it looked like a butterfly, but why did he include that symbol on every slide, does it have a special meaning? He points out the word "transformation, transformative" many times. What's the power of that word? When he asks for my opinion, I say it is about change. He looks as though he does not really agree, he tells us that it is not simply changing; rather it is critical, personal, and practical perspectives. Oh No.., once again I have found the word 'critical'. Since I came to SMEC, most of the lecturers point out the term critical

which I find quite challenging as I never used to think critically. I am beginning to feel confused and am struggling with the different meanings of the words: critical, practical, and transformative. I keep trying to understand Peter's presentation; his language is really philosophical and needs in-depth thinking to understand it. Oh, I think I am wrong, this class is not what I had expected. I thought the first day would be about educational research, research methods, quantitative and qualitative. I keep questioning myself about the lesson. What is this journey about? Is transformation important? My thoughts were floating, that's when I realise that I will be struggling in this unit.

That was my experience in the first meeting of the project class which left me floating above the ground. I learnt that the term transformative does not simply refer to change as not all changes are transformative (Grabove, 1997). I challenged myself, 'Let's see what you can gain from this transformative learning'. During my journey at SMEC, I came to realise the power of transformative learning theory for empowering myself and other SMEC students. I started to change my way of thinking by adopting new perspectives on teaching and learning, and conducting educational research.

As the purpose of this chapter is to explore the landscape of my transformative learning, I have divided the chapter into two main sections:

1. **The Wave of Transformative Learning in My Teaching Identity**. In this section, I reflect on my journey in transformative learning during my master's and doctoral studies, as well as my co-teaching in the ARC project. This journey made me realise the power of transformative learning which has been gradually integrated and reconceptualised into my teaching identity
2. **The Three Main Values of Transformative Learning Theory in My Teaching Identity.** In this section I portray three values of transformative learning theory which I have embraced; 1) Constructivism as a referent, 2) Empowering teacher-student relationships, and 3) Dialectical thinking. I explore these three values in detail in each section.

THE WAVE OF TRANSFORMATIVE LEARNING IN MY TEACHING IDENTITY

My learning experience from the transformative learning process in Peter's research project class motivated me to think critically and reflectively about myself, and caused me to re-envision my future life, especially my pedagogical practice. According to Mezirow (1997, p. 5), "transformative learning is the process of effecting change in one's frame of reference. These references of associations, concepts, values, feelings, and conditioned responses help us to understand our experiences and define our world. In learning, students should have opportunities to negotiate and think critically on their own experiences, values, meaning, and purposes (Garbove, 1997). Mezirow (1997) points out that to facilitate transformative learning, educators need to help learners to become aware of their own and others' assumptions. Teaching methods could include critical incidents, metaphor analysis, concept mapping, consciousness raising, stories, repertory grids, and participation in social action (Mezirow, Taylor & Associates, 2009). Taylor (2008) states that, from a psychoanalytical view, transformative learning is a lifelong journey for individuals to reveal their identity by understanding themselves through reflections on their psychological structures (ego, shadow, personal, collective unconscious, and so on). Therefore, in transformative learning, learners would have more understanding of their own identity within different roles in their own life.

As a science teacher and educator, I hope that my student teachers will have the same experiences as me in transformative learning which are both engaging and empowering. Even though self-critical reflection is the nature of transformative learning, I have to be aware that not all critical reflections necessarily lead to transformative learning (Grabove, 1997). According to Taylor (2008), the central aim of critical reflection in transformative learning is developing students' awareness of their agency to transform society and their lives. This view stimulates me to empower my student teachers, not simply to become chemistry teachers, but empowered chemistry teachers who are aware of their agency to change society and who can empower their own students to do the same. Thus, I have realised the importance of internalising transformative learning in myself as a science educator. Even though I struggled during the time that I conducted co-teaching with other

science teachers, I found transformative learning theory was becoming a part of my teaching identity.

The story below is one of the experiences I had when I discussed a teaching plan with one of my co-teachers, which helped me to identify the value of transformative learning in my evolving teaching identity.

2010
Co-teaching: Planning the Lesson

The Timeline

I am driving in my car along Leach Highway, as I gaze over at the Canning River with its beautiful scenery. Again, I am feeling happy that I can breathe in the fresh air and see the clean and beautiful river. I let out a sigh, as soon as I am thinking about my own country, I feel miserable; when can I feel this happiness looking at the rivers and beautiful scenery in my home country? I look at the time; it is now 10 minutes before my appointment with Emilia, who is one of the science teachers I am working with. We agreed that during the school holidays we would arrange a time to discuss the lesson plan for the next term. I really enjoy working with her, she is a science teacher with a passion to improve her teaching practice. Finally, I reach her home, and she greets me with a beautiful smile, she says Salam.

Mrs. Emilia : "Assalamu'alaikum Yuli? How are you? Please come in"

Me : "Wa'alaikumussalam, Alhamdulillah, I am fine, how are you?"

Mrs Emilia : "Alhamdulillah, I am good"

I go inside her house and sit on the comfortable sofa. I look over at the table and notice she has already prepared the science books and the timeline. She asks me to have a drink before we start the discussion. After taking a breath and as we are starting to enjoy the conversation, we start to discuss the lesson plan.

Mrs Emilia : "Yuli, for the next term, it will be 9 weeks, and we still have many topics to cover. I am not satisfied with the Chemistry topics last semester, we didn't cover all topics"

Me : "I agree with you, we have a problem with limited time. I understand that we need to cover the topics, but I think it is much better to focus more on students' engagement and understanding than on covering all topics"

Mrs Emilia : "Yeah, we really have a problem with improving students' understanding, they don't show much motivation for learning"

Me : "Yes, do you remember how we kept trying to stimulate students' understanding of their previous knowledge before we helped them develop new knowledge? We need to relate it to their experiences"

Mrs Emilia : "Yes, and that really takes time"

Me : "I agree, but it is important rather than asking them to simply memorize the facts; they should understand"

Mrs Emilia : " Yes, I agree with you, let's start arranging the lesson plan"

We continue planning the learning activities, we not only discuss the topics but also the teaching methods that can engage the students and improve their understanding.

Through this story, I have realised how I was struggling to incorporate my values and beliefs in transformative learning into my co-teaching. Even though my co-teacher and I didn't focus much on students' empowerment in relation to their roles in society, we tried to incorporate the idea of students' engagement in our teaching. This story is only one small critical incident of how my values and beliefs were challenged while co-teaching. I could feel the power of traditional learning theory in my teaching practice. However, co-teaching was an important journey for me to develop further my teaching identity, especially with the value of transformative learning which I explore in further detail throughout this chapter.

Since then, I have discovered three views that I have been integrating progressively into my teaching identity that are part of transformative teaching learning: constructivism as a referent, empowering teacher-student relationships, and dialectical thinking. These perspectives have been helping me to develop the habit of fostering self-critical reflection amongst my students for the purpose of enabling them to make sense of their experiences and understand themselves as agents of change.

THE THREE MAIN VALUES OF TRANSFORMATIVE LEARNING THEORY IN MY TEACHING IDENTITY

The Lens of Constructivism in My Teaching Identity

I have divided this section into two reflections: on constructivism as a theory of learning and on constructivism as a referent.

My reflections on constructivism as a theory of learning

2002
Teacher Education Programme

Constructivism is Powerful, But….

I am running fast up the stairs. I have to arrive in class within five minutes. With my breathing at a hurried pace, I reach the classroom. My Learning Theory unit lecturer is already in the classroom, but the lesson has not started yet. After finding a seat, I prepare my notebook, because I know I have to write down everything that my lecturer says. I always have to write down everything he covers in his lectures, because his explanations are always checked in our tests. As my breathing goes back to a calmer pace and after I've had a drink of water, I begin to watch him. He starts the lesson with an introduction to different learning theories by using an overhead presentation. He then explains the different learning theories from behaviourism, cognitivism, and constructivism. He conducts the lesson by evaluating the strengths and weaknesses of each learning theory. I continue to take notes while he is talking. The students are busy copying notes from the overhead transparencies as well as from his explanations. He often points out the power of constructivism as a learning theory, but that it is challenging for teachers in Indonesia to implement due to the large classroom numbers and they are overloaded with curriculum. I sit in his class analysing what he is saying, and the situation we are in. I notice myself becoming increasingly interested in his explanations on constructivism, but because he is using a common lecture teaching method almost always during his classes, it sounds very monotone and I start to feel sleepy and uninterested. He only tests for our ability to memorize the content, so as long as I remember his explanations I will pass the test. I go deep into my thinking; if he teaches us that constructivism is powerful, why does he always teach us using the lecture method? Why doesn't he implement constructivism in his own classroom?

The story above is a recollection of my personal experience in teacher education, and it was the first time that I learned about constructivism as a learning theory. My lecturer introduced constructivism as a powerful learning theory for students' learning and teaching practices. However, for me it was only a theory of learning without any real meaning. The main aim of my study was passing the tests and getting good marks. Therefore, I had never really thought much about how my own learning experiences in learning theory could be applied to my teaching once I graduated from teacher education. After constructivism as a learning theory was introduced, the researchers in my university always emphasised the use of constructivism. It was not simply because we recognised the power of this theory, but also because the government provided grants for focusing on constructivist research topics. However, the lecturers as well as the student teachers rarely implemented constructivism in their teaching. As a result, constructivism remained only a powerful theory without high levels of engagement.

During my teacher education program, constructivism became only a theory of learning that we need to know, not a process that we need to implement. I realised how dominant was the memorising of pedagogical knowledge theory in my teacher education.

As mentioned before, I came to realise how my teacher education program was only a list of theories about teaching without any transfer or implementation of what I had learnt in my own teaching practice. I realised how powerful the memorisation of facts was in my teacher education. I understand that pedagogical knowledge and skills are important in teacher education; however I believe that it is very most important to educate teachers to love for and have passion in their teaching. I am not sure that by just memorising the facts teaching knowledge and skills can be deeply incorporated by student teachers. I was not surprised to realise that my journey as a beginning teacher was shaped by traditional learning theory.

My simple understanding of constructivism, which I explored in Chapter 3, was that constructivism is a theory of learning that compromises into personal, social and radical perspectives. In relation to personal constructivism, I used to believe that I must change students' misconceptions through exploring their initial understandings. Their understanding must be changed into the truth of scientific knowledge. Meanwhile, I simply understood that social constructivism involves engaging

students through collaborative work with their peers in the classroom. I had never thought that there is a fundamental underlying reason related to the socially constructed nature of scientific knowledge itself (and other knowledge, too). Moreover, even though I applied cooperative learning, I was still overruling my students' thinking in order to ensure immediate conceptual changes. When I reflect on my experiences, I can see that I was very impatient throughout the process. I used to 'force' the students to get the 'correct' answer conveniently, without giving them much opportunity to put in the effort, by just providing them with 'the food' rather than guidance about 'the way to get the food'.

In addition, I never thought that the learning process would be so complex. However, as Driver, et al. (1994) pointed out, there are no simple rules of teaching. Therefore, I am beginning to realise that my essential role is to become a mediator, in order to introduce my students to the cultural aspects of the learning process. Furthermore, I agree that it is difficult to learn without social interactions, because from birth an individual requires social interactions to learn from adults and their surrounding community. Reflecting on my teaching, I then question why I pushed my students to be passive learners to receive 'the transferring file' from my mind while ignoring their daily activities and social processes.

According to Oser (1994, p. 59), even when teachers know that social learning is an important goal they also feel responsible for a certain amount of content that should be learned, and so they sense a conflict. Students may believe that direct teaching is more valuable than group work; thus, they sometimes internally resist group work as a method even when consciously accepting the fact that communication and cooperation are more important in adult life than is information. I believe that any single teaching act undertaken in the classroom or in any teaching setting has a moral core. The unit of analysis is the decision a teacher makes to help students learn, communicate, share, reflect, evaluate, and so forth. Teaching responsibility is a moral motivation concerning any concrete teaching act (Oser, 1994, p. 59). Furthermore, I realise that conceptual change is popular because many believe that the primary goal of science education is to achieve the 'single absolute truth' of scientific knowledge. This is reinforced by standardized assessment which requires

only right or wrong answers. Thus, I have realised how my past naive ‘constructivist’ science teaching had focused narrowly on conceptual change.

Recently, radical constructivism is a perspective that has challenged me to reconsider the concept of the ‘truth’. To understand this concept I found that I have to shift (again) my concepts of misconceptions, objectivity, observable, measurable, and acceptable scientific concepts. As a science educator, I used to think that there are only wrong and right concepts. This is because of the dominance of objectivity and measurable which dominated my learning of science. I had never considered that the colour ‘red’ in my mind could be a different colour in someone else’s mind. I had never considered that the process of seeking knowledge could come problematic. The other interesting point that I found is that teachers’ beliefs, knowledge and personal experiences about subject matter are important. This helped me realise that I had tried to ‘force’ my students to adopt the same beliefs and knowledge as mine. Now, I recognise the different levels of conceptions in my students’ minds because of the notion of cognitive process.

In implementing constructivism, not only in my past science teaching (in Chapter 4.) but also during co-teaching, I worked to create meaningful learning experiences for my students. We (the teachers and I) developed various teaching methods to engage the students, and diverse ways to assess students’ learning. For example, in the past, one of my co-teachers assessed students’ performance in the laboratory only by theoretical assessment, so we developed integrated practical assessment which provided opportunity for the students to perform their ability in various ways. We could see that the students learned in different ways, and that some students performed better in laboratory practicals than in theoretical assessment, which helped them to improve their science engagement. In co-teaching, I had to make sure that all students have equal opportunities for developing their knowledge. I could say that using constructivism helped me to engage with the students.

Coteaching benefits me greatly which is able to optimise each other's strengths in delivering lesson
(Emilia, teacher interview, October 4, 2010)

I discovered that my attitude to teaching has changed a bit. In my discussion with you, I gained an insight into what the students were expecting, and that was very helpful to me. This helped me to improvise and change my teaching style to accommodate the needs of my students
(Tina, teacher interview, November 7, 2010)

I think that since you came to help our teacher, I have become more engaged in the science classroom and I enjoy the different activities we do. I also think that the students in my classroom are more interested in Science and experiments than they were before. I also think that they are more engaged in the lesson and are eager to learn when the lesson is presented in a fun way
(Student interview, September 23, 2010)

Thus, I can now feel how the value of meaning making, which is central to constructivism, has become integral to my teaching identity. But it is not easy to implement. Every time I talked to my co-teachers they would always say that to implement constructivism takes a great deal of time and energy, especially in the context of large classrooms and rigid curricula. These common teachers' perceptions are the main reason that constructivism is less applicable in the science classroom in my home country. However, I have found that the idea of constructivism as 'a referent' has helped me to reconceptualise the problem of implementing constructivism. I explore this in the next section.

Constructivism as a referent within my dilemma

As I have explored above, it can be very challenging to fully implement constructivism in the science classroom, especially in the education system in my home country. Indonesian teachers often find the large number of students, limited time within the rigid curriculum, and the national assessment discourage them from implementing constructivism in their schools. The teachers often say that the implementation of constructivism in their classrooms is very difficult, almost impossible. Therefore, I agree with Milne and Taylor (1998, p. 1) that science educators have the enthusiasm to implement constructivist-based teaching to improve students' learning, however teachers face difficulties of implementation in which can be understood if "school science is viewed as a cultural activity which is constrained by powerful and ubiquitous cultural myths". Milne and Taylor (1998, pp. 6-14) pointed out three powerful cultural myths

governing traditional science classrooms which disempower teachers from changing their practices:

1. Science cultural myth of naive realism in which our observations of reality correspond exactly to an external reality
2. Science cultural myth of scientific facts in which scientific facts do not depend on reason or opinion, have ethical as well as intellectual status, and a certainty not possessed by scientific theories
3. Science cultural myth of language in which the language used to describe the outcomes of an experimental activity should be plain and simple, and free of figures of speech

Milne and Taylor (1998, p. 20) argued that "constructivism has been partially successful in contesting some pedagogical myths (e.g., transmissionism) which underpin the apparent naturalness of unilateral teacher control of the learning environment; but it has lacked the conceptual power to contest the ontological and methodological dimensions of these myths. Thus, I realise that many innovative teachers revert to traditional theories of learning even though they may be aware of the power of constructivist theory. However, when I found an article by Tobin and Tippins (1993) that proposes the notion of constructivism as 'a referent', based on an idea developed by Wheatley (1991), I could see a light that could possibly solve this dilemma. Constructivism as a referent, as opposed to a totalising framework (or ideology), helps to analyse the 'learning potential' in different situations, even within teacher-centred or large classrooms (Tobin & Tippins, 1993).

Tobin and Tippins (1993) identified several basic principles as guidance for science teachers to apply constructivism in different situations. Learners need opportunities to make sense of science through "an existing conceptual structure" which involves dialectical practice in both content and process.

According to Fox (2001), science knowledge is largely based on social construction, but individuals may generate their own science knowledge through their own experiences. However, in making sense of experience, I had never realised that the role of language and representation is particularly important, since human minds are

shaped by language. Therefore, the representation of science in the classroom is important for engaging students in their learning. I realise that I need to be aware that the teacher's role as mediator of learning involves two critical components: (1) monitoring students' learning and (2) providing constraints to guide students' thinking in productive directions. This doesn't mean that students don't have opportunities to explore their own understanding, but carefully crafted pedagogical constraints will help them develop in-depth understanding. I have found that an important constructivist view is that teachers should make sure that all students have equal opportunities for enhancing their own learning. Therefore, understanding the character of each student's learning is important for providing a 'solid base' for learning and understanding that can be applied in different situations.

Constructivism as a referent helps me to understand that constructivism can be applied in any difficult situation, such as in big classes or teacher-centred classrooms

I used to blame the conditions in my country, where the teaching is mostly shaped by the lecture method, since there are very big large classes. The idea of constructivism as a referent helps me to understand that constructivism could be applied in these conditions. I can identify with how I could give my student teachers the opportunity to express their own meanings/prior knowledge and negotiate those meanings socially within the learning process. As a result, they would become more aware of their own thinking, learn to be aware of others' thinking, and learn to appreciate and negotiate with different ways of thinking. I agree with the ideas of Tobin and Tippins on the view that making sense involves a dialectical process of both content and process, which I can relate to as I always reflect on the competition between the content of chemistry knowledge and pedagogical skills for my student teachers. I realise that rather than thinking about this as a competition, it is better to consider the two as being complementary to each other. Because, it is important for my student teachers to have in-depth understanding in chemistry content as well as the pedagogical skills for representing chemistry in the classroom. Accordingly, constructivism as a referent could be considered as a solution for the problems related to curriculum, assessment and research in education. Constructivism as a referent provides learners with a way to assume more control of their own learning and empowers teachers to think about curriculum

reform. Teachers could think about assessment as a student motivator, assessment as 'the window' into students' knowledge. Thus, different approaches to assessment can be applied to both support and evaluate student learning.

Moreover, in research on education I have come to appreciate how postmodernism is part of applying constructivism as a referent in which personal voice and experience are important data for research on improving the education process. It reminds me of research studies in my university which explored constructivism in the classroom, but by comparing under a positivist paradigm, traditional teaching methods and constructivist methods. This type of research is largely meaningless since the result is expected to be that constructivism is better than the traditional approach, without a meaningful understanding of constructivism as a referent for thinking about all forms of teaching and learning along the continuing of student-centred to teacher-centred.

Although I have become aware of the potential power of constructivist theory as a referent for transforming the science classroom, when I conducted co-teaching I often found myself trapped in the power of objectivism, rationalism, cold reason, and hard control (Taylor, 1996). Taylor (1996) refers to practices a being governed by these as the myth of cold reason and hard control which are mostly applied in teaching and learning science. He pointed out, there are two conditions which lead to the cold reason myth shaping classroom are the absence of: (1) a sense of the socio-cultural, and (2) the uncertainty of knowledge. The pedagogical implications of this myth lead to the belief in the certainty of scientific knowledge. As a result, students must have the correct answers for problems. Teachers who hold this myth will only focus on students' achievement, since it is considered as the goal of 'successful' learning and teaching. As a result, science as a subject matter used to be considered as the knowledge that is not applicable in daily lives. If this myth shapes learning process in the classroom, the relevance of scientific knowledge to the outside world will be considered as an 'extra issues', not as a potentially motivating solution for engaging students. Thus, the myth of cold reason restraint the enculturation process in the classroom because there are no opportunities for students to construct or make sense of their own cultural identity. Meanwhile, the myth of hard control influences teachers' role as curriculum deliverer which seems to have "absolute" power to

control the classroom and leads to students as passive learners. Thus students have less opportunity to express their voice and less power to determine their own learning. Learning becomes culture reproducing rather than challenging of students' knowledge.

During co-teaching, I became aware of how my valuing of strong teacher control still had significant power over my teaching identity and I became aware that I still applied the language of 'transferring' knowledge. I realised more than ever that this traditional way of teaching restricts students' thinking development, restrains their creativity, and separate their experiences from the learning process. I realised that it was not only me focusing on students' achievement during co-teaching, but also the students. It seems that getting a 'good mark' was everything, both for me and the students, as one of the students stated:

> *Since you have come to our class, we had done more experiments and class discussions like we wanted…My scores have really improved, I usually use to always get below the 60s but now I get above it, that's a major improvement*
> *(Student interview, October 10, 2010)*

The idea of achieving good marks in science as an indicator of a high standard of teaching led me and my co-teachers to focus on students' science scores to enable them to pass the exam. I was aware, however, that if I focused solely on this particular aspect, the effects would be detrimental to students' learning. I reflected on my experiences both as a learner and a teacher. As a learner, I used to view my teachers as "heroic individuals" (Taylor, 1996), as the ones who had power to make decisions on my learning process as well as provide the absolute truth of knowledge. As a teacher, I also used to consider myself as the one whose role was to control the classroom, so, facing passive learners was a common occurrence in my classroom. I became the exemplar of my teachers who once played the role as controller.

However, I continued learning to internalize the values of constructivism in my teaching identity; because I knew that I would potentially face more challenging situations in my home country. Again, I constantly reminded myself that constructivism is not simply a theory of learning, that it is also not simply a teaching

method, but is a referent to guide my view of teaching and learning, and to guide me as an individual to construct my teaching identity in a journey of becoming a transformative educator. The poem below represents my journey in the wave of constructivism.

They said….

Teachers said..
Constructivism is powerful
Constructivism is engaging
Constructivism is contextualizing
Constructivism is empowering

But, they also said…
Constructivism is difficult in big classes
Constructivism is not easy within limited time
Constructivism is almost impossible under the text-based curriculum
Constructivism will be useless under the standardized assessments

Students said…
Constructivism is challenging
Constructivism is engaging
Constructivism is collaborating
Constructivism is empowering

But they also said…
Constructivism is difficult in traditional learning
Constructivism is time consuming within overloaded topics
Constructivism is not easy for us as passive learners
Constructivism is not related with our exams

I say…
Constructivism is not simply a method of teaching..
It's a world view, it's a referent
Seeking meaning and understanding
Constructing, negotiating, and empowering
It's possible for big classes and limited time
It's not impossible for standardized curriculum, and assessment

Because it is the way….
To engage students in making sense of their experiential world
To help students cross the border
To help student to understand their own meaning
To empower students to reflect on their own understanding
Within the traps of teacher-centeredness, behaviorism, and objectivism
Within any situation and limitation
Let's shift our paradigm…

Empowering Teacher-Student Interactions: Emancipatory Ethic and Ethic of Care in My Teaching Identity

The lens of emancipatory ethic in my teaching identity

The crisis we face is foremost a crisis of mind, perception and value
(David Orr)

Ever since I commenced studies in my earlier master degree, I have endeavoured to create empowering teacher-student relationships. Previously, I had never thought about how education could empower my students. I simply believed in the high level of educational goals in my classroom for improving students' understanding. Even though the aim of my national education system is to educate holistic individuals, when it comes to classroom practice I had never put much thought into such an issue. Therefore, I was not surprised when I realised that education system in my country is failing to empower students as agents who can participate in aiming for a better future of the country. When I came across the ideas of an 'emancipatory ethic' and 'ethic of care', I could see how they would be able to help me to develop more empowering teacher-student relationships. I only come to realise the power of education in students' empowerment when I studied in Australia, I became empowered to integrate these values into my practice when I conducted co-teaching with my co-teachers.

In my experience, I found it difficult to shift my paradigm from a traditional to a transformative view, but an emancipatory ethic and an ethic of care profoundly helped me to overcome such constraints. The short vignette below represents my feelings during my empowering learning experiences.

Empathy while Empowering…

I feel uncomfortable if every time he asks to me think about the problems in my country, to reflect on my pedagogical practices, to think about my students' learning. I feel really miserable if I think about how complicated the problems were, how meaningless my teaching was, and how passive my students had been. On the contrary, I feel happy when he asks me to imagine my future country, my education, my teaching, and my students. I am excited when he encourages me to envision my

utopic world, my envisioned curriculum, pedagogical practices, and students. I feel empowered despite the problems which currently exist, and disempowering realities. Within my limitations, he understands. During my struggle, he is empathetic. Within my problems, he is willing to listen. And in my happiness and sadness, my health and sickness, my empowering and disempowering situations, he is there. My empowering and emancipatory teacher, Peter….

> It is difficult for me to think critically and express my concerns. Sometimes, I feel uncomfortable with this type of learning, and I think about how that could also be experienced by my students.

The learning experiences with Peter have provided great opportunity for me not only to grasp the concepts of transformative learning, but also to empower myself to become an agent of change for my society. According to Taylor and Williams (1992, p. 4) on Habermas's work, "there is the idea of the ideal speech situation as an environment for empowerment and an opportunity for truth, justice and freedom-ideals which constitute the cornerstones of his societal model of the *good life*". Taylor (1992, p. 6) points out that "emancipation commences with *enlightenment* about the nature of ideological distortion, and continues with political action aimed at reforming the social structures that constrain the emancipatory of teachers and students". Communicative relationships need to be valued in order to achieve those goals [which] will create achieving mutual and reciprocal understanding (Taylor, 1996). This emancipatory ethic could be shaped by establishing a communicative classroom environment and critical discourse opportunities. An emancipatory ethic promotes students' engagement through critical discourse which involves: (1) teacher-students negotiating to control the learning experiences (planning, assessment, etc), and (2) students' having opportunities to express a critical voice and equality to learn (Taylor, 1992). However, I am aware that this critical discourse can also be a "two-edged sword". Although I will try to enhance students' learning, it might negatively affect the learning of those who find comfort in the realms of objectivist epistemology. My students will most likely resist change and prefer to be passive learners. Moreover, students who were once familiar with the 'normal' teaching and learning situation, where the teacher is in control and students are passive receivers, as a result, could behave uncontrollably. In Dawson and Taylor's (1990) paper, Dawson created learning experiences to engage students in open and critical

discourse. She designed learning activities to provide opportunities for classroom debate and discussion. This type of learning activity requires students to be active participants, to engage and be responsible for their learning. It was a positive challenge for some learners who were willing to move out of their 'comfort zone'. But, for others it became a problem, since they viewed learning as a 'transferring' process. Thus, it is important for teachers (especially transformative teachers) who are willing to apply new strategies to realise that some students could lack willingness to engage in the process. Although Dawson students realised the value of the activities, but some felt that it lacked relevance to their science learning. As a result, they were unwilling to engage in the learning activity. Social constructivism requires students' engagement through collaborative learning. Therefore, it is important for students to understand their own leaning process, especially their own knowledge of the world which is based on their experiences. Dawson also taught students to realize and respect o students' different ideas, although they might be difficult to accept. People tend to be happy a sense of being superior. For in applying constructivism, it is not only shifting paradigms for teachers but also for students, from passive to active learners.

2004
Chemistry Classroom, Vocational School

I've Never Seen a Classroom as Noisy as Yours

I come to the class with a bright smile, I am happy because this class has shown small but positive change in their behaviour. Today, I plan to discuss the negative effects of drinking alcohol. Most of the students in this classroom are alcohol drinkers and drug users; therefore, it is very challenging to engage them in learning, especially given that my major subject in Chemistry is considered a minor subject in this vocational school. During the lesson, most of the students are sleeping, playing around, talking to each other, and even fighting. Another problem is that they are very passive learners, those who behave well would most likely keep quiet throughout the lesson. I persist in trying to structure the chemistry lesson so as it can be related to their own experiences. Therefore, I prepare a discussion on alcohol in relation to the topic of alcohol as an organic compound. I begin the lesson with a short and simple overview of these organic compounds. I make it short and simple

because I know they will show signs of sleepiness and boredom if I keep talking. Therefore, I ask them to work in small groups.

Me : "Ok, now we will work in groups to discuss the examples of alcohol compounds"

Andri : "Why should we be in groups?"

Me : "You will learn to share the ideas with your friends"

Andri : "We never do group work in our classroom, except in practical room, how can we do it?"

Me : "I will arrange it for you"

I am not surprised that students are confused when I ask them to work in groups, since most of their teachers in this school only teach by lecture and chalkboard to deliver the lesson. They have had group work before but only when they have had practical tasks in the workshop. This is a vocational school whose focus is to equip students to become electricians, mechanics, and builders. Therefore, the practical lessons are the main subjects and the students are engaged in the practicum. After arranging the chairs and the students' sitting places, I divide them into 7 groups of 5 students each. I begin distributing the article on alcohol and give a short explanation of the implications for their body.

Me : "Now, each of you can discuss the ideas in the articles, as well as identify the alcohol classifications in your articles"

Deni : "So, we need to summarize the article"

Me : "Yes, please"

They start working, most of them are enjoying the discussion, even though I notice some are just playing, but I can see the changes instantly. They seem to be engaging with one another in group discussions. The class is quite noisy as the students continue discussing their ideas. I then begin exploring their ideas; the class is getting noisier because each group is presenting their idea, which has never happened before. If the students are noisy, it is usually because they are playing or fighting.

Me : "Now, let's discuss the negative effects of alcohol to begin with. When alcohol is metabolized in our body, oxidation occurs. As we have learnt, alcohol oxidation becomes aldehyde. This process takes place in the liver, in order to detoxify the alcohol. The accumulation of alcohol can destroy the cells and body organs"

Anton : *"So, it is not dangerous, is it? Since it is detoxified by our body?"*

Me : *"Yes, but our liver can only detoxify a limited amount of alcohol. For example, a maximum 12 ounces of beer and 6 ounces of wine 30-90 minutes after you have stopped drinking. However, it depends on the amount of enzymes in the liver which is different for each individual. Can you control yourself when you are drinking?"*

Dodi : *"No, we just keep drinking until we are drunk, we just enjoy it"*

Me : *"Yes, and that is the danger. I think that all of you already realise that when you are drunk, you aren't aware of what you are doing. Then, if the liver can't detoxify it, the alcohol will stay in your bloodstream. What other effects could be happening that you can think about?"*

Dedi : *"Islam does not allow it and our parents and neighbours also don't like it. I remember when I was once drunk, I kept talking about bad things and disturbed others"*

Me : *"Yes, please think about it before you want to continue this habit"*

So we continue to discuss the effects of alcohol, until the classroom becomes quite noisy again. I enjoy the discussions and am pleased to see their engagement in the lesson today. However I don't realise that Mr. Yanto, the deputy principal, has been standing in front of the classroom door.

Mr. Yanto : *"Ibu Yuli, can I talk to you for a moment?"*

Me : *"Yes"*

I walk slowly toward him as I begin to wonder what I have done wrong

Mr. Yanto :*"Ibu Yuli, your class is really noisy, I can hear the chairs moving, and the students are continuously talking. Please manage your class behaviour"*

Me : *"We have just been discussing the topic in groups, that is why you heard the chairs moving and the students talking"*

Mr. Yanto : *"No, that's not good, it will disturb other classrooms. So, please manage it"*

Before giving me an opportunity to respond, he walks away. The mix of emotions filling my heart, leave me feeling sad and upset. I don't know why he is always of the view that a good class is a quiet class. He is always reminding the teachers who have noisy classrooms, not only me. I try to calm myself down and return to my students. I am not afraid of him and am planning to continue the class discussion, but time is running out, so we then conclude the lesson. I let the students know that we will continue the discussion and continue to use different activities in the

classroom. They look happy, even after the class, some of them keep asking about alcohol and talk about their own situations in relation to being intoxicated.

This was one of my experiences when I taught in a vocational school, as I dealt with many students who were misbehaved and drug users. After I engaged with them by relating their experience of drinking alcohol with the topic, their behaviour changed significantly. At this stage, my main goal was to transform my students from being passive learners to active learners, helping them to better understand the concepts. It was really challenging for me as a beginning teacher, since before changing them to active learners I needed to first change their social behaviour which took an enormous amount of time and energy. I realised that is not easy to transform passive learners to active learners, in the same way that it is not easy for teachers to shift their paradigms from controllers to negotiators. I think that 'smooth' transitions need to be applied in the classroom. It is also important to engage the students through collaborative planning of their learning experiences and listening to their silent and unspoken thoughts. As a result, they will feel more comfortable in the 'new' learning environment, because it is also an outcome of their decision.

Moreover, I believe that using the individual experiential world as a starting point to engage and empower my students will be very influential. They will more likely find the learning process useful in their daily lives. I tried to help my vocational school students to be aware of the border crossing between science culture and their own culture, as well as helping them to cross the border. I also believed that they needed to change their drinking behaviour which was creating problems in their community. I believed that it was important for them to change their behaviour, and even though I am not fully confident to claim that I empowered them to do so, I believe that my teaching did may have had a positive influence helping them to become better members of the community and for their parents.

Do I care? The lens of an ethic of care in my teaching identity

Ever since I became a teacher I have believed that this profession has a great moral responsibility for society and for human beings in general. Becoming a teacher means educating people to be holistic individuals who will play distinct roles in society. The 'good' holistic individual, successful people as well as leaders, will be

primarily shaped through their education. Education plays an important role in shaping the community. However, the fact is that education is in danger of becoming a meaningless process that is perceived as simply a list of content knowledge that must be taught to students for the purpose of passing their examinations. As a result, the primary goal of the education process to generate great people seems to be failing. In addition, the way teachers handle their students has proven to have had a great impact on students' learning, as students replicate the behaviour of their teachers. For example, teachers who give unproductive or meaningless learning experiences could be influencing the later actions of their students, even though they may not become teachers, but the way that they influence others could be a repetition of their own learning experiences. Teachers' morals, values, and ethics are bound to have a major influence on students' perceptions of other people or the world, which influences their social behaviour. Therefore, I believe that an ethic of care is important.

> I realise that empowering my students will be difficult. Caring for students with empathy and trustful relationships will help me to empower my students to move away from their comfort zone and empower them to do better.

The myth of rationalism cultural shapes the classroom beyond objectivism where the myths of cold reason and hard control take place. An ethic of care in an educational context is concerned with the relationship between a teacher and student, and helps to avoid the hegemony of the technical interest which shapes the teacher's role as deliverer of the curriculum while the students are passive receivers. According to Taylor (1996, p. 18), " an important role for the teacher is to create an atmosphere of mutual trust, respect, good will, qualities that are necessary in any relationship that involves disclosure of personally significant meaning-perspectives". Thus, I have realised that it is important to understand students as human beings rather than as 'empty vessels' in which replicate scientific knowledge.

> Students are human beings. They will feel comfortable if teachers treat them with care, trust, and empathy.

Through an ethic of care, teachers become empathic, honest, interdependent and have trustful relationships with students. I am able to show care in the classroom by developing students' sense of belonging through their interactions, collaboration, and active

participation (Rice, 2001). Moreover, I agree with Taylor (1996) that rather than force students to accept and apply transformative learning suddenly, by gradually establishing new teaching and learning roles it is better for transformative teachers to adopt a caring approach. According to Rice (2001), a teacher's level of care is influenced by their life experience, however, teachers can practice an ethic of care through respecting and getting to know the students. Therefore, caring is a fundamental ethical value required to work with students. It helps them to grow and achieve their potential (Sumsion, 2000). I realise that my role as a teacher educator is to take responsibility to educate my student teachers to develop trusting and caring relationships with their students (Lake, Jones, & Dagli, 2004). According to Oser (1994, p. 64), "to change their [teachers] minds means to make them see that caring for students is a never-ending moral obligation with many aspects".

Students are human beings who need a level of interaction that involves caring, trust, and empathy. According to Rossiter (1999), "the student is always more important than the subject…[and] caring is not regarded as a pedagogical technique or strategy, but as the fundamental relation within which education occurs". I endeavoured to embed these three significant principles (communication, emancipation, and care) in my practice during my co-teaching journey. I provided the students with a degree of freedom to express their voice emotionally and critically. I also worked to create science learning experiences as meaningful and engaging processes, as one of the students remarked:

I think that since you came to help our teacher, I have become more engaged in the science classroom and I enjoy the different activities we do. I also agree that my achievement, as well as the students, has improved. I think that this is because we do more fun activities that keep the class entertained, so they pay attention and learn more. I also think that the students in my classroom are more interested in Science and experiments than they were before. I also think that they are more engaged in the lesson and are eager to learn when the lesson is presented in a fun way
(Student interview, Septermber 22, 2010)

In my point of view, as a whole I think all of the students are more engaged into science, especially when compared with last year...I think when you come into the class we are more motivated because we know we'll be doing something very interesting, educational, and a change, rather than reading the textbook
(Student interview, Septermber 25, 2010)

In my own context of teaching and as part of the national education goal, religious and cultural values in the classroom are part of the 'hidden' curriculum. According to Lake, Jones, and Dagli (2004), integrating an ethic of care into the curriculum should occur through consideration for engaging the students. Therefore, the other ethical referents which need to be considered for me are my culture and religion (see Chapters 5 and 6). I feel strongly about this as religion and culture are part of family education, although they are recognised as part of the informal education system in my country. The ethical values of my religion recognise care of and empathy towards others. Moral values are also important to engaging students, not only within the social relationship between teacher and student, but also to stimulate them to become transformative learners. When students feel secure and comfortable to deal with their teachers, they will engage more deeply with the learning process. Transformative teachers have the ability to empower their students within the transformative learning process.

God Creates Everything as Couples: The Power of Dialectical Thinking in My Teaching Identity

I have always believed that God creates everything in twos with a fundamental purpose. Man and woman, black and white, good and bad, all creations have negative and positive aspects. Thus, we should deal with the power between two different things in our lives, which is the nature of dialectical thinking. According to Basseches (2005, p. 51) defines dialectical thinking as "any thinking that looks for and recognises instances of dialectic and that reflects this orientation in the way in which it engages inquiry". Thus dialectical thinkers view existence and knowledge dialectically. Dialectical thinking is a challenging thinking process as stated by Wong (2006, p. 250); "dialectical thinking is a kind of higher psychological process in the Vygotskian sense". Dialectical thinking becomes a bridge for me to understand the different views within my professional practice. Competition between the objectivism and constructivism metaphors in science teaching as described by Willison and Taylor (2006), encouraged me to think about how this tensions influences my pedagogical practice, including when I conducted co-teaching.

As I stated in the section on constructivism as a referent, I realised that tension exist between the objectivism and constructivism metaphors. On the metaphor of constructivism, authors point out concepts of making sense, constructing knowledge, and building ideas. In science education, personal constructivism construes the learner as constructing mind-dependent understandings of natural phenomena, and gives rise so, the ideas of conceptual framework and misconceptions. Social constructivism recognises social interactions in the construction of public knowledge. In science education, this view promotes the ideas of dialogical activity and collaborative learning. The other strong metaphor is radical constructivism which recognises the role of individual experiences in making sense of the physical world. The authors point out that the problem of solipsism within the radical constructivism can be avoided by negotiating meaningfully and sincerely.

On the other hand, the metaphor of objectivism provides the metaphors of knowing as seeing, knowledge as entity, and knowledge as transferable. The authors point out the idea of 'a pipeline' for communicating knowledge which leads to replication of knowledge in students' minds. Within this metaphor curriculum as planned activities and subject matter is applied. Moreover, according to Mueller & Bentley (2006), most science teachers view of students in the classroom is not of 'a decorated landscape' (i.e. pluralism) and thus they rely on the textbook and examination scores, ignoring students' individual lives and differences. It will be dangerous if the teachers only use this metaphor because students' imagination will be trapped (Leahy & Sweller, 2004). Under this metaphor, ideas are objects that can be played with. In science education, this view promotes monologue activity under the traditional teaching.

Willison and Taylor (2006) point out that many of education experts support the implementation of constructivism in the classroom because constructivism is recognised as 'the best' view of learning for giving the meaningful learning experience for the students. However, rather than separating the ideas of objectivism and constructivism, Willison and Taylor (2006) argue for the idea of 'complementarity' through a dialectical mode of reasoning which recognises epistemological pluralism. I can imagine that if I teach only with objectivism metaphors I will limit my creative and critical thinking. However, I also cannot adopt

only the metaphor of constructivism as this would conflict with the social reality of my country, where the main focus is subject matter and measurement.

Dialectical thinking not only helps me in my teaching, but also in conducting research. My early learning experiences in science shaped my thinking process in conducting research associated with the metaphors of measurement and observation. Thus, when carrying out auto-ethnographic research, my questions always have a tendency to be directed to 'how can it be observed?' I believe that this has also shaped my daily life, in which I feel that everything should be measured. Lakoff and Johnson (1980) suggest an alternative view of argument as battle which allows for differences. The writers suggest 'argument is dance' for giving the idea that everyone has their own performance which is unique and acceptable. The dance metaphor allows people to engage in argument without thinking to attack and win over others' arguments. Moreover, the writers point out that 'the essence of metaphor is understanding and experiencing one kind of thing in terms of another' (Lakoff & Johnson, 1980, p. 5). I began to apply the metaphor of 'dance' in my thinking about classroom as a 'culture', and found this helped me to understand that every individual is different, and that I could not force students to agree with all of my thoughts and actions. Using dialectical thinking, I reflected on my culture shock (see Chapter 5) when I came to Australia, which has different food, rules of living, and academic life. I began by not depending on rice in every meal, trying to understand respect in my country as opposed to respect in Australia, such as acknowledging older people as sir or encouraging myself not to keep quiet, but instead becoming more critical. If I didn't apply dialectical thinking, then it would have been very difficult for me to cope with living in Australia. Another example is in how I intend to educate my children later, even though I think that sometimes the entertainment on television is not good for my child, it doesn't necessarily mean that I have to restrict her from watching television, I need to put my dialectical thought to considering both positive and negative effects of television programs. Therefore, the different aspects of my daily life have stimulated me to apply dialectical thinking.

Recently I have begun to think about when I return to Indonesia, how the dialectical thinking will be powerful in order to understand that my colleagues have different views, my students have their own ideas, and my system also creates their borders. I

am aware that in order to survive in my classroom, my university and my country, I have to learn to apply the method of dialectical thinking on competing social realities. For example, under the metaphor of objectivism which has predominantly shaped my education system, it will be a difficult and dilemmatic journey as an educator as well as a teacher educator to deal with this reality. Therefore, I am still questioning myself, "Can I apply dialectical thinking within my professional practice when I return to Indonesia?" I have left this question unanswered in the back of my mind. However, I believe that the concept of dialectical thinking can help me a great deal to overcome this dilemma. I hope that I can implement the metaphor of "teaching as lived, as experienced prior to the conceptualizations laid over raw experience as parking lots over organic soil" (Pinar & Reynolds, 1992, p.7). Creating lived and meaningful experiences for my students will not only create a valuable journey for the students but also it will empower them.

CHAPTER SUMMARY

Writing this chapter engaged me in reflecting critically on the role of transformative learning theory in my teaching identity. I realise that I have worked hard to develop my teaching identity as a transformative science educator who has faith in constructivism as a pedagogical referent, who envisions better teacher-student relationships, and who is trying to establish the wisdom of dialectical thinking. I realise that the value of transformative learning, which has emerged during my journey of postgraduate research at SMEC, is very empowering. This learning experience has stimulated me to think critically, to think and reflect on myself, and to envision my future life, especially within my pedagogical practice. The values of transformative learning were reconceptualised during co-teaching and my reflective writing, when I uncovered the power of the technical interest throughout the journey. I am aware of the politically-driven education system in my home country as well as my role as a government employee who has to deal with a standardised system. I have to face a technicist social reality where it is easy to become vulnerable to the cultural myths of objectivism, rationalism, cold reason, and hard control (Taylor, 1996). However, I prefer to be challenged to shift paradigms and become a transformative educator, rather than staying within the comfort zone of a controlling teacher with passive learners. The suggestions from Taylor on communicative actions in educational relationships and an ethic of care will help me to deal with the

challenges that I may face in my classroom. I believe that education is a life-long process in which it can sometimes be difficult to distinguish between prevailing moral values, and an emancipatory ethic, and an ethic of care. I will try to adopt an integral perspective on radically different views (e.g., modernism and postmodernism, objectivism and constructivism, etc.), dialectical thinking, constructivism as a referent, an emancipatory ethic, and an ethic of care. All of these concepts will help me to deal with the problems and to think reflectively and critically in any situation.

I always think of the kind of teacher I aspire to become whenever I am conducting co-teaching. I hold envisioning to become part of my teaching identity as a transformative educator. Conducting co-teaching and critical auto/ethnography research has helped me to learn to identify, transform, and envision my teaching identity. The research was a personally transformative journey that challenged my newfound identity as a transformative educator. This journey provided me with opportunities to think critically, reflect on myself, and envision my future life, and helped to reveal and reconceptualise my teaching identity as an educator who is committed to transformative learning. This journey has opened the ‘closed window’ of my thinking by emphasising critical and reflective thinking as well as depth of understanding. Finishing this chapter doesn’t signify the end of my journey, but it becomes a starting point to move forward and to discover new ways of becoming a transformative learner and educator, and a life-long learner. I close this chapter with a number of unfinished questions. Can I empower my students? Can I face the challenges? Can I shift my teaching? I hope that in shaping my thinking throughout the different ideas of envisioning curriculum, transformative learning, constructivism as a referent, and an emancipatory ethic and an ethic of care, I can face the challenges while shifting my paradigms and empowering my students.

The Journey of Empowering…

I realize.
The power of objectivism in my education system
The power of standardized curriculum and assessments
The influence of disempowering learning experiences
The influence of technical interests

I am aware of…
The difficulties of shifting my paradigms
The challenges of shifting from passive learning
The problems of empowering my students
The difficulties of shifting from a controller teacher

But, I wouldn't stay…
Within all the complicated problems
Within all the limitations:
Big classes, passive learners, objectivism
Standardized curriculum and high stakes assessments

I will face those realities
I will be going back
For myself
For my students
For my country
As a transformative, emancipatory and caring educator…

CHAPTER 8

IN A DARK LINE OF SIGHT: SUSTAINABILITY EDUCATION IN MY TEACHING IDENTITY

INTRODUCTION

2001
I Was A Student Teacher

A Poisoned Student

Everybody is in shock, 20 university students are poisoned in an organic chemistry laboratory. The students feel nausea, headaches and their pupils were not responding to light. Some lecturers are blaming the students who do not work carefully. The students are blaming the facilities that are less than safe. The laboratory area is too small, and the methods used in organic chemistry involve some very dangerous substances. Students are interviewed by the university newspaper, as well as lecturers and laboratory staff. During the interview, they are blaming one another other. One week later, the case is closed, and the students are getting better. However, the laboratory conditions and the practicum methods in the organic laboratory remains the same.

I was one of the poisoned students, who later became a chemistry lecturer in the same university four years on, and still felt extreme disappointment and regret with the incident. I am also one who hopes that there will never be a recurrence of such an event in future, in the course of my career as a chemistry lecturer. When I began teaching in the analytical chemistry laboratory, which is right next door to the organic chemistry laboratory, the accident was still very real in my mind and influenced my journey as a chemistry educator. Even since the time I attended secondary school, I used to spend a lot of time working in the laboratory and dealing with a vast range of chemical substances, but I was never involved in such a dangerous accident like the one which occurred while I was a university student. The negative experiences and my teaching journey in general have gradually shaped my passion in sustainability education as part of my teaching identity. The accident has become a powerful reminder which gives me determination to investigate different

strategies that help shape my laboratory teaching. This includes administering appropriate safety measures whilst considering approaches that are environmentally friendly, such as implementing principles of green chemistry. In this writing journey, I have discovered how the power of my religion and family and school education have shaped my values in sustainability education. I have also reconceptualised these values through co-teaching and reflective writing. Since I began applying green chemistry principles, I could only go so far as to include them in the content of teaching (education about sustainability), without truly focusing on the desired long-term effects of how they could empower my student teachers to become agents for sustainability education (education as sustainability).

On a personal level, although I had emphasised the importance of chemical waste in the laboratory as a concern, though I was not conscious about common waste in my everyday activity. It seemed that chemical waste was becoming a greater concern than everyday waste. Although I was aware of environmental problems at the time, it was merely a degree of awareness that was not reflected through actions. As I became more conscious about the issue, I found that my everyday life was shaped by creating huge amounts of waste by energy consumption and more generally. I would often produce up to three large bagfulls of rubbish on a daily basis, as well as switching lights on when they were not needed. I also developed a habit of using hot water even though it was no longer winter. I realised that there were many simple things which could be preserved yet they were being wasted in my everyday life routines.

Thus, the reflections in this chapter are a means to understand the role and the challenges of sustainability education in my teaching identity. I have divided the chapter into three sections:

1. **Different Facets of Sustainability Education**

   This section portrays different theoretical perspectives and my reflections on sustainability education.

2. **Reflections on the Value of Sustainability Education**

   This section portrays my reflections on the value of sustainability education which I reflect on from a religious perspective as well as my own educational experiences, both from family and school.

3. **Sustainability Education in My Teaching Identity**

   In this section, I explore how sustainability education has shaped my teaching identity.

DIFFERENT FACETS OF SUSTAINABILITY EDUCATION

Never regard study as a duty, but as the enviable opportunity to learn to know the liberating influence of beauty in the realm of the spirit for your own personal joy and to the profit of the community to which your later work belongs
(Albert Einstein)

The quote above motivates me during my life journey because I deem that the happiest of people are those who can make a contribution to the lives of others, the community, and the world. I realise that as a teacher educator I can contribute to creating a better future environment. However, I have also learnt that it is important to critically reflect on my own values of sustainability education before starting to empower my students. As a teacher educator, I discovered that it is not simply providing learning material on environmental issues to the students or to introduce green chemistry. It is about integrating the value of sustainability education in my teaching and my everyday life. I recognised that the process requires an integrated approach, as there are several solutions from economic, social, political and educational viewpoints which are purposeful in achieving environmental sustainability. Nevertheless I believe that the solutions cannot be effective if those aspects don't integrate and humans don't engage with the environment. Therefore, education, especially for teachers, plays an important role in generating environmental sustainability by empowering the younger generations in strengthening human beliefs and attitudes which are essential in sustaining the environment.

In this section, I explore a number of theoretical perspectives to develop and reflect on my understanding of the concepts of sustainability education. I understand that education is a fundamental part of the environmental sustainability process because

education is “the building block for a society to enrich its human capital” (Munier, 2005, p.132). I believe that education can be a meaningful tool in empowering people to engage with environmental sustainability. Various terms have been used to describe the role of education in environmental sustainability. For example, sustainability education shares similar goals and objectives with environmental education (Chansomsak & Vale, 2008). Environmental education was proposed in 1975 in Belgrade in a UNESCO meeting (Gough, 1997). The term sustainability education emerged after 1992 in the Nations Conference on Environment and Development (UNCED) in Rio de Janeiro (Chansomsak & Vale, 2008). According to Gough (1997) and Fien and Maclean (2000), environmental education should stimulate individual responsibility and action on both physical and aesthetic qualities of the environment. In Australia, environmental education has been included in the Society and Environment Learning Area, which provides students with the opportunity to physically engage with the environment as well as empower their critical thinking, collaboration with others and active by participate in the environment (Gough, 1997; Curriculum Council, 1998). In Indonesia, environmental education is integrated in the curriculum as part of science teaching, which has similar objectives to environmental education in Australia.

Sustainable environments are important, because we realise that humans cannot be separated from the universe. According to Gadooti (2003), sustainability of the environment depends on awareness, and awareness depends on education. Without sustainability education, the Earth becomes “the place that provides our sustenance and technical-technological domain, not the space of life, the space of our heaven, and our care” (Gadooti, 2003). According to Morris (2002), it is difficult to shift our perspective from Earth as a tool for being exploited to being sustained. However, I believe that the education process could be an important way to shift individuals’ perspectives. Moreover, environmental sustainability is not only the responsibility of developed countries and governments, but is the responsibility of all humans. Therefore, education should also play an important role in environmental sustainability. Teachers play an important role to environmentally educate their students (Michail, Stamou, G, & Stamou, G, 2006) to value their world for sustaining life (Morris, 2002). It is important to increase students’ consciousness of environmental problems by incorporating environmental sustainability in the

curriculum. According to Morris (2002), consciousness is a good starting point for reconceptualising cognition which is not separated from the nature of the environment, and educators should re-imagine the possibilities of sustainability education.

According to Sterling as cited in Chansomsak and Vale (2008), sustainability education can have three forms: education about sustainability, education for sustainability, and education as sustainability. Education about sustainability focuses on the content, education for sustainability accentuates the purpose, and education as sustainability means empowerment and action. Education as sustainability will provide opportunities for individuals to become critical and reflective thinkers and lifelong learners (Blewitt, 2006). In considering these three different forms of sustainability education, I have become more aware that I was still at the stage of implementing education about sustainability. Since environmental sustainability within a systems theory needs to address a complex system shaped by multidimensional influenced factors integrated with each other (Clayton & Radclife, 1996), it is important to equip teachers and students with the basic concepts of sustainability as a system (Orr, 2004). Thus, sustainability can be a process of accommodation, reformation and transformation (Sterling as cited in Chansomsak & Vale, 2008). Therefore, I have realised that to achieve the holistic process of environmental education, teachers should engage with education as sustainability, rather than only education about sustainability which merely teaches the subject or includes in the curriculum a topic on the environment. I believe it is important to empower teachers and students to take action in their everyday practice for a better future for the environment (Blewitt, 2006). It is also important for me to examine my own values of sustainability education and explore them within my teaching identity in order to engage my student teachers both at a level of awareness of environmental problems and in contributing towards the future of the environment.

REFLECTIONS ON THE VALUE OF SUSTAINABILITY EDUCATION

The Power of Religion in Shaping My Values in Sustainability Education

1999
I am a student teacher

I Can't Go Anywhere

As I sit in the classroom listening to my Islamic studies lecturer, he explains the role of humans as leaders on Earth to sustain the environment. He points out that Allah (God) doesn't allow his creation to perform any action that could potentially harm the Earth, to which he then highlights an example of waste disposal in a nearby river that we are familiar with in Jakarta. The lecturer tells us about the disasters that could occur in this area because of our actions, including potential flood hazards. I glance over at my classmates; many of them are not paying any attention to the lecture. It seems that religious education is only delivered to a theoretical extent, and not reflected in practice. My lecturer suddenly pauses in speech when we hear the sound of heavy rain begin to pour down and realise that a wild storm is on its way. He decides to finish the lecture now; due to the rain, because of the possibility of a flood which is common in the area when there is heavy rain. I quickly pack up my belongings and leave the classroom. However, I decide not to go directly to the bus stop, because I feel that it will be much better if I go and perform the Ashar (afternoon) prayer first before leaving for home. When the rain is heavy, the traffic usually worsens because the floods are everywhere. After I have completed my afternoon prayer, I walk over to the gates where there are only a few students remaining, and I am quite surprised because the water levels have already risen up to my legs. However, I can't stop walking because if I wait the water will continue to become deeper. I continue on walking in the water although I am fearful because I can't see anything through the water. I keep walking until I reach a spot near the small river. Oh, I can't continue this because I can't even distinguish the river from the street anymore, and the water level is now up to my waist. I realise that I cannot really go anywhere now...

The story above was one of my experiences of being trapped by flood waters. Floods are very common in Jakarta, and they are gradually occurring more often in many other parts of Indonesia. It was beginning to get worse when I was a student teacher, when there were times that I couldn't even make it to university because of the floods. The bus that I used to travel on from nearby my house could not move while there were floods. The issue was always a major debate topic throughout the media

on government responsibility in solving the problem. Some of people argued that it is simply a consequence of natural disasters. However, I personally do not agree with this because when I look at most of the rivers in Jakarta being full of rubbish and most of the green landscapes being overtaken by urban development, there is no place for water absorption. I feel sad, angry, and ashamed as I write this reflection, because a majority of us are Muslim, and we have been taught Islamic values which imply a belief in sustaining the Earth. But what are we really doing? Rubbish is carelessly being disposed of in rivers, more buildings are being erected, all of which has no consideration towards water absorption. We are systematically polluting the Earth with our waste. Is there anybody who really cares?

Since I was a child, through family and school education, I was educated about values of sustaining the Earth. As Muslims, we believe that it is our responsibility to sustain the Earth, and cleanliness is a major part of the Islamic faith. As I explored earlier in Chapter 6, on the power of religion in my teaching identity, I have come to realise how religion has had a profound influence on my values in sustainability education. As I stated before, in Islam we believe that Allah creates humans to become leaders, and those leaders should take care of the Earth, as stated in the Qur'an:

> And [mention, O Muhammad], when your Lord said to the angels, "Indeed, I will make upon the earth a successive authority." They said, "Will You place upon it one who causes corruption therein and sheds blood, while we declare Your praise and sanctify You?" Allah said, "Indeed, I know that which you do not know" (Qur'an, 2:30)

Allah allows humans to take benefit from his creations (plants and animals) on Earth in order to survive, as stated in the Qur'an:

> It is He who produces the gardens, with trellises and without, and dates, and tilth with produce of all kinds, and olives and pomegranates, similar (in kind) and different (in variety): eat of their fruit in their season, but render the dues that are proper on the day that the harvest is gathered. But waste not by excess: for Allah loveth not the wasters
> (Qur'an, 6: 141)

> Of the cattle are some for burden and some for meat: eat what Allah hath provided for you, and follow not the footsteps of Satan: for he is to you an avowed enemy
> (Qur'an, 6: 142)

However, Allah forbids humans from causing conflict on the Earth:

> Do no mischief on the Earth, after it hath been set in order, but call on Him with fear and longing (in your hearts): for the Mercy of Allah is (always) near to those who do good
> (Qur'an, 7: 56)

> Mischief has appeared on land and sea because of (the meed) that the hands of men have earned, that (Allah) may give them a taste of some of their deeds: in order that they may turn back (from Evil)
> (Qur'an, 30: 41)

Over time, I have noticed that for many people, these values are simply religious statements, and not for implementation. However, I cannot disregard the empowerment of Islam in my own identity. I believe that Islamic values are internalised in ways of thinking and acting. As I reflect on this, I feel that I have not been doing very much in contributing towards sustainability education. This reflective writing has become a way to critically reflect on my values and actions in sustainability education both in personal and professional practice. I am aware that Islam, as my way of life has shaped my values in sustainability education and is motivating me to play an important role in campaigning for sustainability education.

The Power of Education in Shaping My Values in Sustainability Education

I strongly believe that my educational experiences have played an important role in shaping my values in sustainability education. Environmental education in my family and early school years has provided me with an insightful journey for the next journey I intend to partake in sustainability education.

My family: "Please keep your rubbish, Uwie!"

Since I was a child, my parents taught me about caring for the environment. They probably weren't aware of the term 'environmental education', but the values and practices that I have learnt from them has shaped my identity in sustainability education. I also believe that a major influence in my beliefs has come from Islamic values, as I was grew up in an Islamic environment, and both of my parents were religion teachers (see Chapter 6). Simple practices such as throwing rubbish in the bin, planting flowers, and cleaning up rubbish have become a regular practice in my daily life. I write the story below to represent how my parents once taught me.

1986
I was 6 years old

Please Keep Your Rubbish, Uwie!

Today is my 6th birthday, my mother has promised to take me to the markets to buy me new clothes as a reward for my great achievement in year 1 and as a birthday gift. I am very happy because my mom is usually very busy with her job, so spending time with her is very valuable to me. We walk over to the bus stop to catch a bus to Pasar Minggu (the traditional market in South Jakarta). My parents are of a middle class economic background, and we are not wealthy enough to own a car or to shop at the local Supermarket. We always buy our groceries and everyday needs from the traditional market where goods are reasonably priced and of satisfactory quality.

My Mother : "Uwie, (my family and some people call me Uwie instead of Yuli), there's the bus, hold my hand"

Me : "Yes, Mom"

We get onto the bus and it's full of passengers, so we have to remain standing during the trip. Fortunately, one man stands up and offers his seat to us. After thanking him, my mother sits down and picks me up onto her lap. I couldn't bear to imagine if my mother had to stand for the entire journey until we arrived at Pasar Minggu, which is quite a distance away. My mother hands me some cookies to snack on during the trip (it is permissible to eat and drink whilst on public transport in Indonesia). I am so excited on this particular morning, that I skipped breakfast. However, my mother has always been a well organised person, and has brought food, drink, and other necessities that we might need during our trip. I unwrap the packaging of my cookies and then throw the plastic wrapper on the floor. Suddenly, my mother says to me:

My Mother : "Uwie, do not throw the rubbish on the floor! You should throw it in the bin"

Me : "But, there is no bin here Mom"

My Mother : "Then keep the wrapper in your pocket, and throw it in a bin when you find one"

Me : "But, my pocket will be dirty"

My Mother : "That's Ok, we can wash your clothes, but can you imagine what would happen if you kept throwing your rubbish on the floor? No

one would put it in the bin, the bus will become very dirty and a lot of people would become uncomfortable because of your rubbish"

Me : "But, Mom why is there a lot of rubbish under the seats here?" (I point out the rubbish under the seats; I was used to seeing unclean buses with a lot of scattered rubbish)

My Mother : "That's not good, your rubbish will make the bus dirtier. You can't follow the bad examples, can you?

Me : "Yes Mom, I will keep it until I find a rubbish bin"

Half an hour later, the bus attendant announces the next stop, "Pasar Minggu, Pasar Minggu!" My mom and I get off the bus.

My Mother : "Uwie, let's go and cross the bridge, the market is just opposite this street"

Me : "Mom, why should we cross the bridge, when we can just cross the road? It looks like many people do that"

My Mother : "That's not good Uwie, it's not obeying the law, nor is it safe"

Me : "Ok Mom"

There are many bridges in Jakarta, but many people do not use them because crossing the road is faster than crossing the bridge. As a result, the traffic becomes more congested due to motor vehicles having to wait for people to cross the road. We arrive at the markets and my mother asks me to throw my rubbish in the bin when we get to the bin in front of the market. The market is not as clean and well maintained as a supermarket, but my parents have always said that if we buy things from the traditional market we are helping the poor people whose lives really depend on selling there. After two hours we have completed our shopping; my mother asks if I would like to have some meat ball soup, which is my favourite soup in the market. I am very happy not only because I got a birthday gift today, but I also get to enjoy my favourite meal on the same day. This day has been one of the most joyous birthday celebrations in my life.

My Mother : "Uwie, what would you like to eat and drink?"

Me : "Meat ball soup and Teh Botol please Mom"

My Mother : "Ok, sit here for a moment please, I will go and place the order"

Me : "Ok Mom, but can I please have a plastic cup to drink from?"

My Mother : "Hmm..I think it will be better if you use a glass cup, not a plastic one"

Me : "But why Mom? I like the colour of that plastic"

My Mother : *"Because it creates rubbish, let's use glass cups, so that they can be washed and re-used again"*

Me :*"Ehm..but…"*

My Mother :*"Uwie let's starting doing good things"*

I remain silent and wonder why my mother is always so concerned about rubbish? I see rubbish everywhere, and many people dispose of it on roads and in rivers. I soon forget about it as the food stall owner approaches with some delicious meat ball soup and Teh Botol for my mother and me.

As I cease writing this story I am almost in tears as I remember my mother. I really miss my mother. I never realised how her teaching of beliefs, values, and social practices were highly important. I used to think that there were too many rules that restricted my daily activities, but I have learnt and reflected on those rules as powerful lessons in life. It taught me to be aware of my environment and continue doing good things as I grew up. Since then I would always keep rubbish in my pocket or in my bag if I couldn't find a rubbish bin nearby. I realise that educating for individual awareness is a crucial process. Family education has been important to me since my childhood. When children are taught good moral values they may have a better outlook for the environment.

My school experiences: "Operasi Semut"

My early school experiences also strongly shaped my values in sustainability education. Schools play an important role in teaching younger generations to be aware of the environment and acting upon their awareness for a better future environment. I still remember common practices which were implemented by my school to encourage students to care for the environment; one of the examples is 'Operasi Semut' which I portray below. If it is translated to English 'Operasi Semut' is 'Ant Operation' which does not make much sense. Nonetheless, this phrase could be described as a method of how the ants work together, which is represented in the school's program for students cleaning up the school together.

1990
I Was a Primary School Student

Operasi Semut

Friday is a special day, not only because we go to school late in the afternoon and the boys have to attend Friday congregational prayers, but also because every Friday we have to do Operasi Semut. Operasi Semut is a regular activity which is performed on Fridays, where we have to collect rubbish for half an hour. However, some students don't like Operasi Semut because the rubbish is dirty and they are unenthusiastic to participate.

Susi : "Uwie, why should we do Operasi Semut? I don't like it."

Me : "Why, Susi?"

Susi : "It's dirty and I am tired of doing it. I think it's better for us to study in the classroom, it's almost exam time."

Me : "Ehm..Susi, don't you like spending time outside and working together with our friends to clean the school?"

Susi : "I do enjoy it, but it's dirty."

Tati : "But, which one is more dirty: our school with rubbish or without it? With rubbish surrounding us, you wouldn't feel comfortable to study or to be at school, what do you think?"

Susi : "Ehm..I agree with you, but I think Pak Agus can do it."

Pak Agus is the cleaner as well as the gardener in our school. He is very friendly with the students. I always share conversations with him during class breaks.

Me : "Wouldn't you be happy to help Pak Agus to clean up our school, so that it looks beautiful and becomes a comfortable place for all of us?

Susi : "I know, but…."

Tati : "Susi, I think that it is also fun to explore our school, the yard, the park, and other areas rather than staying in the classroom."

Me : "Yes, I agree, we can hang out and work together with students of different levels as well. Don't you think it's fun?"

Susi : "Yes...I do think so..."

Tati : "Do you remember what our religion tells us about keeping clean as part of our faith?"

Me : "Yes, then I think Pak Edy, our Moral and Values teacher also encourages us to maintain our environment."

Tati : "I think that it's a good thing to practice, to maintain our environment, starting with our school, what do you think Susi?"

Susi : "Ok, I do understand, I just feel tired to do it."

Me : "Let's work together, you won't be tired. Look, many students have been working at it, our teacher as well."

Tati : "Yes, let's go Susi."
Susi : "Ok.."

Tati and I try to convince Susi to participate in Operasi Semut, but she still seems uncomfortable. We decided to carry on with Operasi Semut, even though Susi looked unhappy.

The story above reminded me about the influence of my school experiences that empowered me to be aware of the environment. I used to wonder why my teachers in primary school would always remind us about keeping the environment clean. Not only did they teach us through their subjects, but they also arranged activities to keep our environment clean and beautiful. For example, students were required to clean the classroom every day. We arranged different groups of students who were responsible for cleaning the classroom. Then we would have 'Operasi Semut' every Friday, which involved picking up dry leaves, bottles, plastic, and any other rubbish that we could find around the school. I enjoyed it because we get to go outside of the classroom and meet other students.

Children have their own ways of understanding Nature which is different from adults. The advantage of engaging children with the environment is that they have a sense of fascination towards the environment. Their excitement and inquisitiveness enables us to encourage caring and empathy in younger generations for a better future of the environment. Children should engage with the environment to understand and appreciate Nature. The process of engagement for children is through creative play. According to Wilson (2008), creative play in the environment encourages children to understand and value the environment, which engages them in caring and protecting the environment. In education, the teacher as a facilitator can direct creative play which gives an opportunity for students to explore nature in different ways. It becomes less about teaching and more about sharing (Wilson, 2008). For example, the teacher can ask students to collect leaves of different sorts, go for a walk in the woods, play with water, and other creative exploring activities. Therefore, I believe that early childhood education plays an important role in engaging children in the first steps of environmental awareness.

Although at the time I didn't know why the teachers would arrange such activities, I now understand that they wanted to educate us to be aware of the environment by learning to maintain the environment of our own surroundings (school grounds). I write the poem below for all the people who have educated me throughout that journey.

My Gratefulness..

My Gratefulness is for…
My parents
My family
My teachers
My friends

My Appreciation is for …
Reminding me to maintain the environment
Educating me that it's important to be aware of the environment
Showing me how wonderful working together to keep our Earth can be

My Gratefulness is for…
Guiding me to do good things
Empowering my awareness
Starting by doing simple things

My Appreciation is for …
Educating me as a daughter, a sister, a student, a friend
Shaping my thinking, my emotions, and my values
Creating wonderful memories and powerful experiences

SUSTAINABILITY EDUCATION IN MY TEACHING IDENTITY

In this section I explore how the value of sustainability shaped my teaching identity in three different ways: (1) my awareness of environmental problems, (2) my teaching practices, and (3) my challenges in sustaining values of sustainability education.

'I Could Do Something': My Awareness of Environmental Problems

Since I first came to Australia I have lived in an atmosphere where I could breathe in fresh air and was surrounded by a clean environment. This made me realise how bad the environmental conditions are in my home country. I felt sad every time I thought about the environmental problems and the factors that contributed to such conditions. I found myself constantly questioning, 'when will I ever be able to breathe this kind of fresh air and live in a clean environment like this back home?' I am aware that it is

challenging to develop people's environmental awareness in my country. Indonesia faces many problems, such as economic crisis, poverty, corruption, as well as political crisis. Therefore, it has been suggested that environmental sustainability is not the main concern, even though we continue to face many disasters, such as floods, air pollution, uncontrollable waste, and a clean water crisis. Politically, the government has put emphasis on the issue, but in the reality of our present society people still have to fight to eat, to sleep, and to work, therefore environmental problems are of lesser importance. Even though some people are doing good to better the environment, such as cleaning up rivers, planting trees and building green schools in Bali, there are only a few people who are consciously aware of the environment. Therefore, I believe that it is important to do something to encourage others, especially my students, to do good actions for the betterment of the environment.

On a number of occasions I have visited Muara Angke, which is one of the polluted rivers in North Jakarta. People have built houses along the riverside in this area. Many of the residents work as fisherman and often throw all sorts of waste in the river. Ironically, they also use the same river to bathe in, obtain drinking water, and cook. The smell coming from the river is very unpleasant, and the water appears to be very dirty. I can't imagine how they could live there for a long time. I describe the situation of these conditions through the poem below.

Because We Need to live…..

We need food
We need clothes
We need houses
We need jobs
We need money

We build houses on the riverside
We throw rubbish into the river
The river becomes a rubbish bin, the bathroom, the kitchen sink
It smells badly, it's dirty, it's polluted, but we use it


Muara Angke River (Wibowo, 2011)

We use it for bathing, we use it for cooking, and we use it for drinking
We don't have any choice..
We just need it to survive

The clean water is too expensive
The houses are not affordable
The food is high-priced
The jobs are unbelievable

We go to the sea to get fish
We pass the polluted river every day,
bad smell, and our skin begins for feel itchy
We realise that we have responsibility to this problem, But..
What we can do? When our children are crying because we don't have food
When our families are suffering because of the hot and cold weather of our inadequate homes
How can we learn about environment problems when what we need more is food to survive?
We just want to live….

Houses in Muara Angke (Pool, 2012)

I realise the challenges that I will face whilst trying to empower my students as well as thinking about the basic needs required for life rather than environmental sustainability. However, how can we live on a planet that is so polluted? We can't separate our needs from the environment itself.

I remember a discussion with my parents about the environmental problems in my country; they would always tell me about how clean the environment was when they were children. Within this dilemma, I represent my parents' story in the poem below:

My Parents Told Me….

My parents told me, the trees were beautiful, the river was sparkling, and the sky was bright

My parents told me that the air was fresh, the water was spotless, and the soil was fertile

My parents told me the city is clean, and the village is beautiful,
My parents told me the jungle is amazing, the animals are happy, the plants are always smiling

Ayah[1]..Ibu[2]..the trees are yellow and brown in colour and covered in dust, how was it ever beautiful?

Ayah..Ibu..the river is always filled with waste, how could it sparkle?

Ayah Ibu..the sky is full of smoke, how could it be bright?

Ayah..Ibu..I can never find fresh air, spotless water, or fertile soil

Where is the clean city, where is the beautiful village?

Where is the amazing jungle? where are the happy animals, where are the smiling plants?

Where is your story?..I can see it in the pictures, I can see it on television
But I can't see it around me

Ayah..Ibu..Where I can find those beautiful things?

Ayah..Ibu..When will the dream world will come back to us?

Ayah…Ibu..who will create all those changes

Can it come back…?

Every time my parents told me stories about the environmental conditions that once existed I would feel miserable. This feeling still exists every time I hear about the environmental problems in my country. I keep asking myself, 'where am I?'

Where am I?

In 2004, residents of a small village in North Indonesia are suffering from water pollution. The conditions are miserable, as they are suffering from tumours, skin lumps and blotches, migraines and pregnancy complications. The people of these villages are blaming one of the biggest gold mining companies which had polluted Buyat

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[1] *Ayah (bahasa) : Father*
[2] *Ibu (bahasa) : Mother*

Bay in Northern Sulawesi with toxic waste. The people from the mining company deny such allegations, and they argue that the waste is already being treated properly. However, the fact is that the river is used by the people in those villages to drink, cook, wash and bathe in. The water is unclean, has an unpleasant smell and is contaminated. This accident has become the focus of government, industry, society and international NGOs, not only because the mining industry is one of the biggest companies in the world, but also because residents in the area are evidently suffering and dying from the present living conditions. There are many who are blaming the government which seems to allow industry development in this rural area without any expression of concern about the environmental impact. The government also faces another problem, as the mining company involved contributes to a significant amount of tax income for the government each year. An investigation has been conducted several times and, ironically, different environmental institutions are presenting vastly conflicting chemical analysis results of the water tests. It has become apparent that the political and economic authorities have immense control over the situation which is having a negative effect on the people and environment. One of the institutions involved is one that a friend of mine works at. I found out that they were told to remain silent about the results of the chemical analysis. Another institution involved was the chemistry department that I belonged to, who were capable of providing information about chemical waste pollution. They also had the power to voice important factors about this issue, however, nothing was happening and no one was stepping forward to implement change that could help the people, society, and my country. I then asked myself, why couldn't I do something about it, and where am I?

This story is yet another example of environmental problems that exist in Indonesia. Therefore it is not only natural disasters that take place in a country which lacks in environmental nourishment. Floods, erosion, water and air

Where am I?

Where am I when...
The Earth is crying
The Animals are howling
The Plants are suffering

Where am I going, when
The Sun is getting hotter
The Sky is getting thinner
The Air is getting polluted

Where am I working, when..
Chemical waste is produced
Chemical waste is disposed
Chemical waste is dangerous

Where I am standing, when
My students produce waste
My students never think about the Earth
My students replicate what I am doing..

Where am I ?Who am I?
If I am doing nothing for the environment
If I am not responsible for the environment
While reproducing chemical waste
While recreating large amounts of chemical waste
I am here, just standing, silent and doing nothing...

pollution can be found in many areas throughout Indonesia. Blaming one another is a common repercussion when disaster takes place. The government seems to have very little power over industrialisation which gives rise to environmental problems. However, when I am left blaming others for the conditions I begin to wonder, where am I? What can I do?

As I teach chemistry, I have become aware that chemical substances cause several environmental problems that have given rise to significant negative effects on the environment, human health, and quality of life. Toxic waste is harmful material that is often found in chemical substances that can cause injury or even lead to fatal circumstances for living organisms. Industries dispose of waste that contains many hazardous toxins into rivers that can cause long-term health and environmental risks. One example is the Minamata disease which is caused by Mercury compounds. The polluted river can lead to the death and extinction of many amphibians. I believe that the conditions of the environment will only worsen if people continue to do nothing about it. The entire world is searching to find solutions and numerous suggestions to try and solve these problems, but without peoples' self-awareness and empowerment on environmental issues the suggestions that they continue to seek are useless. The majority of Indonesian society seems to be unaware of these environmental problems. If they were aware, why do I still find myself surrounded by rubbish in the rivers, roads, and many public places? If the industries are aware, why can I still smell the effects of toxic chemical substances contaminating the rivers? If I am aware, why do I still dispose of chemical substances in the washbasin in my laboratory, without querying as to whether or not there is a waste treatment system in place? The questions keep calling out to me, 'am I really aware?'

My Teaching Experiences: "Here it is, Green Chemistry"

Throughout writing the reflections on my teaching practices, I found that my values and beliefs in sustainability education became more deeply embedded in my teaching identity. My negative experiences in the laboratory, my Islamic faith and

As a new lecturer who has previously had a bad experience in the laboratory, I have expectations that my students should not experience the same as I did. While at university my lecturers would teach the theory of laboratory safety and management, as well as the dangers of chemical substances, but it often did not apply in practice. Therefore, I wanted to implement theory into practice to avoid the accident that once happened to me.

educational experiences have shaped these values, even though they are still on a minute scale in practice. An example of one of my teaching practices was implementing green chemistry approaches in the classroom. Green chemistry is one example of the purpose of chemistry to sustain the environment. According to Anastas, and Williamson, (1996, p. 1), green chemistry is "an approach to synthesis, processing, and the use of chemicals that reduces the risks to humans and the environment". There are 12 principles of green chemistry: "(1) prevention, (2) atom economy, (3) less hazardous chemical syntheses, (4) designing safer chemicals, (5) safer solvents and auxiliaries, (6) design for energy efficiency, (7) use of renewable feedstock, (8) reduce derivatives, (9) catalysis, (10) design for degradation, (11) real-time analysis for pollution prevention, (12) inherently safer chemistry for accident prevention" (Anastas & Warner, 1998, p. 30). Therefore, I found that the green chemistry approach could be one potential strategy to encourage the sustainability of the environment in education. According to Haack, Hutchison, Kirchoff, and Levy (2005), green chemistry provides opportunities for innovations in curriculum integration, and engaging students in environmental awareness. Integrating 12 principles of green chemistry into class material will provide the essential basic concepts of green approaches both in theory and practical (Braun, et. al., 2006). While teaching in the chemistry laboratory, I applied green chemistry approaches by substituting dangerous chemical substances with less dangerous ones, used small-scale laboratory equipment, and managed waste disposal in a less harmful way. These are all part of the green chemistry approach, which aim to reduce the use of dangerous chemical substances (Lancaster, 2002).

My critical reflections taught me that it was possible to make further improvements. Compared to the school system and university, a lecturer has more room to change the methods or material as long as the objectives are achieved. For example, I decided to change the procedures of the analytical chemistry practicum by using a green chemistry approach. I applied smaller quantities of chemical substances and used substitutions for dangerous chemical substances. These elements of green chemistry approach reduced the quantity of dangerous chemical substances used (Lancaster, 2002). This reminds me of my negative experience in an organic laboratory 4 years ago. If only we had worked with smaller quantities, the accident may have never occurred. The toxic gas that I inhaled could be a result of the excess

quantity of dangerous chemical substances that we were handling. However, I have become aware that there was also a safety issue which affected the laboratory conditions.

The other problem that I encountered in the analytical chemistry practicum was safety. The analytical chemistry laboratory was inadequate to cater for 30 students, as it was over crowded. Sometimes, it was very difficult for me to observe all of my students' activities. It was also difficult to inhale fresh air. Most of the chemical substances used in the analytical chemistry laboratory were very dangerous. Therefore, it was very important for me to be concerned about the students' safety. On one occasion, one of my students did not wear a gas mask during an experiment. So, I asked, "Why aren't you using a gas mask?" He said, "I forgot to bring it." I then said, "You really should have one, I think you should either borrow one from a friend or you will have to leave the laboratory." It was challenging for me to discipline my students in the laboratory. However, I had the duty to educate my students to observe safety measures, as they would also one day become chemistry teachers who are responsible for their students' safety in the laboratory. I would often remember my accident. I did not want it to happen to my students.

I tried to minimize the interaction between my students and dangerous chemical substances. I substituted some dangerous solutions with others. For example, to determine the concentration of Iodium, we can use Arsenic Oxide, but it is very toxic. Therefore, I changed it to Iron. Sometimes, if I could not change the substances I chose another method that would not use any dangerous chemicals. I had many ideas to make changes but I also had to consider the limitations of university facilities and resources. I was also concerned with the waste from my laboratory with regard to environmental issues. My students used to dispose of their chemical waste directly into the washbasins. It was dangerous because the concentrated solutions can have negative effects on the environment. I remember the time when I observed the houses around my university.

2005
I am a Teacher Educator

Where is the Waste?

I am looking out the window of the third floor of our science laboratory. My eyes focus on the houses around my university. The houses are not in good condition because most of the people who live there come from a low income economic background. There is waste everywhere, dirty and stagnant water surrounds the houses, and there is also air pollution and an unpleasant stench. I glanced over at a place that is known as a public toilet. It is common that there are public toilets for use by the people in this area, but this one is not in very good condition. Looking at the laboratory room where my students are working on their practicum, I then begin to wonder about the waste produced by my laboratory. It may even pass through the living areas that surround the university. I know that there are some designated areas for laboratory waste, however, due to the high costs of waste management sometimes the waste treatment is inappropriately managed. As a result, it's possible for the liquid waste to be absorbed by the soil, consequently affecting groundwater resources. The water is then used by those people. Oh my God, how could this happen? There may be only a small impact now, but how about in 5, 10 or 15 years time? What could I do then?

These reflections encouraged me to implement a new rule for laboratory waste. The students would have to dilute the substances first before disposing of them. I asked students to recycle the chemical solutions, such as silver nitrate that is used as a titrant. These solutions can be recycled as a silver precipitation. However, at that time it was very difficult for me to supervise the experimental methods and recycling at the same time. I realised that the strategies I applied were very simple, but as a beginner teacher I felt that it was within my duties to do something, not only as an educator who has a responsibility to shape my students' learning, but also as a human who has social responsibilities to society.

Later during the co-teaching in 2010, I tried to incorporate different approaches to engage the students in sustainability education. I introduced green chemistry elements in an attempt to stimulate students' awareness of environmental problems. I also provided several articles relating to environmental issues. The articles were distributed amongst the students so that they could discuss them in groups. They

presented their discussion and findings to the class. I also conducted group discussions outside of the classroom. The students seemed happy and actively engaged in the discussions about environmental issues. According to Chambers and Rowell (2007), topics of environmental issues in science curricula can promote students' awareness of the social, economic and political dimensions in society. Hence, I have become more concerned to find additional methods that can be applied in my future pedagogical practice. I have found that it is highly effective to stimulate students in real-life situations as it helps them to examine their knowledge and awareness of the environment. When I recently introduced ideas of green chemistry to the students and my co-teachers, they agreed that the concept would be excellent to implement during practical work in the science laboratory. However, I was not able to provide an in-depth understanding of green chemistry, they could be only be guided by my strategies without understanding the true value of sustainability education in green chemistry. The story below represents one of my experiences while implementing a green chemistry approach.

August 23, 2010
I am a Co-teacher

Should I put one drop?

I arrive at Southgate school at around 9.30 am. The chemistry practical is due to start at 10.50am. As per our usual routine, the teacher and I decide to plan Monday as a practical day. Therefore, I come in early because I have to prepare some equipment and substances for the practical, while the teacher is still teaching in another class. So far, teaching science at this school has been quite challenging, not only because of the cultural differences but there are also language barriers, academic achievement, and students' behaviour as well as human resources needs to be considered. For example, the school does not have a laboratory assistant; therefore, the science teacher experiences difficulties in managing time in preparing for laboratory activities. As a result, this situation discourages them to engage the students in practical activities.

I planned some activities with the teacher a couple of days ago, and we agreed that the practical activities should allow students to relate their daily lives to environmental sustainability. Therefore, as it is an acids and bases practical, we use everyday products such as dishwashing liquid, soap, shampoo, vinegar, lemon,

tomatoes and many others. Then, we try to minimize the use of chemical elements. For example, for standard acids and bases, which are HCl and NaOH, we use a diluted concentration of 0,1M. In the laboratory, the available concentrations of NaOH and HCl are 2M and 4M. Since the purpose of the activity is to identify acids and bases and their pH levels, the dilute concentration is still suitable for use. Then, for the identification, we use white depression tiles, so that the students will only need to use small volumes of chemical substances and samples.

After I finish preparing the equipment and substances it is already 10.50 am, and the students are waiting in front of the laboratory. The teacher asks them to come in and prepare for the activities. The first student who comes into the laboratory is the first to say Salam to me, "Assalamu'alaikum Sister Yuli". I say: "Wa'alaikumussalam, Isa". He walks over me and says, "I got the best mark for today's quiz, and I am so happy about it". "That's great Isa, well done, please keep up the good work". "Thank you sister Yuli", he says as he turns to go to his desk. Since I've become the co-teacher in this class, I have noticed that the students enjoy sharing their feelings. This makes me realise that empowering others needs caring. All of the students are now in the laboratory room. The teacher starts to explain the main concepts of today's activities. I then explain the activities in detail to the students. I start by telling them that today we are going to start implementing green chemistry in our laboratory activities. I had explained the term green chemistry when we began teaching chemistry as a topic in the classroom. Then, I tell them that the simplest thing to do is to minimise the amount of chemical substances that are used in the laboratory. A couple of days ago, I had asked the students the question, "Where do they throw their waste from the laboratory?" All of them answered, "Into the sink". I asked them to think about where the chemical waste might travel. They told me that they realised it would be going through the water and soil around the school. I then asked them to think about whether they could do something to save the environment, such as minimise laboratory waste by using smaller quantities as well as using less dangerous chemical substances. Therefore, in the acids and bases practical today, I advise them to use just one drop of universal indicator on the sample. Since they are going to use a tile, they only need to use three drops of the sample and one drop of indicator to identify acids and bases.

I have learnt that there is a process to engage the students with education as sustainability, not only in becoming aware of environmental sustainability, but also in actively participating in campaigning for the idea. I can see that the students don't always follow the rules; they tend to use more drops of indicator and chemical

substances than necessary. I can also see that since I have been observing the students they are more likely to change their behaviour. One student asks, "Should I put one drop? The colour is not really clear". I tell her to wait since there has not been enough time to allow the substances to properly combine. Then I tell them to mix it, and then they notice a change in colour. Sometimes the students are too impatient to wait for change to occur. They prefer to use large amounts of chemical substances to achieve an instant result. Sometimes, we simply aren't aware of how much our actions and behaviour can affect the environment because we cannot see the immediate reality of the problem. When we dispose of the waste into the sink we never know exactly where it is going. It will take time to empower the students, but at the very least it could be beneficial for them to begin thinking about it.

Although I was aware that the process of engagement would take an enormous amount of time and energy, but I was quite happy that the students seemed to have started to think about their roles in environmental sustainability. The teacher at this school had also begun to demonstrate a level of concern regarding laboratory waste management. However, it is also important to bear in mind that teachers can return to their 'previous practices' once co-teaching has finished. I became increasingly aware that all the strategies that I had applied only focused on how the practicum could be effective and how it could become more environmentally friendly. The implementation of green chemistry by the students took place within the school laboratory, but the value of sustainability itself might not have been internalised in their daily lives and their roles in society. Thus, I understand that encouraging them to be aware and actively participate in sustainability is an ongoing challenge for my pedagogical practice. I have found that most research studies focus on how to create procedures of chemistry processes that involve green chemistry approaches, not on students' deeper empowerment via sustainability education. Finally, I conclude that although it may be challenging to empower students as agents for sustainability of the environment this experience has sustained my commitment step forward to develop my student teachers in my home country as agents for sustainability.

I Will Face Challenges

I realise that I have been empowered through my learning experiences at SMEC and my reflective writing. However, I have also realised the challenge to stay empowered

while holding the value of sustainability education in my teaching identity. I remember a disempowering journey when I sat the exam of an environmental chemistry unit when I was a student teacher. I had assumed that environmental education should provide students with opportunities to engage with environmental problems arising from lived reality, rather than simply recalling the knowledge.

1998
I am a Student Teacher

I Have Failed

This week is the mid semester exam, I feel stressful every time an exam is approaching. Sometimes, I cannot sleep. I also have a decreased appetite and I feel much too stressed to deal with exams that require me to memorise things and recall my knowledge. Today is the day of my exam for an environment unit. I am really not confident to sit the exam today, since last night I can't remember all the content. I had not slept well. I walk slowly into the classroom and find a chair. I try to find a chair that is in the back row. I hope that this will reduce my stress. I sit down, attempting to read and remember all my lecturer notes, but I am getting more and more stressed when I look at my friends reading books and appearing confident. Finally the lecturer arrives and begins by explaining instructions for the exam. One of my friends who sit in the front row hands a blank sheet of paper to each student and my lecturer distributes the problem sheet. We are not allowed to open the problem sheet until instructions are given by the lecturer. Oh my God, I can feel the time start to pass by very slowly and the procedure makes me more stressful. I begin to perspire from the anxiety; I can feel my body go cold as I begin to feel unwell.

My lecturer gives the instruction to start the exam. When I open the problem sheet I am really surprised, not only because of the number of problems on the exam but also the questions. The questions require the students to have memorised the answers. I read the first question slowly, "What is the definition of each term below?" I begin to panic. I know I have read about all of those terms, but I can't seem to remember any of them. I read the next question, "What is the effect of these elements below on the environment?" Again, I can only remember a few of them. I don't know what is happening in my mind, as I can barely remember anything. I read through all of the questions; I then answer just a few of them before handing the paper to my lecturer. I tell her that I couldn't answer all of the questions and I would prefer to re-sit the exam and she agrees. Next week my lecturer announces

the results, and I am made aware that I have failed. I have to undertake a remedial exam. But even if I obtain a good result from the remedial exam, or get 100%, the maximum score will be counted as 70%. This rule seems to be unfair, but it is the rule. I begin the wait feeling even more stressful for the next remedial test, how can I achieve 100%? What will happen if I can only answer 50% of the exam questions? I sense another feeling of failure approaching me.

The story above really demonstrates a disempowering situation while undertaking an environmental course at my university. My experience during the course made me to realise that the environment course was about remembering environmental problems rather than carrying out actions to influence the environment. At that time, I believed that the goal was to encourage students' to have in-depth understanding of environmental problems, especially those caused by chemical elements. But why do we have to remember all of those chemical elements? Why do we have to remember all of the definitions? I realised that although it was important to recall the knowledge, even if I was to memorise the entire content of the exam, after the exam I may forget all that was previously memorised. So, is the aim of pedagogy to remember facts and knowledge? Is the aim of assessment only for making judgments and selecting students who have failed and been incompetent? Is the aim of teaching to get 100% of the students to pass their exams? I sincerely hope that my personal experiences do not have to be repeated by my students, especially the experience of that environmental education course.

The experience above is an account of when I was a university student. Then, I became a lecturer in that same university. When I began teaching, I have the responsibility to teach practical work. Teaching practicums in the laboratory is considered as training before teaching theory in the classroom. If I was to teach theory in the classroom it would take place as co-teaching with senior lecturers. I gained these experiences during the year before I moved to study in Australia. The story below represents my regular activities from the beginning of the semester whilst teaching an environmental chemistry unit.

2005
I am A Teacher Educator

What Is the Goal?

I am looking out for the chemistry lecturers' room. Due to the re-arrangement of the university facilities I am a little confused as I search for the room. Finally, I locate room 1.6 where I notice my colleague reading a book. Mrs Erni was my lecturer when I was an undergraduate student. I knock on the door lightly, as I am worried that I might disturb her concentration. Suddenly, she looks up at the door and sees me directly through the window.

Mrs Erni : "Hi Yuli, come in, I have been waiting for you"

I walk in slowly and sit down on the chair opposite her. The lecturers' room is not very big, but it is convenient for two people to hold a discussion. She looks at me and starts talking.

Mrs Erni : "So, will you be teaching environmental chemistry this semester?"

Me : "Yes"

I say it slowly. I have responsibility to teach the practicum subject and the senior lecturer will teach theory in the classroom. We need to have a discussion in order to determine the relevancy between theory and practicum in the classroom, which is why I am meeting her today. Miss Erni looks over at her cupboard before taking down a thin book.

Mrs Erni : "Ok, Yuli, this is the practicum book, You can use it as a guide, then I will be teaching the theory aspect in the classroom"

My department has two programs known as chemistry and chemistry education. The chemistry program is for the students who want to become chemists, while chemistry education is for students who want to become chemistry teachers. The environmental unit is designed for chemistry students. I remember the reason why this subject is not designed for the chemistry education students, as my colleagues had argued that chemistry teachers do not need knowledge on how to solve and work with pollutants such as water analysis pollutants in the laboratory. As a student at the time I did not agree with this reason. I believe that the chemistry teachers have a responsibility to give their students an awareness of environmental problems. My memory begins to flow, until Miss Erni's pen drops on the floor. Suddenly, I look at her and ask,

Me : "So, what is the goal of this subject in the laboratory? "

Miss Erni answers my question carefully. I think she remembers the way I asked the same question when I was a student

Mrs Erni : "The students have skills to analyse the pollutant because they will become chemists, these skills will be important for them, right? Just follow the laboratory procedures, that's part of the curriculum"

Hearing the terms 'just follow,' 'laboratory procedures', and 'curriculum' has already made me feel uncomfortable. This process seems to be entailed in the bible book of chemistry which can't be changed. I ask Miss Erni carefully,

Me : "So, they just follow the practicum procedure in the same way one would do with a cooking book?"

Mrs Erni : "Don't be too specific Yuli, the requirement is for them to have skills to analyse the pollutant"

Me : "How about the students' awareness of the environment? Is it not important?

Mrs Erni : "I know it is important, but how can you teach that and how can it be measured?

I keep silent, as I don't know how to answer the question at this time.

Mrs Erni :"Ok, Yuli, the lectures will be commencing next week, just prepare everything at the laboratory, good luck"

I leave the room questioning myself, "but what about environmental awareness?"

I learnt from this experience that the environmental unit should empower students to be aware of the environment, not only how to deal with the waste. Even after my students graduate from university, they might become chemistry analysts who work in laboratories to analyse chemical waste. It is possible that they could become the decision makers in a company that has influences policies relating to chemical processes and waste. In addition, my student teachers could empower their students as the next generations to participate in saving the environment. I believe that each of my students could become pioneers in their own roles in society. Therefore it is crucial to empower them through my teaching.

Finally, I have discovered that these two disempowering experiences have shaped my perspective on dealing with the university system and my colleagues. Although I accept my role as science teacher educator, I also understand the power of the

technical interest in focusing only on content of knowledge and strongly influencing my teaching practice, causing me to sometimes ignore the values of sustainability education. I have also become more aware that the values of sustainability education are not really deeply embedded in my teaching identity. Thus, I need to remain empowered to hold the values of sustainability education in my teaching identity, which is a real challenge.

CHAPTER SUMMARY

Writing this chapter stimulated me to think deeply about the power of sustainability education in my teaching identity. It was not an easy journey, because I had to think and reflect on my experiences, and uncover the 'black box' of my negative experiences in the chemistry laboratory. I also became more aware of the power of Islamic values and formal and informal education in sustainability education through my life experiences, including that which came from my family, as well as my school and teaching experiences which have shaped my values in sustainability education.

In writing about my roles as a chemistry teacher educator, a chemist, and an individual, I was stimulated to be critically aware of my responsibilities. I understand that it is possible for me to do something for the betterment of the environment. As a teacher educator, I can educate my students to be aware of environmental problems and develop their agency to participate in solving the problems, although it will require an enormous amount of energy and will be an intensive process. Their empowerment could potentially have a great impact on society, since they may one day become chemistry teachers who will also have a responsibility to educate the younger generations to participate in creating a better future environment. However, I became aware that I was particularly focused on education <u>about</u> sustainability by integrating it into topics, and that I was not moving forward to focus on students' values and empowerment. Thus, I engaged in reconceptualising my teaching identity in relation to the value of sustainability education. To put this into practice will be quite a challenge, since the education system in Indonesia tends to discourage students from becoming critical and reflective thinkers. I can see how chemistry is not simply a science subject in the classroom. It can and should a subject that is treated as a tool for the betterment of the environment. Despite limitations and

challenges, I believe that I can move forward to implementing education as sustainability by being an agent for sustainability education who not only has a passion in her teaching, but also the intention to empower my students to participate in a better future for the environment.

PART FIVE: REVISITING THE JOURNEY

CHAPTER 9

REVISITING MY RESEARCH QUESTIONS

INTRODUCTION

In The Line of…

In the line of understanding, I am standing
Looking back at the tough journey
I remember the black tunnels
I remember the endless ways

In the line of empowerment, I am standing
Looking back at the visions and the border
I remember the rainbow sky
I remember the bright light

In the line of the journey, I am standing
I see the light at the end of black tunnels
I see the arrows at the end of the ways
I see the rainbow sky with the bright light

In the line of journey, I am standing
It is a journey of struggling
Up and down, forward and backward
It is a journey of mixed feelings
Happy, sad, exciting, and miserable
It is a journey
A journey of empowerment and achievement

The poem above represents my journey in writing my doctoral thesis. The journey not only involves enrichment of my knowledge, but also enrichment of my personal emotions. It has been valuable and empowering journey for my ongoing lifelong journey. Thus, I write Part Five, the last part of my thesis, with the title "Revisiting The Journey", which comprises two chapters. Chapter 9: *Revisiting My Research Questions,* and Chapter 10: *I See The Light: The Journey has not Ended, It is Just Begun*. Chapter 9 is a revisitation of my four research question, and Chapter 10 consists of an envisioning of my pedagogical practice, my future research, and of the Transformative Education Research Group- Indonesia.

In Chapter 9, I reflect on my journey in revealing and reconceptualising my teaching identity through revisiting my research questions. I realise there is no single answer for my research questions; some questions create other new questions. However, the journey of exploring the 'answers' to my research questions has transformed my values, beliefs, and practices as a teacher. I have divided this chapter into my four research questions:

1. How do my experiences in co-teaching stimulate me to reveal and reconceptualise my teaching identity?
2. How can I reflect on my past science teaching experience to understand my science teaching journey in order to reveal and reconceptualise my teaching identity?
3. What are the roles of cultural identity, religious belief, transformative learning, and sustainability education in shaping my teaching identity?
4. How can the journey of revealing and reconceptualising my teaching identity help me to transform my future as a science teacher educator at my university in Indonesia?

REVISITING THE RESEARCH QUESTIONS

How Do My Experiences in Co-Teaching Stimulate Me to Reveal And Reconceptualise My Teaching Identity?

Co-teaching experiences with three different teachers from different backgrounds, including culture, religion, and personal experiences, stimulated me to think about how teaching identity shapes teaching values, beliefs, and practices. During co-teaching if I had only focused on transforming classrooms, without thinking critically about those practices, I would not have revealed and reconceptualised much about my teaching identity. Revealing and reconceptualising my teaching identity was a learning process of coming to understand myself more deeply, especially in my professional practice. I came to realise and reconceptualise the powerful dimensions of religion, culture, transformative learning, and sustainability education. As stated by Palmer (1998, p. 24), "as we learn more about who we are, we can learn techniques that reveal rather than conceal the personhood from which good teaching

comes". During my earlier teacher education, I learnt teaching techniques and chemistry knowledge which, at the time, I thought was enough for being a good teacher. At this stage, however, I realise the importance of reflective thinking in understanding ourselves as teachers. As I stated in Chapter 5, I had had various prior experiences with collaborative teaching, however, it was useful only during the official period of the project. When the project finished, the teachers were not empowered to continue transforming their practices. Thus, I came to realise that it is important not simply to engage in collaborative teaching, it is important also to reflect critically on our practices. Critical reflexivity will continue to be a powerful part of my future professional practice, because critical reflexivity has enabled me to identify ideologies that both support and restrain my life (Brookfield, 2000). During co-teaching with teachers and students from different socio-cultural backgrounds, I learnt to work with difference and develop empathetic relationships, to share control and power, and establish negotiability for mutual understanding. Thus, I experienced co-teaching as an empowering journey that helped to reveal key aspects of my teaching identity, and I learned to understand these differences which are powerful for achieving the next step of my professional practice.

How Can I Reflect on My Past Science Teaching Experience to Understand My Science Teaching Journey In Order To Reveal and Reconceptualise My Teaching Identity?

During my reflections, I felt challenged as it seemed that I had opened the black box of my personal experiences. I reflected on my past science teaching experiences by using several theoretical perspectives on the nature and history of science, science education, Habermas' three interests, constructivism, curriculum theory, and assessment. As stated by Habermas (1972, p. 198), "interest in general is the pleasure that we connect with the idea of the existence of an object or of an action. Interest aims at existence, because it expresses a relation of the object of interest to our faculty of desire", I came to realise the three interests had been shaping my way of thinking and my actions in interacting with students and dealing with different hegemonies. In reflecting with Habermas' three interests, I came to realise the strong power of the technical interest that had shaped my teaching values, beliefs, and practices, especially how I had strictly controlled my students' learning by focusing

solely on passing the examinations. Although, few of my past teaching experiences were strongly shaped by the practical interest and fewer still by the emancipatory interest, I came to realise the importance of including the practical and emancipatory interests in my teaching practice. Teaching is not simply transferring knowledge; it should be also be about student engagement and empowerment.

In relation to the nature of science and science education, I came to realise the narrow horizon of my understanding. I felt ashamed that I, as a teacher educator, didn't have a deeper understanding of fundamental ideas in the fields of science and science education. My understanding of the nature of science had resulted in the objective truth influencing the way I taught my students. As a teacher, I used to apply the language of 'transferring' knowledge, and this strongly influenced my thinking and actions. I 'abused' my students to unquestioningly accept my ideas as well recognised and accepted. I now know that this approach severely restricts students' thinking development, curtails their creativity, and separates their lived experiences from the learning process. As a result, these horrible learning experiences are likely to influence students' perceptions throughout their lives.

In reflecting on constructivism, I realised that my narrow understanding about constructivism as simply an instructional method was shaped by the didactic way I was taught during my teacher education. I had understood the importance of students' engagement in learning, but when it came to assessment I had neglected this aspect. Assessment was a powerful hegemonic source in governing my past teaching practice. I understood 'assessment of learning' rather than 'assessment for learning', and thus students' summative achievement was of most importance in my teaching. I had never conceived that assessment could help students to become thoughtful people who can improve their world (Superville, 2001).

When I reflected on Schubert's (1986) curriculum images, I remembered that ever since I was a student in elementary school most of my teachers used to teach me under the images of curriculum as subject matter, curriculum as objectives, and curriculum as planned activities. The picture that I captured throughout my early learning process was one of the teacher writing down the material on the whiteboard, explaining the material during the remaining time, then the class finishing with an

overload of homework. I realise that I was strongly shaped by these restrictive curriculum images in which "curriculum is quite often defined as a product- a document which includes details about goals, objectives, content, teaching techniques, evaluation and assessment, and resources [which are issued by government]" (Marsh, 2000, p. 66). Thus I came to understand how my experiences as a learner had shaped my past science teaching practice. As a teacher, I had aimed at finishing the list of topics in the curriculum rather than focusing on my students' understanding and creating meaningful learning experiences for them. Reflecting critically on past teaching experiences helped me to understand myself as a teacher within various hegemonic powers, and helped me to reveal and reconceptualise key aspects my teaching identity during the prolonged journey of writing this thesis.

What Are the Roles Of Cultural Identity, Religious Belief, Transformative Learning, and Sustainability Education in Shaping My Teaching Identity?

I came to realise teaching identity is not fixed, and thus the journey of revealing and reconceptualising one's teaching identity is endless. Throughout the journey of my doctoral study I began the process of reconstructing my own teaching identity. According to Palmer (1998), good teaching comes from the identity and integrity of the teacher, where identity means any 'forces' that constitute a teacher's life. Thus it is important for teachers to understand the invisible forces that shape their teaching identities. In my reflective journey, I discovered and reconceptualised key four dimensions - *cultural identity, religious belief, transformative learning, and sustainability education* that constituted the 'closed box' of my pedagogical thinking and practice. During my critical reflections, I came to realise that the journey of opening this black box is not easy.

In culture

I realised and discovered the power of culture in my teaching identity. Although I was born into a mixed cultural background, I realised that the power of each culture was not only shaping my personal identity but also my teaching identity. In the journey of understanding my teaching identity I explored my cultural identity, which was a challenging task. I endeavoured to understand who I am from within a cultural perspective. Although I am still questioning my cultural perspective, I realise the

power of different cultures -Javanese, Bimanese, Indonesian, and Australian on my cultural identity. These cultures have distinct values, beliefs, and practices which have been shaping me for almost 32 years. Aware of different perspectives and debates on the concept of cultural hybridity, I consider myself a product of hybrid isolation resulting from interactions of different cultures. This was a powerful insight as stated by Taylor (2008, p. 882), "a critically self-aware hybrid identity is greater than the sum of its parts because its fluidity offers new ways of being and innovative kinds of cultural meaning". In relation to my parents, who are also teachers, I could see how culture had shaped their different teaching identities, which was represented through interactions with their students and their values and beliefs about good teaching.

During the journey of co-teaching, I came to realise that culture shaped my co-teachers' teaching values, beliefs, and practices. According to White, Zion, and Kozleski (2005), culture and social interactions shape teachers' personality and teaching style which sometimes they are unaware of. However, I could not make any generalisations about the teaching identity of Asian and Australian teachers because I realised that culture is not the only factor that shapes teaching identity. It also can be influenced by personal experiences. The culture of Javanese and Indonesian which does not permit direct criticism of others influences strongly the way I interact with my students, and causes me to think much about what others are thinking about me. In Australian culture, I have learnt to develop a different relationship with students by engaging in open discourse and overt caring. I realise that my students have their own cultures which they bring to the classroom, which could be both a source of power and a problem at the same time. According to Taylor (2008, p. 882), "...science teachers sensitive to a sociocultural approach to teaching for cultural difference and diversity involve concepts such as equity, language, multiculturalism, identity, and social justice in the multiple ways of knowledge construction, representation and communication". Thus, I realise it is important to become a culturally responsive teacher.

In religion

I discovered that religion is a prevailing dimension of my teaching identity, because both of my parents are religion teachers and are also religious people who educated

me with Islamic values since I was a child. In the education system of Indonesia, Religion is one of the school subjects, from primary to university level. Thus, I grew up with Islamic values. Islam became my way of life and shaped my values, beliefs, and actions in all roles of my life, including teaching. Islam as my religion is the source of my spiritual identity; as stated by Kiesling, Sorell, Montgomery, and Colwell (2006, p. 1269), "*spiritual identity* as a persistent sense of self that addresses ultimate questions about the nature, purpose, and meaning of life, resulting in behaviors that are consonant with the individual's core values".

Islam puts high reward on being a teacher, and this has motivated me to become a good teacher, one who is not only professional but also empowering. The basic principles in Islam, which I have described in Chapter 6, have inspired me to become a good teacher. In addition, I have realised that science and Islam are not necessary in conflict with each other. Combining them in harmony helps me not only to integrate them in my teaching, but also deepens my belief in Islam. Islamic values also shape interactions with my students. I believe that good Islamic practices should shape my students' roles and contribute to their future and to them making a better future for their society. Although, I have to deal with other hegemonies, such as curriculum and assessment, Islamic values help to deal with them. Getting a blessing from Allah for being a good teacher is more important than getting a blessing from a human for following the hegemonies of curriculum and assessment which sometimes compromise my empowerment. As a science teacher, I don't have any problems about the relationship between Islam and Science, although there are debates on the conflict of religion and science. As stated by Seng (2006) (refer to Chapter 6), the conflict between religion and science is due to differences in ideology in basic beliefs and understanding God, which is part of religion, is under the ideologies of idealism and theism, while science is under materialism and atheism. The controversial relationship between Science and Islam caused me to realise the hegemonic power of religion in my teaching identity, but I use this hegemonic power to empower myself for being a good teacher.

In transformative learning

I started to envision myself as a transformative educator when I finished my master's project. I planned to apply transformative learning in my home institution; however,

since I had the opportunity for a doctoral degree I took the challenge which involved co-teaching with different teachers in Australian schools. As I stated before, co-teaching stimulated me to reflect on the role of transformative learning theory in my teaching identity. According to Mezirow and Taylor (2009, p.22), "transformative learning may be defined as learning that transforms problematic frames of reference to make them more inclusive, discriminating, reflective, open, and emotionally able to change". Merizow and Taylor (2009) also point out three core elements that frame a transformative approach to teaching: individual experience, critical reflection, and dialogue.

I developed three dimensions to my personal theory of transformative learning: (1) constructivism as a referent, (2) empowering teacher-student relationships, and (3) dialectical thinking to help me remain empowered. Taylor's (in press/2013) recent article on transformative education for science educators also has powerful guidelines for transformative teaching based on five ways of knowing to be involved in transformative learning:

- *Cultural-Self Knowing* (self-realisation) involves coming to understand our culturally situated selves, in particular how the (mostly invisible) premises underpinning our worldview – our shared values, beliefs, ideals, emotionality, spirituality – give rise to our cultural identities and govern our habituated ways of being in, making sense of, and relating to our social and natural worlds.
- *Relational Knowing* (opening to difference) involves learning to connect empathically and compassionately with our true (nonegoic) selves, our local community, the culturally different other, and the natural world.
- *Critical Knowing* (political astuteness) involves coming to understand how and why (political, institutional, economic) power has structured historically our social realities by creating seemingly natural categories of class, race, gender, vocation, intelligence, etc., and how this mostly invisible power governs (especially distorts) our lifeworlds, our relationships with others, and our relationship with the natural world.

- *Visionary and Ethical Knowing* (over the horizon thinking) involves us in creative, inspirational and discursive processes of idealising, imagining, poeticising, romanticising, meditating on and negotiating a collective vision of what a better world *could be* like and, importantly, what a better world *should be* like.
- *Knowing in Action* (making a difference) involves consciously developing our capacity to help make the world a better place, committing to making a difference, and taking action locally while thinking globally.

In these concepts, I found that transformative leaning is powerful and holistic and creates different views on my role as a teacher educator. Thus, the journey at SMEC within transformative learning has embedded transformative learning in my teaching identity.

In co-teaching, I experienced a struggle to stay empowered as a transformative educator when I was in classrooms facing different hegemonies that influenced my teaching practice. During my auto/ethnographic writing, I also came to realise my narrow understanding, my slender transformation process, and my floating thinking on the meaning of transformative learning itself. This led me engage in the process of reconceptualising the values of transformative learning in my teaching identity. However, I believe the power of transformative learning in my teaching identity will enable me to remain empowered when I return home. I realise that it is difficult to create empowering learning experiences, especially within the hegemonic power of the technical interest in my country. However, dialectical thinking will enable me to face the dilemma of transforming myself and my students, and understanding different (competing) views within my professional practice. The dialectical tension between students' different learning metaphors, by Willison and Taylor (2006), encourages me to think about how it can shape my pedagogical practice. I can imagine that if I align myself only with the 'objectivism' metaphor this will shut down my creative and critical thinking. However, I also could not align myself only with the 'constructivism' metaphor because this would alienate me from the curriculum reality of my country which focuses largely on subject matter and measurement. I need to deal with differences by understanding that my colleagues

have different views, my students have their own ideas, and my system also has different perspectives.

In sustainability education

I also came to realise and reconceptualise the power of sustainability education in shaping my teaching identity, not only because of my 'Green Chemistry' master's project, but because of my core life values since childhood. Environmental problems, especially in my country, are getting worse, particularly air pollution in Jakarta which is one of the worst environmental problems in the world. I have come to realise that I can contribute to solving these problems, not only as a teacher educator, but also as an individual. I have realised the role of my religion, my parents, family and school in shaping my environmental education. My awareness started from my parents' education which provided basic values in sustainability education. Furthermore, in my religion, we believe that God creates Earth and its resources should be cared for, not to be destroyed. How beautiful the world could be if among humans and other living beings can live in harmony with the Earth. As an individual, I believe that starting to do something, even if sometimes it looks too simple, is much better than doing nothing. According to McKay and Bonnin (2007), a third of the water in the house is using for showering, if every person can take a shower for only 5 minutes it could save 15000 litres of water. As we know, only 3% of the world's water is fresh, and only a third of that is available for human consumption. Thus, simple things for 'green action' can be done in the household, such as reducing soap for washing, reusing plastic containers, reducing bath time, and reducing use of the clothes dryer machine.

Reflections on my journey of implementing green chemistry helped me to reconceptualise the values of sustainability education in my teaching identity. I believe that I should empower my students to change the world, and that I could use green chemistry to achieve this. Although during my science teaching experiences, I haven't much focused on empowering students in campaigning for a better future for the environment, I realise that it is empowering for my next agency. I also have realised the limitations of my earlier teaching of sustainability education. According to Sterling as cited in Chansomsak and Vale (2008), sustainability education can have three forms: education <u>about</u> sustainability, education <u>for</u> sustainability, and

education as sustainability. Education about sustainability focuses on the content, education for sustainability accentuates the purpose, and education as sustainability means empowerment and action. Education as sustainability will provide opportunities for individuals to become critical and reflective thinkers and lifelong learners (Blewitt, 2006). Therefore, I remind myself to be aware of environmental problems and sustainability, and to move further towards education for sustainability and education as sustainability. Thus, I want to further empower myself to be an holistic individual who not only has knowledge but also a soul to be integrated into my practical life as well as for empowering my students.

How Can The Journey of Revealing and Reconceptualising My Teaching Identity Help Me to Transform My Future As a Science Teacher Educator At My University in Indonesia?

The research in co-teaching was a personally transformative journey that challenged my newfound identity as a transformative educator. I came to realise how the four dimensions of culture, religion, transformative learning, and sustainability education are shaping my teaching identity. This critical awareness helped me to develop 'new eyes' and higher-order thinking and feeling (Brookfield and O'Sullivan's study as cited in Pereira, Settelmaier, & Taylor, 2005). Thus, in my future role as a science teacher educator, I will look through my 'new eyes' in using these four dimensions to empower my pedagogical practice.

As an educator who lives under the hegemonic power of the technical interest, I will bring the values, beliefs, and practices of my culture and religion to lead my way as a professional science educator. In my culture, teachers are recognised as 'good people' who educate society and who should be followed and respected. With 'new eyes' that can see the hegemonic power of culture, I will recognise and accommodate the different cultures of my student teachers. My religion also provides higher rewards for those who teach knowledge to others and the most valuable people are considered to be those who are useful to others. Other dimensions of transformative learning and sustainability education will guide me to educate my student teachers as holistic individuals who care for their environment. The three dimensions of personal transformative learning that I have revealed and reconceptualised in this research will

guide me to remain empowered as a transformative science teacher educator. I will continue my passion for green chemistry by moving forward to education for sustainability and education as sustainability. Thus, these four dimensions in my teaching identity will help me to continue developing my professional practice.

In relation to my journey in revealing and reconceptualising my teaching identity, my role as a science teacher educator empowers me to reflect on how I can help my pre-service student teachers to better understand their own teaching identities. It is important in my context since my university is one of the leading pedagogical universities located in Jakarta. A large number of teachers in Indonesia have graduated from my university. Therefore, in this context, I realise that it is important for me to help my student teachers to develop their own teaching identities, so that they can be good chemistry teachers who have passion for their teaching, who understand their profile as teachers, and who can re/negotiate their identity in their contexts and within the borders of the education system.

As a science teacher educator, I realise that my student teachers will have the experience of border crossing between educational theory and classroom practice. My student teachers need to understand their teaching identity in order to smoothly cross this border. During the transition, there are likely to be "some feelings of isolation, mismatch between idealistic expectations and classroom reality and lack of support and guidance" (Flores & Day, 2006, p. 219). Therefore, as a teacher educator, I need to facilitate their transition through exploring their identities, because during the teacher education program student teachers start to form their identities as teachers (Witt, 2011). There have been several research studies on how to help student teachers in teacher education programs to reveal and reconceptualise their teaching identities. Hoffman-Kipp (2008) used cultural historical activity theory through praxis and socialisation, Graham and Phelps (2003) used metacognition and reflection, and Cattley (2007) used writing as a reflective log. This research recommends reflection as the best way to reveal teaching identity. Our student teachers need to be aware of how their teaching identities shape their roles as teachers who are responsible for the future of the young generation.

Throughout the writing process in this research, I came to realise how this study has encouraged me to think deeply, reflect critically and imagine creatively. I have become aware also that writing as a process of inquiry is tough, challenging and empowering. Within the limitations of myself and my research, I hope that I can engage my readers in revealing and reconceptualising their own personal teaching identities.

CHAPTER 10

I SEE THE LIGHT: THE JOURNEY HAS NOT ENDED, IT HAS JUST BEGUN

To be a human agent ... is to participate at least potentially in a speech community ... but no agent can be potentially a member of a speech community who cannot recognise the difference between true and false statements in some general way
(Habermas)

Real knowledge comes from those in whom it lives.
(John Henry Newman)

INTRODUCTION

This chapter is the second chapter of Part Five which portrays on envisioning of my future professional practice. The journey in my doctoral study has been very empowering, as well as challenging, and has created a vision for my future. This chapter is divided into three main sections:

1. **My Pedagogical Practice**

   In this section, I portray a vision for my pedagogical practice. This envisioning arises from my journey both in co-teaching and the doctoral study, and focuses on my passion for transformative education.

2. **My Future Research Practice**

   I portray my vision for my research practice. I am aware of the challenges I will face when I return to my home country. However the journey within different research paradigms has elicited my passion for transformative research.

3. **Transformative Education Research Group Indonesia (TERG-Indonesia)**

   This section portrays my vision for creating and developing a Transformative Education Research Group in Indonesia. As a first step, I have developed a website for TERG-Indonesia and a Facebook group to describe my vision and

mission for embedding transformative education in Indonesia. These will useful for developing a network with my other colleagues in TERG-Indonesia.

2012
I am a Doctoral Student

Welcoming another Journey

I walk to the front office of the Islamic school. Today I have an appointment when the school manager to talk about my daughter's school because we plan to return to our home country in this final year. After talking to the front office staff, the school manager with his friendly face says 'salam' and asks me to sit. After replying his salam, I explain my purpose in meeting him. We start talking about education and living in Indonesia and Australia. He comes from Indonesia and has spent most of his professional life outside Indonesia, including Singapore and Malaysia. I tell him that I would love to stay in Australia with its comfortable lifestyles, including working. However, my heart also calls me to contribute to my society in Indonesia.

The School Manager : *"After my experience in moving from Indonesia to other countries, I still have want to go back to Indonesia, may be later. I miss the values, beliefs, and practices in that society. Maybe we can survive, but how about our kids and the next generations, I am worried they will lose their culture and religion"*

Me : *"Yes, it is really difficult if we talk about culture and religion, basic education from the family is very important"*

The School Manager : *"There is something that can't be replaced, the values of living in our society, the environment that has shaped our thinking and practices, the relationship with family and society members. Even though living in Indonesia is not a perfect life, it is our culture and religion that is practiced in our society that make us feel happy and comfortable"*

Me : *"Yes, I agree, I have missed that. I can see the differences, it cannot be replaced. Especially, when I think about my daughter, I ask myself what values,*

beliefs, and practices will shape her way of life if she lives here without strong educational values, culture, and religion from me and my husband"

The School Manager : *"Yes, I always ask the question, why do I live here? What are the aims? Is for a job and for wealth? Are those the most important things in our lives? As a moslem, Allah's blessing is the most important. What can we do for helping others? What can we do better future? What can we do for helping our society? What we can do for maintaining our culture and keeping our religious practices for future generations? I don't say living in Indonesia is perfect, I also can't say living in Australia is happily ever after, but success in the world, a good profession and wealth is not everything. As a moslem, we believe in the day after our lives, when happiness forever is coming. Allah loves moslems who can contribute and help others"*

Me : *"Yes, I do realise that, I can contribute more in Indonesia. You can imagine, if I teach my student teachers then they become empowered science teachers who educate their students for a better future for our society, which is so valuable. I also can help more unfortunate people or give education for poor families, many things. I also feel comfortable if my child is growing up in Indonesia with our extended family and our society. Uff, yes, I just think about the good life and working in Australia. I am worried about difficult living conditions in Indonesia which have almost forgotten the purpose of our lives as moslems"*

The School Manager : *"Look at how much you can contribute in Indonesia. Do you remember there things that continue to get reward from Allah after our death: charity given to others, knowledge given to others, and my child's prayers? You definitely have a great opportunity to have those three. Teaching in Indonesia is much more useful in terms of give knowledge to others, the knowledge will be passed from your student teachers to their students and to next generations. Having*

children who have good Islamic values who can pray for you, then giving charity to others, these are most important in our lives as moslems"

Me : *"Thank you so much, I am feeling more motivated to return to Indonesia"*

The School Manager : *"Yes, you are still young, you still have many choices, just think about it. I wish you all the best for your future and take care"*

Me : *"Thank you so much, this has been such an insightful conversation"*

After an hour-long conversation, I am thanking him for the powerful conversation. I am feeling more motivated to return home. Sometimes, I need to be reminded about the purposes of my life. After this long journey, too many things have happened to change my mind about returning to my home country. I am ready to welcome another journey.

The story above is my experience of meeting the Islamic School Manager in the last part of the journey of my doctoral thesis. I cannot ignore that I feel comfortable living in Perth, and this sometimes stimulates me to think about continuing to live in Perth rather than returning back home. He stimulated me to reflect critically on my values which have strongly shaped my personal identity and my teaching identity. I also remember my journey throughout my master's and doctoral degrees which have been very important in contributing to my vision for creating a better future for my society and for empowering my students as the future generation. The social, cultural, and academic environment in Perth has been powerful in shaping my individual and professional life, however, it is time for me to go back home to contribute my professional knowledge and skills to my society.

MY PEDAGOGICAL PRACTICE

Reflections on my teaching practice and teaching identity have helped me to envision my future pedagogical practice. As I stated before, I will continue my commitment as a transformative educator who has a passion for educating my students as holistic individuals, who understand deeply and reflect on their lives, and for empowering their agency. I will use that content as a tool to empower my students as imaginative thinkers. For example, I could use teaching strategies that develop their imagination,

through constructivism as a pedagogical referent. According to Fensham (1988), teachers should "act as couriers" who bring the science curriculum into students' lives. I will be concerned to empower my students as social agents to participate in creating a better world without ignoring their holism as individuals. I believe that every student is "an active initiator and reactor" for his or her environment (Marsh, 2000, p. 215). My students could use their out of school experiences to connect them with their school subjects. It is important to empower my students to dialogue with their experiences (Pinar & Reynolds, 1992). I also need to explore "my students' motivations and feelings about learning as important as the content of learning" (Arnold, 2005, p.19). Moreover, according to Apple (1997), we need to work together with other groups, such as decision makers, to balance the influence of social, political, and economical factors. I realise that decision makers are able "to make specific decisions about what is to be taught, when, how and to whom" (Marsh, 2000, p. 361). Therefore, I hope that as a teacher I could bring my voice to my society.

I am now aware how my earlier assessment practices have shaped my students' character as passive, test oriented, and less motivated learners. By contrast, innovative modes of assessment can help students to become thoughtful people who can improve their world (Superville, 2001). There are five assessment factors that can improve the learning process: provision of effective feedback to students, active involvement in students' learning, adjusting teaching with assessment results, and the need for students to assess and improve their own learning (Assessment Reform Group, as cited in Parkinson, 2004). Thinking about assessment stimulates me to reflect on the aims behind teaching and learning in my classroom. Rather than focus solely on maximizing students' grades and drilling them to pass the exam, I will also try to focus on maximizing my students' learning and help them to become self-regulated learners. Even though I have to deal with the reality of my country where the grade determines the quality of teachers, students and school, I will endeavour to give them good quality feedback, both often enough and in enough detail as a way to improve their learning (Gibbs & Simpson, 2005). Focusing on students' learning and shaping them as holistic individuals, lifelong learners, and 'good citizens' will be the concern of both my assessment and pedagogy.

MY FUTURE RESEARCH PRACTICE

During the experience of working in different paradigms, I have realised that each research paradigm has its own strengths and limitations. Therefore, I believe that it will be powerful for me to integrate different research paradigms. I don't want to be trapped in the hegemony of a single paradigm as this would not be helpful for my country. I could say that transformative research design will guide my research practice. However learning from my own experiences as well as my colleagues' experiences when they returned home after postgraduate study overseas, I realise the importance of dialectical thinking and empathy with differences. Thus, I will create the Transformative Education Research group (TERG)-Indonesia, which I describe in the next section, to help me stay empowered. Finally, at the end of writing my doctoral thesis, I realise that it will be my starting journey in my country. I am really struggling to finish this thesis, not only because of my language limitation, but also to demonstrate critical reflection aimed at understanding myself and my professional practice. Sometimes, I feel trapped inside my own experiences and the problems in my country, which makes me feel miserable. Sometimes I just sit down in front of the computer and watch the screen many times without writing anything. However, I have come to realise the power of writing as a process of inquiry, even though it is tough and challenging.

TRANSFORMATIVE RESEARCH GROUP (TERG) INDONESIA

I will create TERG to support my vision as a transformative educator. At this stage, I have created: (1) a TERG Indonesia blog on the http://transformativeresearchgroupindonesia.wordpress.com/ , and (2) a Facebook group on http://www.facebook.com/groups/156160677840849/. This will help me to create a network with TERG groups in other countries (e.g. Nepal, Mozambique, Philippines, and Japan), with my colleagues as well as with my student teachers. These two media will help me to express my voice on transformative education, empower others for changing the world, especially in education, and also help me to stay being empowered in order to create change. I realise that it will be a challenging journey, however, my journey experience in Australia will be one of the sources of motivation, knowledge, and skills for dealing with the reality in my home country.

Writing Part Five has stimulated me to revisit the aims of my research journey and to envision my future direction, which involves my imagination and creativity. This rich journey has created new meaning in understanding my identity and my teaching. I am a teacher who started a journey to becoming a good teacher by understanding her teaching identity. I am a teacher who started to understand different forces that constitute my life journey within my professional practice. At this stage, I am ready to say ‘welcome to another journey’.

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APPENDICES

Appendix 1- Going Back Home

July 20, 2007

Going Back Home

As I slowly approach the department office, I feel a rush of excitement as I am about to meet my colleagues who I haven't seen since I undertook my master's degree at SMEC, Curtin University of Technology. During the last semester break, I spent some time in my home country, Indonesia. Even though it was only for two weeks, I was extremely happy. Not only was I able to reunite with my family, friends, colleagues, and students, but I also felt very excited about sharing my new knowledge and experiences which I have gained whilst studying at SMEC. I noticed some students who were gathering outside the room. They looked really surprised to see me. After having a short chat with the students, I enter the office.

Me	*: "Assalamualaikum"*
Mrs. Tina	*: "Wa'alaikumussalam, Ya Allah, Yuli…is that you? How are you?*
Me	*: "Yes, it's me, Alhamdulillah, I'm fine. How are you Mrs. Tina?*
Mrs. Tina	*: "Alhamdulillah, I'm fine too, are you on holiday? It seemed like it was only a few months ago that you left Indonesia, your study hasn't finished yet has it?"*
Me	*:"No, it hasn't finished yet, I am just on holidays for two weeks"*
Mrs Tina	*:"Thank you for coming, unfortunately the other lecturers are still in class at the moment, and I have an appointment with students regarding their research"*
Me	*:"That's Ok, I'm not in a hurry, I want to meet a few others, I will be waiting. Please take your time, I will be fine"*
Mrs Tina	*:"That's Ok, the students haven't arrived yet. We can have a chat while I am waiting for them"*

The conversation continues. We discussed about my study, life in Australia, and my family. Mrs Tina is a very friendly and helpful lecturer. She was my lecturer when I was a student at the same university and I enjoyed sharing conversations with her. We heard the voices of "salam" from the students.

Mega, Asti, and Dina	*: "Assalamu'alaikum"*
Me and Mrs Tina	*: "Wa'alaikumussalam"*
Mrs Tina	*: "Please come in, I have been waiting for all of you"*
Mega	*: "Mrs Yuli, how are you? It's really surprising to see you"*
Me	*: "Thank you, Alhamdulillah, I'm fine, it's nice to see all of you as well"*
Mrs Tina	*: "Ok, I think we can begin our discussion about your research, how is it going?"*
Asti	*: "We have started looking for the literature on the bilingual classes"*
Dina	*: "But, we are confused about how to develop the teaching resources and its lesson plans"*
Mrs Tina	*: "That's Ok, we can start step by step"*
Me	*: "Ehm, may I know what the research is about?"*
Mrs Tina	*: "It's about developing teaching resources for bilingual classes in the chemistry subject. Some schools have been using English as the language of instruction"*
Me	*: "That's good, but it must be a big challenge for the teachers"*
Mrs Tina	*: "Yes, it most certainly has been. Hence we have made the intention that after we develop the teaching resources and lesson plans for our research, we would like to measure the effectiveness of these teaching resources and lesson plans"*
Me	*: "How will it be measured?"*
Mrs Tina	*: "We will give questionnaires to both teachers and students. The questionnaire consists of several closed questions which are based on the scale of effectiveness. Then the participants can respond through the different Likert scales"*
Me	*: "So in that case you will be using statistics to measure the effectiveness, is that correct?"*
Mrs Tina	*: "Yes it is, do you have any other suggestions?"*

I pause and reflect for a moment. I understand what challenges I might face when I return to my previous university and introduce new ideas in relation to research paradigms, postmodernism, auto-ethnography, personal experiences, stories, metaphors, and poems. However, I am quite pleased because not all of my colleagues have focused exclusively on the positivist paradigm. They seem to mix positivist paradigm when doing interpretive research.

Me : *"Have you tried asking teachers if they would share their personal experiences whilst using the teaching resources and lesson plans?"*

Mrs Tina : *"What do you mean by sharing personal experiences?"*

Me : *"I mean we can ask them to write a story, such as writing reflective journals"*

I try to use the term 'reflective journals' to represent the idea of personal experiences as data, and not to surprise them.

Mega : *"Do you mean asking them to write their experiences and then use them in these resources?"*

Me : *"Yes, that's right, what do you think?"*

Mrs Tina : *"Story? What kind of story? Is that considered data? And with personal experiences, what is the method for this?"*

Me : *"There is a methodology that is called auto-ethography which can be shaped under interpretive, post/modern, and critical research paradigms. In this research, personal experiences become powerful sources of data"*

Mega, Dina, Asti :*"Research paradigms, post/modernism? What is that? Can you translate them into Bahasa?*

Me :*"It's a little bit difficult to translate, but I can give one example. We can translate research paradigms into paradigma penelitian, which means the fundamental view of the world which influences peoples thoughts and actions. In education, it influences how researchers conceive their research, thereby trying to justify personal practical truths with meaning and understanding"*

I tried to explain my suggestions in simpler terms, staying away from words such as epistemology and ontology, even though it would be accurate to use these terms. In addition, I also have to consider my colleague, Mrs Tina, because we are discussing this in the presence of the students.

Mrs Tina : *"Ehm..I think it is complicated"*

Me : *"Yes, I realise that"*

Dina : *"Ehm..I can think about using some of my personal experiences. I remember some of my experiences when I was a student and one of my teachers taught chemistry by using English as an instructional language"*

Me : *"Yes, that will be great as well"*

Mrs Tina : *"But, yuli, I am not sure we can do that because I doubt that a story which involves personal experiences can be data. How can you measure the validity of that kind of research?"*

Me : *"Ehm..there are the other ways to ensure the 'validity' in research. It is not done by using statistics. It is more on personal perspectives of how the research can engage the readers and empower them to reflect and reform their practices"*

I tried to use words that relate to positivism paradigm such as validity and measurement. I also made simple explanations rather than using pedagogical thoughtfulness and praxis. I am unsure if I have explained it clearly, however, it is difficult to find the exact translation in bahasa.

Mega :*"It seems interesting"*

Asti :*"Yes, it is really different"*

Mrs Tina :*"But Yuli, I don't think it will be appropriate to implement in this kind of research. It's really difficult to make sense of it"*

Me :*"That's Ok, may be after I've completed my studies, we can discuss it further"*

As we concluded the conversation, I realised it could be an uncomfortable situation for my colleague to explore auto-ethnography as a self-study. I tried not to explain it in too much detail so that it would not confuse them. I chose to speak patiently about my new perspectives. At that time, I felt it would be best to pursue this perspective after I've completed my master's degree; the time would perhaps enable me to develop a deeper understanding on this research. I also had to anticipate the unexpected expressions and opinions from my colleagues and students.

Appendix 2 – Don't Say the Old Paradigm

My journey continued on after I completed my master's degree, when I returned home. At that time I had received my doctoral scholarship from the same institution (SMEC, Curtin University). I was home for approximately three months while applying for a new student visa. During this time, I worked at the university which I used to study at. I still felt empowerment for transformative research design. Therefore, I asked the head of my department to allow for the opportunity to present my learning experiences at SMEC and the transformative research designs to my colleagues. At that time, I feel that I was probably over confident. However, I also felt it was important to stimulate my colleagues to open the new doors in educational research. Although I was only home for three months, it was important for me to share my empowering experiences, rather than keeping them to myself. Thus, it would also help me to prepare for my "revolution" journey when I return back home following the completion of my doctoral study. The head of my department allowed me to present the topics in the upcoming lecturers' meeting which was held every Wednesday. The following is an account of my experiences when I delivered the presentation to my colleagues.

2008
I finished my Master's Degree

Don't Say the Old Paradigm

I walk slowly to the meeting room. Oh, this is the moment I start my journey to begin empowering my colleagues with new ideas for conducting educational research. I am well prepared for my speech and presentation. However, as I get closer to the meeting room, my body suddenly begins to tremble with fear, my heart is pounding heavily, my hands become sweaty, and my legs are feeling weak. I just can't work up the courage to enter the room. I stop walking, and then I feel someone touch my shoulder. When I look behind me it is one of my colleagues, Mrs. Mia smiling to me.

Mrs Mia : *"Assalamu'alaikum Yuli, are you Ok?"*

Yuli : *"Oh yes, I am fine (trying to calm myself)"*

Mrs Mia : *"I can't wait for your presentation today, good luck. Let's go into the room"*

Me : *"Thank you, I hope I can do my best"*

Mrs Mia : *"Dont worry, you will be fine"*

I enter the room and prepare my external drive to connect to the laptop. I try to remain as calm as possible while many of my colleagues start to enter the room. However, I become especially nervous when the head of department arrives. I don't know why I feel so nervous, because I am the one who asked if I could present my personal views and experiences. Perhaps I am just worried about the reaction of my colleagues to my presentation. Then after connecting my thumb drive to the laptop I take a seat while the head of department commences the meeting.

Head of department	*: "Good morning, bapak dan ibu (ladies and gentlemen)" lecturers, today we will listen to Yuli's presentation on her learning experiences in Australia, including her view on conducting educational research. If there are any matter which need to be discussed regarding our department, we can do it after Yuli's presentation, Please Yuli"*
Me	*: "Thank you Mr. Andi and thank you everyone for coming today". Firstly I would like to give an overview of my postgraduate study at SMEC, Curtin University of Technology (before it changed into Curtin University). Then, I will give an insight on the new perspectives of educational research.*

The room is quiet which makes me even more nervous. I open my slides by discussing about my course and what I have learnt during my master's degree. Their expressions show that they are interested in the discussion, as the head department will soon be introducing a new course which will be Master of Chemistry Education, so my overview of the course helps them to obtain a general idea of postgraduate study in another country. After I presented my views on the course, my colleagues asked a number of questions. The questions focused more on the content of each course. I then moved on to the next component of my presentation regarding new perspectives on conducting educational research. I contacted Peter a couple weeks ago to ask for his presentation on this topic. Therefore, in my power point presentation, I included Peter's name. I made a few small changes to his presentation, especially in relation to language, so that it would appear simple and easy to understand. I also included several points which were relevant to the context of my institution such as the types of research that are possible to conduct at this particular institution.

Me	*:"Firstly, before giving an in-depth view into research methodology (I used this introduction to engage my colleagues, since we used to jump into the research methodology rather than research paradigm as the discussion), I would like to discuss the research*

paradigms that are commonly used in educational research"

In this part, I explain each paradigm one by one. I observed the facial expressions of my colleagues, and they looked serious. I begin explaining each research paradigm from positivism into integralism. When I start with positivism, there is the term "old paradigm" which shows that positivism as the old paradigm which is developed around 1970's. I explained that old doesn't mean it is not used anymore; it is simply a matter of history. I tried to initiate some discussion as I realised how strong the power of post/positivism approach currently is in my institution. Even, at a postgraduate level in an education course in my institution, it seemed to be obligatory to conduct research in the positivism paradigm. Suddenly, the head of department raises his hand to say something.

Head of department : *"I don't agree with you Yuli, about the language of old paradigm. Please, don't say it is the old paradigm, old mostly means negative rather than positive. You could use other words to describe it, especially in this context we still use this paradigm in conducting our research"*

Me :*"Yes, I do understand, as I explained, in this context, the old refers to historical views and is not negative in any way. We should reflect on what we are standing for in conducting educational research. However, I agree with you that we need to use different words to describe it, if in our context old creates negative feelings. Thanks Mr. Andi."*

I tried to use simpler language to make it easy to understand. I found that it was difficult to develop a thorough understanding of each research paradigm in just one meeting. However, I think it is one way of moving forward in providing ideas to my colleagues that there are different ways of conducting educational research. My presentation continues through until the postmodernism paradigm which I explain as the roles of language and using different ways of data such as personal experiences, poems, and stories. At this point I realise that not everyone appears to agree with me. One colleague suggested that we can use stories for reflections, but not for research. I remained positive and I told them yes, it was also surprising to me, when my lecturer first introduced this type of research; however there have been many researchers who have applied this type of research. I explained that there are several journals and books that we can use as guidelines, although I did not have any with me. They suggested it would be best to bring those books the next time there was a meeting. I thought about the power of literature as experts' voices in my institution, especially, Western books. It will be much better if I bring the books with

me such as the Handbook of Qualitative Research by Denzin and Lincoln, as "evidence". I finish my presentation, and I am surprised to see that everyone is silent, as I had expected many more questions towards the end. Then, one of my senior lecturers approaches me, as a chemistry education lecturer, he is also the head of department in postgraduate school for childhood education. He tells me that the presentation was excellent, and that he is also being empowered to build new ideas in conducting research, especially in postgraduate school, which goes beyond conducting research under "quantitative" studies which are not really helpful. He comments, "We should move, but it is difficult, we have to be strong enough to survive and to break the system, otherwise we become the passive followers of 'quantitative study'. Hopefully, you can stay being empowered once you are back at this institution". I am so surprised and pleased with his statement. Even though he had remained silent during the presentation, I was happy to fine that there was someone who was able to comprehend the new ideas of conducting educational research. Then, he asks me to help with indicating the key books in educational research which will help him to explain the concept to his colleagues in postgraduate school. I tell him that I will purchase the books and send them to him. The meeting comes to an end as we have run out of time. I have mixed feelings but I know the journey has just begun.

This story is truly a valuable experience to me. I was able to realise what I will be facing once I returned to my home country. As one of the youngest lecturer in my department and for someone who had graduated from that department, I felt welcome to express my own views.

Appendix 3 – Conversation with my SMEC Colleagues

I also shared my personal experiences with my colleagues from the Philippines and Malaysia who also graduated from SMEC in the same year when we were still in the process of developing a network to support each other. We realised the powerful learning experiences at SMEC. Most of us agreed that the most powerful learning experiences are shifting to the new perspectives of looking at the new methods of conducting educational research.

"The most inspiring learning experiences at SMEC is probably about paradigm shift, before entering SMEC I had anticipated what I wanted to learn (designing instructional materials) but during our class with Peter, I was challenged to do different things. I was inspired to undertake new research paradigms. I was inspired to bring change to our institution but to do this I had to first change myself and that is how I became motivated to do research under new paradigms" (Martin, July 14, 2009)

"For me the most useful of learning experiences at SMEC is Learning new research paradigms, understanding classroom climate, principles in teaching science (activating prior knowledge, teaching approaches, etc.)"(Martin, July 14, 2012)

When we talked about our struggles to implement the new research approach, we almost had similar experiences in feeling rejected and isolated. However some of them succeeded in implementing the new research approach.

My colleagues shared similar views to me on doing research under different paradigms. My writing on auto/ethnography research in one journal was rejected. They said: It was not research. I attended the National Seminar of Science Education; it was really influenced by the strong power of the positivism research paradigm (Yasmin, July 25, 2009)

"I supervised about 12 final year students research project. What made me happy is they no longer use postpositive paradigms to do their research. They go one step ahead which is interpretive paradigm; perhaps I can share my struggle to persuade my supervisees to change their perspective in conducting educational research"(Merry, June 11, 2009)

"I am now in-charge of faculty development of the university. As to the research genre, our research center is now open to qualitative research. In fact, the center has already reserved slots for action research that may involve qualitative methods" (Maria, June 6, 2009)

"I think I am successful in getting out of my comfort zone of being positivist. Now I have been incorporating mixed-methods in data gathering every time I conduct some sort of research activities" (Almar, July 20, 2009)

"When I first reported for duty in my university, it was not easy for me to share to my colleagues what I had learned from SMEC, because I had to wait for the right time, and the right time came when I conducted the workshop where I had the opportunity to share what I had learned" (Almar, June 10, 2009)

"I am now a believer of the power of journal writing as a way towards transformations of one's values, beliefs, etc. In fact, reflective journals have become one of the course requirements in the subject that I am teaching this semester" (Almar, July 20, 2009)

Conversation with my SMEC colleagues inspired me to stay in the pathway. I realised it is not an easy journey. However, when we support each other, we feel more empowered and know that we are not alone.

Appendix 4 – Timeline of Science Developments

Idiosyncratic Timeline of Some Developments (Milne, 2011, p.21)

Time	Place and People	Information
2000 BCE	**Egypt**	Becomes a united kingdom, which it basically remains for 2000 years. Much of what is recorded is directly associated with the ascension of each Pharaoh.
1490-1436 BCE	Tutmose III	12-hour day and development of shadow clocks recorded.
1397-1360 BCE	Amenhotep III	Waterclocks in use.
1027-771 BCE	**China, India, Nigeria**	Emergence of iron working and extensive use of irrigation
560-500 BCE	**Greece** Pythagoras	Geometry. Owed much to the Babylonians. It was understood that vision was caused by something emitted from the eye.
450 BCE	Parmenides	The universe is continuous and unchanging.
492-432 BCE or thereabouts	Empedocles	Proposed combining four elements mentioned by earlier philosophers - earth, water, air and fire – into a coherent system. Elements are not considered identical with the ordinary substances that go by those names but their essential and permanent characteristics. Every material substance is composed of these four elements. For example, wood contains earth (heavy & solid), water (gives off moisture when heated), air (it smokes) and fire (emits flames when heated). Luminous objects emit rays, which meet the rays emitted by the eyes. The universe is a crystal sphere.
478 BCE	Leucippus	"Two things exist – atoms and the void" Fire and the human soul were atomic. The atoms of the soul generate warmth in the body: they are a vital force. When there is death the soul disperses. There is no afterlife because there is no soul to experience it. This was a speculative theory.

Birth not known. 460 BCE possible.	Democritus	Pupil of Leucippus. Contemporary of Socrates. Atomist who argued that because everything was composed of atoms it was possible to determine causes associated with matter and emotions.
470-399 BCE	Socrates	Not interested in explaining the natural world
b. 427 BCE	Plato	True reality is permanent and unchanging what we observe is an inadequate imitation of reality because living things will age and die but the essential idea of a living thing will go on forever
about 400 BCE - about 340 BCE	Arete of Cyrene (then part of Greek Empire now Lybia)	Philosopher attended Plato's academy and took over the Cyrenaic School after the death of her father. Promoted hedonism, i.e. seeking a balance between pleasure and pain in everyday life. Egalitarian
330 BCE	Pythias of Assos	Biologist. Married Aristotle (denied her the recognition she probably deserved). Thought to have collaborated with him on *Generation of Animals* but involvement unacknowledged.
b. 384 BCE	Aristotle	Unlike Plato valued observations of the natural world as the basis for knowledge building.
About 460-370 BCE	Hippocrates	Established a school of medicine. The School focused on patient care and prognosis rather than diagnosis, which was difficult considering the Greek ban on dissections, although it might have been acceptable to dissect slaves.
341- 270 BCE	Epicurus	Influenced by Democritus. Gave priority to the use of direct observation (using the senses) for generating new knowledge. Atoms are material. Actually allowed women and slaves to attend his school. Know of his work through Lucretius' (ca. 99 – 55 BCE) poem, *On the Nature of Things.*
221 BCE	**China** Ch'in (Qin)	Standardization of weights and measures by Ch'in (Qin) establishing "Empire of All Under Heaven" – unification of China Paper invented
90 – 168 CE	**Egypt** Ptolemy	Roman citizen living in Egypt, likely of Greek ancestry, whose synthesis of extant Babylonian and Greek astronomical knowledge within a geocentric model formed the accepted basis of astronomical understanding in Europe until at least the 16th century.

Early CE	**China and elsewhere**	Alchemy emerges in many different parts of the world simultaneously and generally independently. Chinese alchemy elixir of life. These elixirs became more and more toxic (Needham, 1963).
Somewhere in the first to third centuries	Maria of Alexandria (Mary the Jewess)	Invented apparatus for chemical processes such as distillation including the water bath (forms still named after her e.g. bain Marie). First alchemist of note in Afro-European thought?
CE 296	Emperor Diocletian	Claims that he banned alchemy in Roman Empire do not seem to be supported by a range of texts or evidence.
CE 391	**Egypt**	Alexandria library is sacked and burned by Christian mob that destroyed the entire manuscript collection. Hypatia (370-415 CE), Head of Platonist School in Alexandria, is murdered. She promotes a form of *neoplationism* that combines Plato's ideas with other influences, including Mesopotamian, East Asian, African, Christian, and Jewish, but the paganness of the main philosophy upsets some Christians to the extent that a mob murders her.
CE 670	**Syria/ Byzantium** Callinicus of Heliopolis (b. ~673- d. unknown)	Jewish refugee and chemist to Constantinople (Byzantium). Uses "Greek fire" composed of distilled crude oil, potassium nitrate or carbonate (source of oxygen), and quicklime [calcium oxide] (reacts with water to produce heat) to destroy Arab fleet on the Bosphorus.
	Islamic cultures	Scientific development in Arab hands for the next 500 years. Golden age of Islam 8th Century CE to 11th Century AD. Islamic cultures flourish in Spain, North Africa, Syria and Iran. In 11th Century CE revival of Christendom in Spain and move to expel Islamic culture.
		Arab contributions to science included both communication and synthesis of ideas of earlier ages and original work. For these scholars the cosmos was not a physical realm but a domain with a variety of levels of existence illuminated by revelations from Islam.
late 8th and early 9th century	ibn-Hayyan (Jabir)	Accepted Aristotelian doctrine of four elements, four qualities (hot, cold, dry and wet) and proposed two basic principles mercury and sulfur (not the elements but principles of action). It was the 'wedding' of these principles that gave rise to the different metals found in nature and in the right combination to gold. These metals were 'extraterrestrial'. Transmutation of base metals to gold was not just a physical process but also a higher way of operating in the world.

mid-9th Century	al-Battani	Book of Astronomical tables.
b. 965 CE	al-Haytham	Proposed that light was a 'ray', proposed the concept of refraction, and other innovations in his book "Optics".
1041-1048	**China** Bi Sheng	Development of movable type (printing). Chinese characters made its use a challenge. Whether this development contributed to the development of moveable type in Europe is a source of scholarly debate.

Appendix 5 – Dilemma Story

Climate change dilemma

1. Introduction

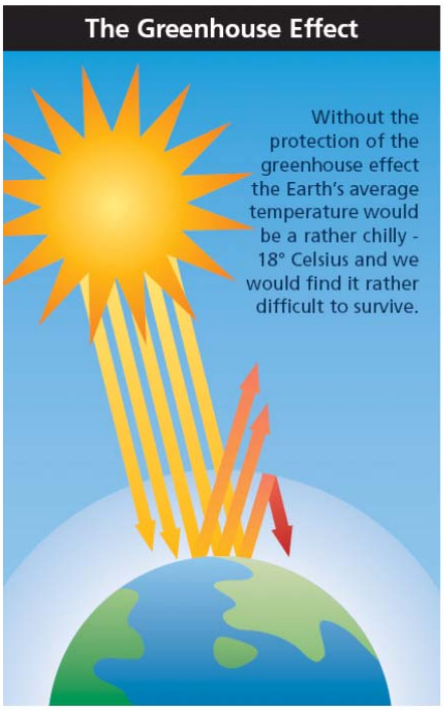
The purpose of this Climate Change dilemma is to help years 10, 11 and 12 high school students understand:

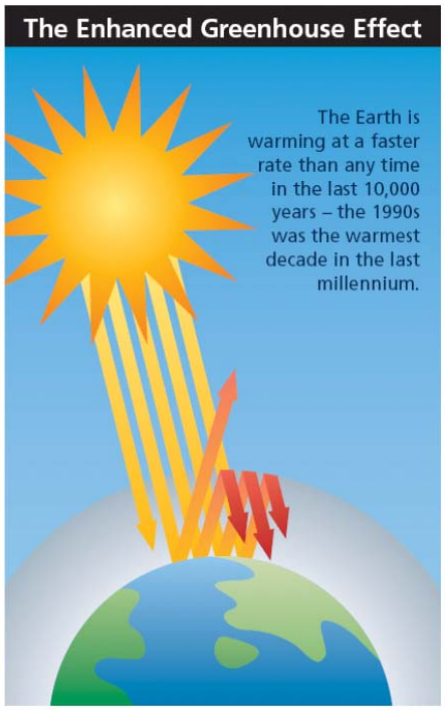
- the Greenhouse Effect;
- the impact climate change will have on Western Australia's agriculture;
- personal impact on WA farmers and their families of climate change; and
- a stronger sense of connection to the people and landscapes of rural Australia

The dilemma examines some of the social, economical and environmental impacts of climate change. The dilemma includes opportunities for group discussion and problem solving.

2. Greenhouse Effect

For millions of years, life on Earth has evolved an environment that sustains life because of natural 'greenhouse effect' which has warmed the planet. Without the 'protective' layer formed by greenhouse gases temperatures would be much. much lower and most living things would die.





The chemical composition of the atmosphere and global climate conditions have varied for millions of years. But during the past 250 years, human activities have increased the atmospheric concentrations of several greenhouse gases, including:

- Carbon Dioxide CO_2;
- Methane CH_4; and
- Nitrous Oxide N_2O.

Increases in greenhouse gases have been caused primarily by the use of fossil fuels (coal, petroleum, natural gas) land clearing, agriculture and the massive expansion of industrial processes in the last 250 years.

These relatively recent changes to the Earth's atmosphere are affecting weather in all parts of the world. Drought is more common, glaciers and snowfields are melting and unseasonable heavy rainfalls are occurring in many parts of the world. Heatwaves are also more common and more intense.

As temperatures increase across the world weather patterns will change considerably. Australia's rainfall will continue to decline, storms will become more frequent and more violent and drought will be more common.

Economic

Agriculture plays a major role in the economy of WA, representing the largest renewable resource sector. In 2005/06 the gross value of agricultural production was $5.7 billion. The value of agricultural exports in 2005/06 was $4.3 billion, some 9% of the state's total exports. Fifty per cent of Australia's wheat exports came from WA (State of the Environment Report – WA 2007).

Social

Seventeen per cent of WA's workforce are employed in the agricultural sector (State of the Environment Report – WA 2007). Rural towns have suffered population declines for many years and many country Local Governments are approaching insolvency. Unemployment is generally higher in rural towns and opportunities for young people decreasing. The exceptions are the mining communities located in the Pilbara

Environmental

Agriculture is among the highest users of water, consuming an estimated 40% of supplied water (non-rainfall). The South West has experienced a decline in rainfall of between 15-20% over the last 20 years with 2006 the driest year on record. Surface run-off into dams has decreased on average 50% and groundwater aquifer recharge has reduced significantly.

As temperatures increase this century scientists predict further significant decreases in rainfall of up to 60% in the South-West Australia agricultural region.

Future temperature increases will also result in lower moisture levels in soil leading to lower crop yields and increased soil erosion

4. Your Family Story

Your family are farmers living in Western Australia's wheatbelt region. They currently grow cereal crops such as wheat and barley and also raise sheep for their wool.

The closest town is Tammin which is 30 kms from your farm. Tammin is 300 kms from Perth. Your family has been here for four generations and the 'land' is in the blood. You would like to pass the farm onto your children when you retire.

1987

You are a teenager living on the Tammin farm with your parents and your brother and sister. Life on the farm is reasonably good, rainfall over the last few years has only been average but Dad and Mum have managed to make a profit each year by adopting new farming techniques.

Dad is worried about 'the long dry spell' but is convinced that next year's rains will be better.

You have just completed high school with a good academic record and have the opportunity to enrol at Muresk Agricultural School in Northam to learn more about farming. There is also the opportunity to pursue a university course in Perth which would lead to a career away from farming.

Q1. What do you decide is the best course for your future career?

Students write the answer to the above and their reasons why they came to that decision. Then share their answer with a partner and give them the reasons. Discuss any differences.

A. You accept the place at Muresk and complete the course with flying colours returning to work on the family farm with your father.

1997

Your Parents have retired and passed the family farm on to you. Your brother and sister have also left the farm and pursued other careers. You have married and have two very young children.

Rainfall continues to decline but you have managed to continue to make a profit by implementing the new farming techniques that you learnt at Agricultural School. You have planted thousands of trees for eucalyptus oil and wood production and to help reduce salinity on your property and diversify your farming business.

You have protected about 500 hectares of bush on your property because you are a keen conservationist and aware that only about ten per cent of native vegetation remains in the wheat belt.

You have the opportunity to acquire more land by buying properties from neighbouring farmers who are traditional older generation farmers who do not have your university education and modern business management training. They have made the decision to retire and leave the land.

You have to seriously consider your position and whether to increase the size of the farm to remain economically viable and to replace land that you have lost to soil erosion and salinity. To do this you would need finance from your bank.

The alternative is to stay with the farm as it is and risk facing a similar decision to your neighbours if you continue to have low rainfall.

Q2. Do you buy up the properties?

Students again think through the dilemma and decide what they would do and why. They then form a group of three and share and discuss each other's points of view.

A. You borrow a substantial amount of money to increase the size of your farm with the support of your bank manager who has faith in your business plan for the future.

2007

Your personal situation:

Your farm is now 10,000 hectares, four times the size of your grandfather's farm.

Your two children are currently at boarding school in Perth as Tammin no longer has a Senior High School.

You and your family have not had a holiday in seven years. Because you cannot afford to employ farm labourers you and you wife have to do all the work on the farm. Your children help when they are not away at boarding school.

You do not sleep very well because you are so worried about your financial situation and the possibility of losing the farm. Your family and friends are very supportive and help whenever and wherever they can.

Your dams are only half full after disappointing winter rains. You have had a severe drought in your region now for the last five years and you have been able to grow very little grain or stockfeed for your sheep. Your soil and your dams are now completely dry. It is late July and you have had only 20

millimetres of rain. You cannot plant your crops unless you receive at least 150 millimetres of rain as the plants will wither and die.

You have sold many of your sheep to pay off some of your debt and you have had to buy stockfeed and water to keep your remaining animals alive.

You have been reading and hearing a lot about the greenhouse effect and climate change. You have heard repeatedly that climate scientists (climatologists) suggest that rainfall will continue to decline in the South-West of Western Australia in the next few decades.

However you have yet to be convinced that the decline in rainfall is not a natural event. You have a feeling that the drought will break very soon and you will again be able to produce good crops and wool and pay off your debts.

5. Your current financial situation

You currently owe the bank $3 million for outstanding loans. Your farm and your farm machinery have been valued at $3.5 million by the bank though you believe it is worth a lot more.

Your income last year was less than $150,000. Your total expenditure, including school fees, last year was more than $300,000. You made a net loss of $150,000 and were not able to make any repayments to the bank.

Your plantation trees have not grown as fast as they were meant to and cannot be harvested for another five years. You have been able to collect some eucalyptus oil this year and hope to be able to double your production next year for which you expect to be paid approximately $100,000.

You will have to borrow another $150,000 for stockfeed and water this year if you don't receive substantial rains in August.

Your bank Manager has indicated that he will provide you a further $150,000 but he has stated that this will be the final loan as your total debt is now approaching the sale value of your farm.

The bank Manager has also stated that he will have to sell your farm to clear your loan if you are not able to meet your monthly repayments.

You have considered the selling the farm now and moving to Perth and getting a normal job. You know that if you sold the farm now you would have enough money to buy a comfortable house. Being with your children is also attractive as is saving nearly $30,000 in boarding schools fees.

You know that if you wait another year and it doesn't rain your then decide to sell the farm you will only receive enough to pay off your debts. You will have nothing left.

Q3. You have a dilemma – keep the farm and hope that it rains soon or sell the farm now and be able to afford to buy a home for your family?

Form groups of 4 and discuss the alternatives you have available to you. Discuss what actions you could take, and the consequences for you and for the farm, of what you do.

Summarise them in a poster and report your group decision and reasons to the class. Students take home the 'Human Biology from the Story' worksheet and complete it for homework to be discussed in a follow up lesson.

6. Dilemma – Teacher instructions

- Use one or more of the recommended class activities to enhance your students understanding of the greenhouse effect and climate change.
- Provide your students with the notes in Items 2 to 3 and ask them to read them. Give time for them to read, then hand out the 'Climate Change Student Record Sheet'.
- Read Item 4 - 5 to your students.
- Students are presented with choices at the points indicated. At each point the discussion group size is increased.
- Finally the groups of four prepare a presentation to the whole group explaining their choice, reasons for it and what they see as the consequences for the family and the farm.
- Hand students the 'Human Biology from the Story' document. They complete this for homework and discuss in follow up class.

Class activities

Available from the Department of Environment and Conservation http://www.dec.wa.gov.au/

Click on Department of Environment, then 'Greenhouse', then 'Climate' This will get you to 'Climate Change Education' Resources

Teachers may use one or more of the following activities to enhance student learning of the greenhouse effect and climate change.

Activity 1. 'The Carbon Dioxide Game'

Activity 2. 'Climate Change and Antarctica'

Activity 3. 'Lake Chad – why are you shrinking?'

Activity 4. 'Communities against climate change'

Activity 5. Counting Carbon – how do we measure up?

Appendix 6 – Publications

The Following Publications and Presentations Have Resulted From the Research Described in This Thesis:

Book Chapters

Rahmawati, Y. & Koul, R. (in Press). Teaching biodiversity: Co-teaching and co-generative dialogue in environmental science education. In Wardell-Johnson, K. Munyard & A. Kaczmarczyk (Eds.), *Biodiversity and People – linking values and research perspectives*. Black Swan Press: Perth.

Conference Proceedings

Rahmawati, Y., Taylor, P.C., & Koul, R. (2011, November). A personal transformative journey in co-teaching for revealing teaching identity. Paper presented at the *Australian Association for Research in Education*, Hobart, Australia. http://www.aare.edu.au/11pap/ and http://espace.library.curtin.edu.au:80/R?func=dbin-jump-full&local_base=gen01-era02&object_id=174746

Rahmawati, Y., Koul, R., & Fisher, D. (2011, November). Co-teaching and co-generative for teacher evaluation and transforming teaching practices: Multiple case studies in Western Australian schools. Paper presented at the *Fourth International* Conference *on Science and Mathematics Education*, Penang, Malaysia. http://espace.library.curtin.edu.au:80/R?func=dbin-jump-full&local_base=gen01-era02&object_id=173622

Rahmawati, Y., Koul, R., & Fisher, D. (2010,January). Setting a scene for co-teaching and co-generative dialogue for teaching environmental education. Paper presented at the *Sixth International Conference on Science, Mathematics, and Technology Education*, Taiwan.

Conference Presentations

Rahmawati, Y., Taylor, P.C., & Koul, R. (2011, November). A personal transformative journey in co-teaching for revealing teaching identity. Paper presented at the *Australian Association for Research in Education*, Hobart, Australia.

Rahmawati, Y., Koul, R., & Fisher, D. (2011, November). Co-teaching and co-generative for teacher evaluation and transforming teaching practices: Multiple case studies in Western Australian schools. Paper presented at the *Fourth International Conference on Science and Mathematics Education*, Penang, Malaysia.

Rahmawati, Y., Arpana, D., Koul, R., & Fisher, D. (2011, August). Co-teaching and co-generative for transforming classroom practices: multiple case studies. Paper

presented at the *Annual Meeting of Western Australian Institute for Educational Research*, Perth, Australia.

Rahmawati, Y., & Koul, R. (2011, July). Teaching biodiversity: Co-teaching and co-generative dialogue in environmental science education. Paper presented at the *Curtin Institute for Biodiversity and Climate*, Perth, Western Australia.

Koul, R., **Rahmawati, Y.**, & Fisher, D. (2011, June). Being reflective science teachers through collaboration, dialogue and critical reflexivity. Paper presented at the *Annual Meeting of Australiasian Science Education Research Association*, Adelaide, Australia.

Rahmawati, Y., Koul, R., & Fisher, D. (2010, January). Setting a scene for co-teaching and co-generative dialogue for teaching environmental education. Paper presented at the *The Sixth International Conference on Science, Mathematics, and Technology Education*, Taiwan.

Future Conferences Presentations (These will be included into Conference Proceeding)

Rahmawati, Y., & Taylor, P.C. (2013, April). 'Open the black box of culture and religion': a transformative journey of a science educator in revealing teaching identity. Paper presented at the *The Fourth Asian Conference on Arts & Humanities (ACAH)*, Osaka, Japan.

Rahmawati, Y., Koul, R., & Fisher, D. (2013, January). Co-teaching and co-generative dialogue for transforming teacher interpersonal behaviour in secondary schools. Paper presented at *epiSTEME 5*, Mumbai, India.

Rahmawati, Y., Koul, R., & Fisher, D. (2012, November). Co-teaching and co-generative for transforming teacher interpersonal behaviour and teacher-students interactions in secondary schools. Paper presented at the *Seventh International Conference on Science, Mathematics and Technology Education*, Muscat, Oman.