EFFECT OF INTEGRATING LESSON STUDY APPROACH IN THE PREPARATION OF PRESERVICE CHEMISTRY TEACHERS

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by

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LIST OF ABBREVIATIONS

BPG	Bahagian Pendidikan Guru
DASTT-C	Draw-A-Science-Teacher-Test Checklist
GT	Grounded Theory (GT)
KBSM	*Kurikulum Baru Sekolah Menengah* (New Curriculum for Secondary Schools)
LSPAF	*Learning Study* Performance Assessment Form
PCK	Pedagogical Content Knowledge
PSTEB	Personal Science Teaching-Efficacy Beliefs
SEM	Structural Equation Modelling
SPSS	Statistical Package for Social Sciences
STEBI	Science Teaching-Efficacy Beliefs Instrument
STEB	Science Teaching-Efficacy Beliefs
STOE	Science Teaching Outcome Expectancy
USM	Universiti Sains Malaysia

KESAN MENGINTEGRASI PENDEKATAN *LESSON STUDY* DALAM PERSEDIAAN GURU KIMIA PRAPERKHIDMATAN

ABSTRAK

Tujuan utama kajian ini adalah untuk mengkaji keberkesanan model *Cognitive Apprenticeship* melalui pendekatan *Lesson Study* untuk menyedia guru praperkhidmatan memperoleh pengetahuan dan kompetensi dalam pengajaran Kimia. Penyelidikan ini telah dijalankan menggunakan rekabentuk *mixed-methods* dinamakan model '*Concurrent Embedded Experiment*', yang menggabungkan kutipan data secara kuantitatif dan kualitatif. Sampel terdiri daripada 43 orang guru sains praperkhidmatan. Instrumen yang digunakan dalam kajian kualitatif adalah *Draw-A-Science-Teacher-Test Checklist* (DASTT-C) dan dalam kajian kuantitatif ialah *Science Teaching-Efficacy Beliefs Instrument* (STEBI). Hasil dapatan kajian kualitatif menunjukkan terdapat perbezaan dalam Kepercayaan Pengajaran dan Pembelajaran Sains guru praperkhidmatan. Kepercayaan mereka adalah setara dengan teori pengajaran dan pembelajaran terkini. Kajian kuantitatif pula menggunakan analisis ujian-t berpasangan bagi membandingkan min PSTEB, STOE dan STEB, sebelum (ujian pra) dan selepas (ujian pasca) *Lesson Study*. Hasil dapatan menunjukkan bahawa terdapat perbezaan yang signifikan dalam skor min untuk PSTEB (t = 2.754; p .05), STOE (t = 2.947;p .05) dan STEB(t=3.533;p.05). Kaedah penyelidikan menggunakan kajian kes turut dijalankan bagi memahami hasil keberkesanan proses perlaksanaan *Lesson Study*. Kesemua 43 orang responden telah dibahagikan kepada lapan kumpulan dengan bilangan ahli terdiri antara 5 hingga 6 orang berdasarkan subjek jurusan mereka. Instrumen yang digunakan dalam kajian kuantitatif adalah *Lesson Study Performance*

Assessment Form (LSPAF), suatu borang rubrik penilaian bagi menilai prestasi guru dalam kemahiran pengajaran mereka semasa pemerhatian pengajaran mikro yang dijalankan dalam tiga kitaran. Dapatan kajian menunjukkan bahawa semua kumpulan yang terlibat telah mencapai prestasi pengajaran yang dijangkakan. Kajian kes telah membincangkan secara menyeluruh dapatan kajian kualitatif. Analisis isi kandungan jurnal individu bagi satu kumpulan responden yang terdiri daripada 5 peserta guru praperkhidmatan dalam jurusan pendidikan kimia turut dijalankan. Hasil dapatan telah menemukan lima tema, iaitu kepercayaan terhadap pengetahuan isi kandungan dan pengetahuan isi kandungan pedagogi (PCK), kemahiran yang diperlukan bagi menghasilkan pengajaran kimia yang berkesan, kemahiran menyoal, kepercayaan terhadap amalan pengajaran yang baik, dan kepercayaan terhadap jangkaan hasil pengajaran sains. Hasil dapatan kajian menunjukkan bahawa guru praperkhidmatan ini telah membentuk mental model yang baru dalam pengajaran dan pembelajaran kimia setelah memperluas pengetahuan mereka dalam isi kandungan subjek. Namun begitu, tiga kitaran *Lesson Study* masih belum mencukupi bagi memupuk kepercayaan mereka dalam menjalankan pelajaran inkuiri dalam kalangan guru praperkhidmatan. Berdasarkan dapatan ini, adalah disyorkan supaya program pendidikan guru turut mengintegrasikan isi kandungan mata pelajaran dalam kursus metodologi bagi meningkatkan pengetahuan isi kandungan pedagogi serta pengetahuan pedagogi dan pengetahuan kandungan. Kesimpulannya, pengintegrasian *Lesson Study* telah menyokong pemupukan kemahiran pengetahuan isi kandungan pedagogi, imej inkuiri dalam pengajaran sains, dan peningkatan kepercayaan guru praperkhidmatan dalam pengajaran subjek kimia dalam tempoh 14 minggu.

EFFECT OF INTEGRATING LESSON STUDY APPROACH IN THE PREPARATION OF PRESERVICE CHEMISTRY TEACHERS

ABSTRACT

The main purpose of this study was to investigate the effect of Cognitive Apprenticeship model through *Lesson Study* approach to prepare preservice teachers to acquire appropriate knowledge and competencies in teaching Chemistry. This research was conducted using a mixed-method research design known as Concurrent Embedded Experimental model, which incorporated both quantitative and qualitative data collection. A sample of 43 preservice science teachers participated in this study. The instrument used in the qualitative study was the *Draw-A-Science-Teacher-Test Checklist* (DASTT-C) and in the quantitative study was the Science Teaching-Efficacy Beliefs Instrument (STEBI). Findings in the qualitative study revealed that different changes were observed in the Beliefs of Teaching and Learning Science with the preservice teachers beginning to show their beliefs in line with *current* teaching and learning theories. Findings in the quantitative study using paired sample *t*-test analysis to compare the mean PSTEB, STOE and STEB before (pre-test) and after (post-test) *Lesson Study* showed that there was a significant difference in mean scores for PSTEB (t= 2.754; *p* .05), STOE (t= 2.947; *p* .05) and STEB for (t=3.533; *p* .05). The case study method was also conducted to study the implementation process to explain the outcomes. The 43 participants were divided into eight *Lesson Study* groups comprising 5 to 6 members based on their major subject. The instrument used in the quantitative study was *Lesson Study Performance Assessment Form* (LSPAF), a rubric assessment form as observational tool for assessing teacher performance in their teaching skills during the

microteaching observation conducted in three cycles. Findings revealed that all the groups involved in the study met the expected teaching performance. The case study discussed comprehensively the content analysis of the individual reflective journal of one group consisting of five participants who were chemistry majors. The findings identified five themes, i.e. beliefs about content knowledge and pedagogical content knowledge (PCK), skills necessary for producing effective chemistry teaching, questioning skills, beliefs about practices of good teaching, and beliefs about science teaching outcome expectancy. The findings indicated that preservice teachers have obtained a new mental model of teaching and learning chemistry through the broadening of content knowledge in the subject matter. However, three *Lesson Study* cycles were considered insufficient to develop confidence in conducting inquiry lessons among preservice teachers. Based on the findings, it was recommended that teacher education programmes should integrate subject content in the methodology courses so as to enhance their PCK as well as pedagogical knowledge and content knowledge. In conclusion, integrating *Lesson Study* had supported the nurturing of pedagogical content knowledge skills, the inquiring image in science teaching, and the enhancement of teaching confidence of preservice teachers in teaching chemistry within the 14 week period.

CHAPTER 1

INTRODUCTION

1.0 Overview

Cognitive Apprenticeship based on the situated learning theory suggests that skills be acquired through authentic contexts and by communicating with peers and experts about those contexts. It is a model of instruction that makes learners' thinking visible (Collins, Brown, and Holum, 1991) through a process of carrying tasks to be learned and easily observed. In situated approaches, students collaborate with one another and their instructor toward some shared understanding. Learners are usually challenged with tasks slightly more difficult than they can accomplish on their own and must rely on assistance from and collaboration with others to achieve these tasks. In the present research, *Lesson Study* is integrated as a task activity in the chemistry teaching-method course offered to the preservice chemistry teachers in the teacher education programme of Universiti Sains Malaysia.

This study is an effort to propose *Cognitive Apprenticeship* through *Lesson Study* termed as *Integrated Lesson Study* as an approach to prepare the preservice teachers to acquire appropriate knowledge and competencies in teaching chemistry before the teaching school practicum. The use of *Integrated Lesson Study* in the methods course is an intervention to affect the mental models, teacher's beliefs, and science efficacy beliefs in teaching and learning, in view of the fact that those constructs are related to the common problems of learning to teach by preservice teachers. This chapter will describe the background of this study, specifies the problem statement, explains the rationale of study, describes the purpose and

objectives of the study, states the research questions and the hypotheses to be tested, highlighting the significance of the study and indicating the limitation of the study. Finally, the chapter elaborates the operational definition to be used in the study.

1.1 Background of the study

The study in the preparation of preservice teacher is considered critical in creating teacher preparation pedagogy to enable teachers to acquire the knowledge, skills and dispositions which will allow preservice teachers to succeed in their profession. Although there is no single best way to organize teachers' learning experiences in a preparation programme, there are still some common considerations that can be encountered.

There have been more than twenty years since teacher education has been reformed to produce programme designs in representing more integrated, coherent programmes that emphasize a consistent vision of good teaching. In Malaysia generally, the initial teachers' education programme is aimed to focus the future teachers' development. The programme customizes teachers to be professionals in terms of academic as well as their personnel development (Molly, 2002). The current model of teacher education programme has to be based on the blue-print of "Standard Guru Malaysia" (Bahagian Pendidikan Guru, 2009), to provide teachers with an image of effective educational experience. Some challenges suggested need to be overcome by teacher educator are the transforming of ingrained belief, values and biased perception of teaching and the actual training of teachers (Goh, 2011).

Effective teacher training are associated with the overcoming the challenges of the problem of learning to teach during the teacher education preparation

programme. The common problem of learning to teach is identified as the misconceptions or preconceptions about teaching, the problem of enactment and the problem of complexity (Darling-Hammond and Baratz-Snowden, 2007). All these three problems need to be addressed to equip the teacher with teaching skill, especially the beginning teachers, with the ability to continue to teach (Darling-Hammond and Baratz-Snowden, 2007). It has been clear from the literature that knowledge, skills and attitudes to promote optimal teaching could not be fully developed in preservice teacher education programmes (Hammerness et al., 2005). Therefore, the new teacher needs to be trained for lifelong learning foundation, helping them to acquire teaching with the impact on the quality of teaching inside the classrooms (Stigler and Hiebert, 1999). Classroom teaching was identified as the most important resource in improving students' school achievement. Classroom teaching is seen as a "system" linking many different ways to enable learners to learn.

Classroom teaching relies heavily on beliefs teacher hold within a philosophical approach and a psychological frame (Richardson, 2003). Beliefs and actions in classroom teaching has been well documented (Richardson and Placier, 2001; Richardson, 2003, p.5). In preservice teacher education, within the psychological frame, the beliefs of how learners should learn resulting from teacher experience during their early education as students', could have created an image of teaching (Calderhead and Robson, 1991; Thomas, Pedersen, and Finson, 2001). This image of teaching, also termed as "teaching as cultural activity" or "mental version of teaching patterns" (Stigler and Hiebert, 1999, p.87), evolve over long periods of time and help maintain the stability of cultural teaching systems over time.

Reviewers and researchers see this teaching image or mental model in teaching as critical (Thomas et al., 2001), since what and how teachers' beliefs do give tremendous impact on their behaviour in the classroom teaching (Pajares, 1992; Richardson, 1996). In the context of preservice science teachers, the mental model in teaching and learning science relies heavily on beliefs in science teaching and learning, and science Teaching-Efficacy Beliefs, to acquire good skills for effective teaching. Preservice teachers need to inquire beliefs about science teaching and learning, according to the current educational theory (Markic, 2008) to meet the diverse needs of current science students. At the same time, to be competent and functioning (Bandura, 1997), the preservice teacher needs to acquire good sense of science Teaching-Efficacy Beliefs to teach science (chemistry in the case of this study) effectively. High efficacy as a science teacher is an important factor for the teacher to be confident and fully optimistic during the real teaching situations (Hoy and Spero, 2005), as well as showing good professional value in teaching practice of the high-quality science teacher (Van Driel, Beijaard, and Verloop, 2001).

Most of empirical studies on learning to teach highlight the tension between the hopes and expectations of teacher educators and the experience of beginning teachers (Wideen, Mayer-Smith, and Moon, 1998). Most research highlights that traditional programmes of teacher education have little effect upon the firmly-held beliefs of the preservice teachers. The successful programmes are those that feature the built-up beliefs in a systematic and consistent long-term support in collaborative settings (Wideen, Mayer-Smith, and Moon, 1998). Method course with the potential to influence those teachers' beliefs (Hart, 2002; Wilkins and Brand, 2004) with the component of the course implemented to specify a new image of teaching-methodology for effective and good teaching. Another theory posits that the

improving design in training should have focused on a systematic way of learning to teach, studying one's own practice and the experience of others, to create and to increase knowledge for both teaching and teacher education (Hiebert, Morris and Glass, 2003).

One possible way to develop teacher preparation programmes that have been practised for a long time, but less noticed in the literature, is to make preservice teachers to learn from teaching (Hiebert, Morris, Berk, and Jansen, 2007), with the purpose of teaching to support student learning. The idea of preparing to learn to teach within contexts to the learning situation means knowing how to learn from classroom teaching experiences from one's own experience and share experience by creating environments for generating knowledge for teaching (Hiebert et al., 2003). It means planning these experiences in a way that affords learning and then reflecting on the outcomes in order to maximize the benefits that can be gained from the experiences (Artzt, 1999). Rather than attempting to produce skilled teachers upon graduation, preservice education should prepare teachers to learn from teaching when they enter the profession (Hiebert, et al., 2007; Hiebert, et al., 2003). Preparation programmes can be more effective by focusing on helping preservice teachers to acquire the tools they will need to learn to teach rather than the finished competencies of effective teaching (Hiebert, et al., 2003).

A given component of the method courses shall be implemented is suggested to hopefully build new image of teaching-methodology as well as providing the confidence of the preservice teachers before they go for teaching practicum in the final year. Programmes designed to change the beliefs of preservice teachers may involve short- and long-term deliberate interventions. These interventions may range

from single courses defined as short-term intervention to full-length programmes which frequently included student teaching (Wideen et al., 1998).

The short-term preparation programme intervention seems to have little effect upon the firmly-held beliefs about teaching (Weinstein,1990; Ullrich,1992); and studies report that beginning teachers aimed to survive (Maistre and Paré, 2010) rather than learn from the experience (Munby and Russell, 1994). One of the approaches which suggest creating dissonance in prospective teacher's beliefs about teaching and learning science (Dana, McLaughlin, and Freeman, 1998) helps to change their beliefs, as later proven by Richardson (2003). These studies suggest a process of plan-teach-access-reflect cycles in the field. They found that dissonance between initial beliefs and results (and no results) in a structured field experience created dissonance that compelled students to examine and change their beliefs. In sum, conjugating theory and practice within short-term intervention -- incorporating the elements of content of teacher education (to acquire a cognitive map of teaching), learning process and learning context by situating learning in productive contexts and learning in professional communities -- are some of the elements in designing teacher education programmes to overcome the problem in learning to teach (Darling-Hammond et al., 2005).

Lesson Study similarly involves a process of plan-teach-access-reflect cycle (Richardson, 2003) in its framework. *Lesson Study* with its focus on high quality classroom teaching is much accredited to the bestseller book -- Teaching Gap -- written from the conclusions of the Trends in International Mathematics and Science Study (TIMSS) (Stigler and Hiebert, 1999). According to Stigler's and Hiebert's (1999) view, "teaching is the next frontier in the continuing struggle to improve

schools. Standard set the course, and assessments provide the benchmarks, but it is teaching that must be improved to push us along the pass to success (p.2). Teaching requires that teacher impart knowledge and see that pupils learn (Buchman, 1984). It demands principled and strategic thinking about ends, means and their consequences. However, according to Stigler and Hiebert (1999), the teaching profession does not have enough knowledge about what constitute effective teaching, and teachers does not have means to successfully share such knowledge with one another. *Lesson Study* (Stigler and Hebert, 1999; Hiebert, Morris, and Glass, 2003; Hiebert, Morris, and Jansen, 2007) is an especially promising mechanism for such preservice teacher preparation model because it fits well the learning goals proposed for preservice teachers, and as will be seen shortly, it fits well the knowledge generation and continuing improvement processes proposed for teacher preparation. Furthermore *Lesson Study* has also been reported by the literature as a method of professional development that summarizes the various features of the high quality of educational development (Perry and Lewis, 2008; Darling-Hammond, 2009).

Lesson Study is a form of long-term professional development in which a small group of teachers systematically and collaboratively conduct research on teaching and learning in classrooms (Darling-Hammond, Wei, Andree, Richardson, and Orphanos, 2009; Perry and Lewis, 2009). A *Lesson Study* cycle generally involves a group of teachers collaboratively planning lessons based upon research, implementing the lesson in a classroom, collecting data by observing others teach the lesson, collecting student assessment and observation data, reflecting upon and discussing the data, examining quality of student work, and developing a record of their activity to improve their practice and seek new solutions. Darling-Hammond (2003) states: "Teachers learn best by studying, doing, and reflecting; by

collaborating with other teachers; by looking closely at students and their work; and by sharing what they see" (p. 278).

This study proposed *Cognitive Apprenticeship* model incorporated with *Lesson Study* termed as *Integrated Lesson Study* as a process to acquire knowledge and skills in learning how to teach chemistry by the preservice teachers. The task given according to *Cognitive Apprenticeship* model through *Lesson Study* integrated to the teaching-method course are predicted to provide apparatuses for preservice teachers with apprenticeship to scaffold new knowledge in learning to teach as new knowledge in their mental models about teaching and learning. A good quality mental model about teaching and learning science is a process of acquiring knowledge to be articulated, reflected and explored, to further cultivate good quality mental models about teaching and learning. Thus, throughout the process of learning in *Integrated Lesson Study*, the preservice teachers will attain a quality mental model which demonstrates greater learning outcomes about teaching and learning science.

The main problem associated to the problem of learning to teach (Carter, 1990; Darling-Hammond and Baratz-Snowden, 2007) among the preservice teachers are predicted in concerned to beliefs or vision of teaching (Hammerness et al., 2005) explained as early conceptions of teaching (Lam and Kember, 2006). These teaching conceptions or mental model are also described as beliefs that are highly correlated with specific, intense memories of the students' own learning experience in elementary, high school and college science courses (Thomas et al., 2001) have been highlighted by many researchers prior to entering programmes of preservice teacher education (Markic and Eilks, 2010; Pajares, 1992; Richardson, 2003; Tanase and Wang, 2010; Taylor, 2003). These early beliefs are also seen similar to the problems

of “apprenticeship of observation” (Hammerness et al., 2005; Lortie, 1975) which is widely documented. How and what teachers beliefs have a tremendous impact on their behaviour in the classroom (Pajares, 1992; Richardson, 1996).

1.2 Problem Statement

Teachers` beliefs influence how teachers’ present science in their classrooms and the kinds of opportunities they provide for students to learn science (Roth et al., 2006). Therefore, research on teachers’ beliefs has been considered as essential in science education. The preservice teachers` beliefs which are deeply held, and often unexamined, need to be sought out by teacher educators to provide preservice science teacher with ample opportunities to develop a teaching and learning science classroom that are aligned with current reforms. The preservice science teachers’ beliefs need to be developed into the direction that science should be taught accordingly within the recent context. Fenstermacher (1979) argued that one goal of teacher education is to help young teachers transform tacit or unexamined beliefs about teaching, learning and the curriculum into objectively reasonable or evidentiary beliefs. Thus, understanding the individual preservice science or chemistry teacher beginning and end of teacher education courses would help teacher educator to transform new beliefs consistence with the science educational theories.

As teachers` beliefs connects to teacher’s practices (Richardson, 1996). Therefore, the belief teachers hold ought to influence their classroom judgements and actions. Hence, better understanding about teachers` beliefs is essential to improve teaching practices (Pajares, 1992; Richardson, 1996) since teacher’s belief provides a true window to look at their decision making and instructional practices (Nespor, 1987; Pajares, 1992). Beliefs also may act as a filter through which preservice

teachers acquire and interpret new knowledge (Pajares, 1992; Lundeberg and Levin, 2003, p.23).

This focus of the study is on *Cognitive Apprenticeship* through *Lesson Study* namely as *Integrated Lesson Study* as one of the components of the teaching-methods course to contextualize learning within the professionalism aspect to overcome the problem of learning to teach in chemistry which takes a 14 weeks' period time.

1.3 Rationale of the study

There is also study showing that new teachers are becoming less optimistic when they faced with actual teaching assignments at school (Woolfolk Hoy, 2000). These problems of learning to teach are anticipated to relayed by the teacher mental model on the understanding of problem of enactment (Kennedy, 1999) and complexities in teaching (Hammerness et al., 2005). The understanding of the individual preservice teacher beliefs at the beginning of the teacher education courses may assist teacher educators in the process of enhancing and consolidating teachers' sense of efficacy beliefs, especially the personal Teaching-Efficacy. Bandura (2001) postulated perceived self-efficacy as the important prerequisite of successful teaching. Teaching particularly in chemistry requires confidence in the teacher's own abilities and competence to teach, these are indicated by a high level of personal Teaching-Efficacy Beliefs. Understanding the individual preservice science teacher beliefs at the beginning of the teacher education courses may assist teacher educators in the process of enhancing and consolidating teachers' sense of efficacy beliefs, especially the personal Teaching-Efficacy in promoting teaching confidence.

Development of knowledge understandings or new mental model by beginning teachers on teaching practice through conceptual and practical tools (Grossman et al., 1999) includes the learning of variety instructional activities to promote student learning, carry out lesson plan as well assessment and understand; when, where, how and why to use the practice approaches. This knowledge is assumed to be influenced by the nature of the preparation or training of the preservice teachers. Chee (2008) in his study suggested beginning teachers still need to improve their strategies to motivate students in teaching and learning (T&L), stimulate students' thinking during T&L and learn to create the classroom atmosphere with fun learning. The needs of training for the preservice teachers for being creative in science instruction, updating knowledge in the application of science and technology in everyday life, updating knowledge of innovations in science instruction, updating knowledge in evaluating teaching effectiveness, and understanding the goals of the syllabus also have been reported for teacher preparation concern (Kamariah and Rohani, 1994). The training of the preservice teachers is seen needed to be strengthened, in helping the preservice teacher to identify what difficulties in teaching performance there are facing, the challenges and problems before the school teaching practicum.

1.4 Purpose and Objective of the Study

This study is an effort to investigate the effect of integrating *Lesson Study* approach to the preservice teachers' mental models in teaching and learning. The research aims to seek the changes of preservice teachers' mental model referring to the representations or assumptions of their beliefs in teaching and learning science and their science Teaching-Efficacy Beliefs in teaching and learning science. The *Integrated Lesson Study* is an apprenticeship approach to transfer knowledge in

shaping the preservice mental models in terms of beliefs in teaching and learning science and their science efficacy teaching beliefs in teaching and learning. This study will be carried out through the chemistry teaching-method course, a compulsory teaching-method course for the entire preservice teachers in the science teacher-education programme. The teaching-method course is conducted in the course of one semester at the School of Educational Studies, Universiti Sains Malaysia.

The study focuses primarily on the use of *Lesson Study* approach as a component in a method course in learning to teach chemistry and acquiring the appropriate skills in teaching.

Specifically the objectives are:

Research Objective 1:

To identify the effect of *Integrated Lesson Study* on the preservice teachers' mental model of teaching and learning chemistry.

Research Objective 1.1

To identify the difference in Beliefs of Science Teaching and Learning before and after the *Integrated Lesson Study* approach was conducted. To specify the evidence to show there are changes.

Research Objective 1.2 (a)

To identify the difference in the Personal Science Teaching-Efficacy Beliefs (PSTEB) of the preservice teacher after *Integrated Lesson Study* was conducted compared with before the treatment.

Research Objective 1.2 (b):

To identify the difference in the Science Teaching Outcome Expectancy (STOE) of the preservice teacher after the Integrated *Lesson Study* was conducted compared with before the treatment.

Research Objective 1.2 (c):

To identify the difference in the overall Science Teaching-Efficacy Beliefs (STEB) of the preservice teacher after the *Integrated Lesson Study* was conducted compared with before the treatment.

Research Objective 2 (a):

To determine the extent of any improved performance in teaching skills of the preservice teachers for all *Lesson Study* group in the three consecutives cycles.

Research Objective 2 (b):

To investigate or explore how the learning experiences during planning, teaching and evaluation of the *Lesson Study* reflected as the apprenticeship in learning to teach chemistry.

1.5 Research Questions

Based on the goals and objectives, this study will answer the following questions:

Research Question 1:

What is the effect of *Integrated Lesson Study* on the preservice teachers' mental model of teaching and learning chemistry.

Research Question 1.1

Is there any difference in Beliefs of Science Teaching and Learning before and after the *Integrated Lesson Study* was conducted? If there are changes, is there any evidence that shows those changes occurred?

Research Question 1.2 (a):

Is there any significant difference in the Personal Science Teaching-Efficacy Beliefs (PSTEB) of the preservice teachers after the *Integrated Lesson Study* was conducted compared to before the treatment?

Research Question 1.2 (b):

Is there any significant difference in the Science Teaching Outcome Expectancy (STOE) of the preservice teacher after the *Integrated Lesson Study* was conducted compared to before the treatment?

Research Question 1.2 (c):

Is there any significant difference in the overall Science Teaching-Efficacy Beliefs (STEB) of the preservice teachers after the *Integrated Lesson Study* was conducted compared to before the treatment?

Research Question 2 (a):

Is there any improved performance in the teaching skills of the preservice teachers for all *Lesson Study* groups through three consecutive cycles of *Integrated Lesson Study* intervention?

Research Question 2 (b):

How were the learning experiences during the planning, teaching, and evaluation of the *Integrated Lesson Study* reflected as the apprenticeship in learning to teach chemistry?

1.6 Research Hypothesis

The research hypotheses stated below are for research question:

Research Question 1.2 (a)

Ho1: There is no significant differences in the preservice teachers' Personal Science Teaching-Efficacy Beliefs (PSTEB) before and after conducting *Integrated Lesson Study* at significant level $p < 0.05$.

Research Question 1.2 (b)

Ho2: There is no significant difference in the preservice teachers' Science Teaching Outcome Expectancy (STOE) before and after conducting *Integrated Lesson Study* at significant level $p < 0.05$.

Research Question 1.2 (c)

Ho3: There is no significant difference in the preservice teachers' overall Science Teaching-Efficacy Beliefs (STEB) before and after conducting *Integrated Lesson Study*; at significant level $p<0.05$.

Research Question 2 (a)

Hypothesis 1: All *Lesson Study* groups had improved the performance in teaching skills after the three consecutive cycles of *Integrated Lesson Study* intervention.

1.7 Significance of the study

The significance of the study will be discussed according to its contribution in terms of education and research in education. Among them are the following:

The interest to understand the elements of mental models in terms of beliefs in teaching and learning science as well as the Science Teaching-Efficacy Beliefs will provide knowledge and information to understand the participants' problems of learning to teach that is common among teachers especially the preservice teachers. In learning to teach in chemistry, those teachers will learn how to combine the content knowledge and pedagogical content knowledge (PCK) to teach in the classroom and science laboratory.

Knowing the beliefs would benefit the participant teacher candidates, giving them reflections about knowledge and skills need to be developed and strengthened. The study would also benefit other science or chemistry teacher candidate about understanding insight beliefs that is inconsistence with new reforms in science education teaching and learning

Besides, teacher educators need to understand the preservice teachers' thinking and the diversity of beliefs that may influence their action and behaviour in teaching in the classroom. The knowledge gained may help teacher educators to plan their strategies and come out with an effective course for teaching-methods. The

teaching-method courses are seen to provide a sustainable manner in improving teachers' professionals' skills, thus improving their confidence in teaching and learning science particularly the chemistry subject for upper secondary school.

The findings from the study may also help teacher educators to understand the factors that can influence the changes experienced by preservice teachers particularly in terms of teacher self-efficacy (Bandura, 1977), that has proven to be a major influence on learning and motivation of students. In addition, the findings of this study will also provide knowledge to see the impact of the *Lesson Study* process as a component to the situated learning environment within its context.

The analyses on impact of *Integrated Lesson Study* on the preservice teacher education programme may be visible through case-studies analyses. The case-studies analyses will contribute toward the understanding of how the *Lesson Study* process helps those teachers to build their knowledge base of teaching, PCK and strengthen their conception of teaching chemistry in secondary schools.

1.8 Limitation and Delimitation of the study

This study involve only a small group of preservice teachers in year three of teacher education programme who enrolled in the chemistry teaching-method course in Universiti Sains Malaysia (USM). These teachers have not attended the student teaching practicum; therefore, the results will not represent the whole population of the preservice teachers in the university or other university. The *Integrated Lesson Study* approaches only involve the chemistry group of teachers as a case study research; thus it could not be generalized for the whole preservice chemistry teacher in the country but can generalized to those groups with the similar situation.

1.9 Operational definitions

1. The term **preservice teachers** refers to the undergraduate student teachers, who are studying in universities and teaching institutions, and have not yet served as a qualified teachers in the school. In this study, the **preservice teachers** refer to the preservice teachers studying at USM for the academic year 2010.

2. ***Lesson Study*** is a model (framework) that involves preservice teachers in collaborative planning of teaching goals, teaching strategies, making observation in the classroom, analysing and evaluating teaching, reviewing and revising the teaching, and documenting the process of planning and teaching. This study conducted *Cognitive Apprenticeship* model through *Lesson Study*, also termed as ***Integrated Lesson Study*** is a model (framework) that involves steps of implementations process of *Lesson Study* i.e. define the problems or learning outcomes, plan the lesson, simulated microteaching, analysing and evaluating the teaching, review and revise teaching and documenting the process and material in portfolio.

3. **The mental models in teaching and learning science** are cognitive construct that describes a preservice teacher's understanding in teaching and learning chemistry. The mental models refer to the representations or assumptions on beliefs which the preservice teachers hold about how the world around works (teaching and learning science), therefore influencing a person's judgment and decision making. It includes the *internal* representations of reality that the preservice teachers use to understand specific phenomena.

4. **The Science Teaching-Efficacy Beliefs (STEB)** is defined as the confidence of the preservice teacher to teach chemistry effectively and influence the performance of their participating students. STEB consists of two independent dimensions, i.e. Personal Science Teaching-Efficacy Beliefs -- PSTEB (the confidence on the ability to teach science) and Science Teaching Outcome Expectancy -- STOE (the confidence to influence student performance).

5. **Belief in teaching and learning science** refers to the preservice teacher beliefs about classroom organisations, teaching objectives and *Epistemological Beliefs*. The three categories of beliefs are also viewed as traditional/ teacher-oriented or modern/ student-oriented.

6. **Pedagogical content knowledge (PCK)** is defined as part of the knowledge base of teaching. PCK blends the content and pedagogy into an understanding of how particular topics, problems or issues are organized, represented, and adapted to the diverse interests and abilities of learners and presented for instruction.

7. **Learning to teach** is defined as how preservice learn to teach by combining the content knowledge and the pedagogical content knowledge (PCK) to teach in the classroom. The preservice teachers learn to be teachers through courses and practical training. During the course of their teacher education they learn to teach through micro-teaching and simulated teaching as part of the coursework requirements.

8. **Teaching performance** is defined as skills of teacher candidate in teaching and learning science such as implementing inquiry lesson, developing scientific skills, ability to develop constructivist environment, using appropriate teaching and learning strategies, questioning skills in developing student scientific learning

2experiences and considering the appropriate responses to what the students simulated contribute to the lesson. Teaching performance is measured using a rubric assessment; *Lesson Study* Performance Assessment Form (LSPAF).

1.10 Conclusion

This study attempts to explore *Cognitive Apprenticeship* through *Lesson Study*, also termed as *Integrated Lesson Study* as one component in the Chemistry teaching-method course in the science teacher-education programme. The approach is an effort to provide the preservice teachers with formative experience prior to teaching at the school through discussion and reflection on teaching and learning methods that are effective and in-line with the actual classroom. The study aims to investigate whether the promising *Integrated Lesson Study* approach may provide knowledge in shaping a good mental model of teaching science particularly affecting their beliefs in teaching and learning science as well as building their science Teaching-Efficacy Beliefs.

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

This research aims to investigate the influence of *Lesson Study* as one of the apprenticeship approaches for preservice chemistry teachers to overcome problems in learning to teach chemistry. This research examined changes in mental models of preservice chemistry teachers that could influence their teaching action and behaviour during their planning and decision-making in the process of learning to teach. The term mental model in this study refers to teacher assumptions about the beliefs of teaching and learning of science and Teaching-Efficacy Beliefs of the preservice teachers in teaching chemistry. This study postulated that the *Lesson Study* approach provided a tool for helping teachers to develop new knowledge in a new form of mental model in teaching and learning chemistry within a 14 week teaching-method course. This is because the new knowledge needs to be articulated, reflected and explored, to be developed as a mental model of good quality, especially in the teaching and learning of chemistry.

The literature review discusses the related area of research, survey of methodology and findings of past research. All related theories, concepts and themes related to the variable are explained. The chapter begins with a review of related literature and empirical studies related to the research, a conceptualization of all the variables, as well as the theoretical and research frameworks.

2.1 What is Lesson Study?

Lesson Study, specifically known as a collaboration-based teacher professional development approach, originated from Japan (Fernandez and Yoshida, 2004; Lewis and Tsuchida, 1998; Murata, 2011; Stigler and Hiebert, 1999). It is highly valued among Japanese teacher educators (Stigler and Hiebert, 1999). *Lesson Study* is a translation of the word *Jugyuokenkyu*: *Jugyuo* means instruction or lesson and *kenkyu* means research or study (Yoshida, 1999). The term *Jugyokenkyu* encompasses a large family of instructional improvement strategies (Lewis, 2000).

Lesson Study incorporates many characteristics of effective professional development programme identified in prior research: it is site-based, practice oriented, focused on student learning, collaboration-based, and research oriented (Murata, 2011). It includes cycles composed of several phases: collaborative planning, lesson observations by colleagues and other knowledgeable advisors, analytic reflection and on-going revision (Lewis, 2002b; Stigler and Hiebert, 1999). As part of the process, *Lesson Study* groups develop a written reflective report of their work (Fernandez and Yoshida, 2004; Lewis, 2002a).

Lesson Study as a professional development approach places teachers at the centre of the professional activity. It is developed based on teacher interests and their desire to better understand student learning based on their own teaching experiences. The steps of a typical *Lesson Study* are outlined with a research lesson (live lesson observation) as the centrepiece of the study process (Fernandez and Yoshida, 2004; Lewis, 2002b; Lewis and Tsuchida, 1998). The *Lesson Study* process begins by identifying a lesson goal and throughout the process the teacher plans a lesson. The goals can be general at first and further increasingly refined, as

the process goes. The teacher designs a teaching approach to make student-learning visible, keeping their lesson's goal in mind. The main purpose is not to plan a perfect lesson, but to test a teaching approach in a live context to study how students learn (Murata, 2011). As they plan, they will anticipate students' possible responses and craft the details of the lesson. During planning, teachers also have the opportunity to study curricular materials, which can help teachers' content-knowledge development.

During the lesson, a teacher attends to student thinking and takes notes on different student approaches. In the debriefing session, the teacher discusses student- learning based on the data they have collected during the observation. The main strength of *Lesson Study*, apart from other professional development programme, is the *live* research lesson. The live research lesson creates a unique learning opportunity for teachers such as shared classroom experience that expose "teachers' professional knowledge" that is not easily shared among teachers (Murata, 2011). A summary of the process is outlined in the following *Figure 2.1.*

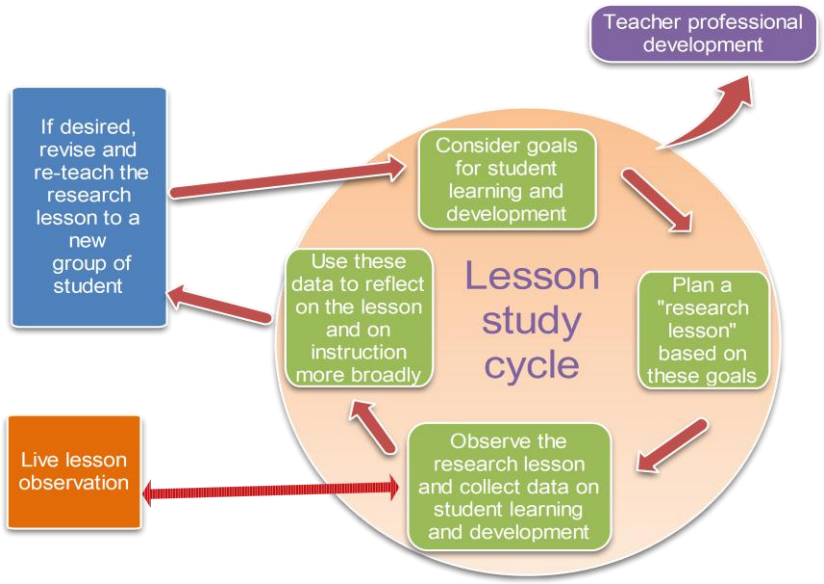

Figure 2.1. A typical *Lesson Study* cycle.

Adapted from Murata, A. (2011). Introduction: Conceptual Overview of Lesson Study in *Lesson Study Research and Practice in Mathematics Education* (1-12)

Henceforth are additional perspectives or views from North American, Australian and Malaysian cases, including this university.

2.1.1 *Lesson Study* from North American Cases

Catherine Lewis first heard about *Lesson Study* while observing classrooms in 1993 for her book "Educating Hearts and Minds" (published in 1995). She terms *Lesson Study* as "research lesson", the actual classroom lessons with special characteristic features (Lewis and Tsuchida, 1998). She proposed *Lesson Study* as being critical to support educational change and innovation in Japan (Lewis and Tsuchida, 1998) and bringing about Japan's evolution of effective mathematics and science teaching (Lewis, Perry, and Murata, 2006). *Lesson Study* research was brought to the United States and Lewis published the first scholarly article on *Lesson Study* in the United States: "A Lesson is Like a Swiftly Flowing River" in 1998 (Lewis and Tsuchida, 1998).

After a decade of research and dissemination in North America, a theoretical model of *Lesson Study* was proposed as an improved approach to instruction and connected to student teaching (Lewis, Perry and Hurd, 2009). Lewis argues that *Lesson Study* provides the mechanism to improve instruction by developing teachers' knowledge (content, pedagogy and student thinking), by building teachers' professional community and by improving teaching materials (not just improved lesson plans). *Figure 2.2* presents how *Lesson Study* results in instructional improvement: two conjectures explain the mechanism of how *Lesson Study* produces instructional improvement (Lewis et al., 2009; Lewis, Perry, and Murata, 2006).