CHAPTER 3

METHODOLOGY

This chapter captures three main sections: first the thesis conceptual framework; second the samples; and third explains the stages of remedial framework development. The conceptual framework provides the overview of the thesis implementation namely problem, solution and outcome. The samples emphasize the background information of subjects such as age, place of study, sex as well as background of English language study. The stages of remedial framework development was taken to build, implement, test and refine the constructionism based remedial framework (hereinafter referred to as the remedial framework) in year 2008 - 2011. The aim of this remedial framework is to bring students' poor English proficiency to the level required of international university program as well as serve the requirements of the labour market beyond the university.

3.1 Conceptual Framework

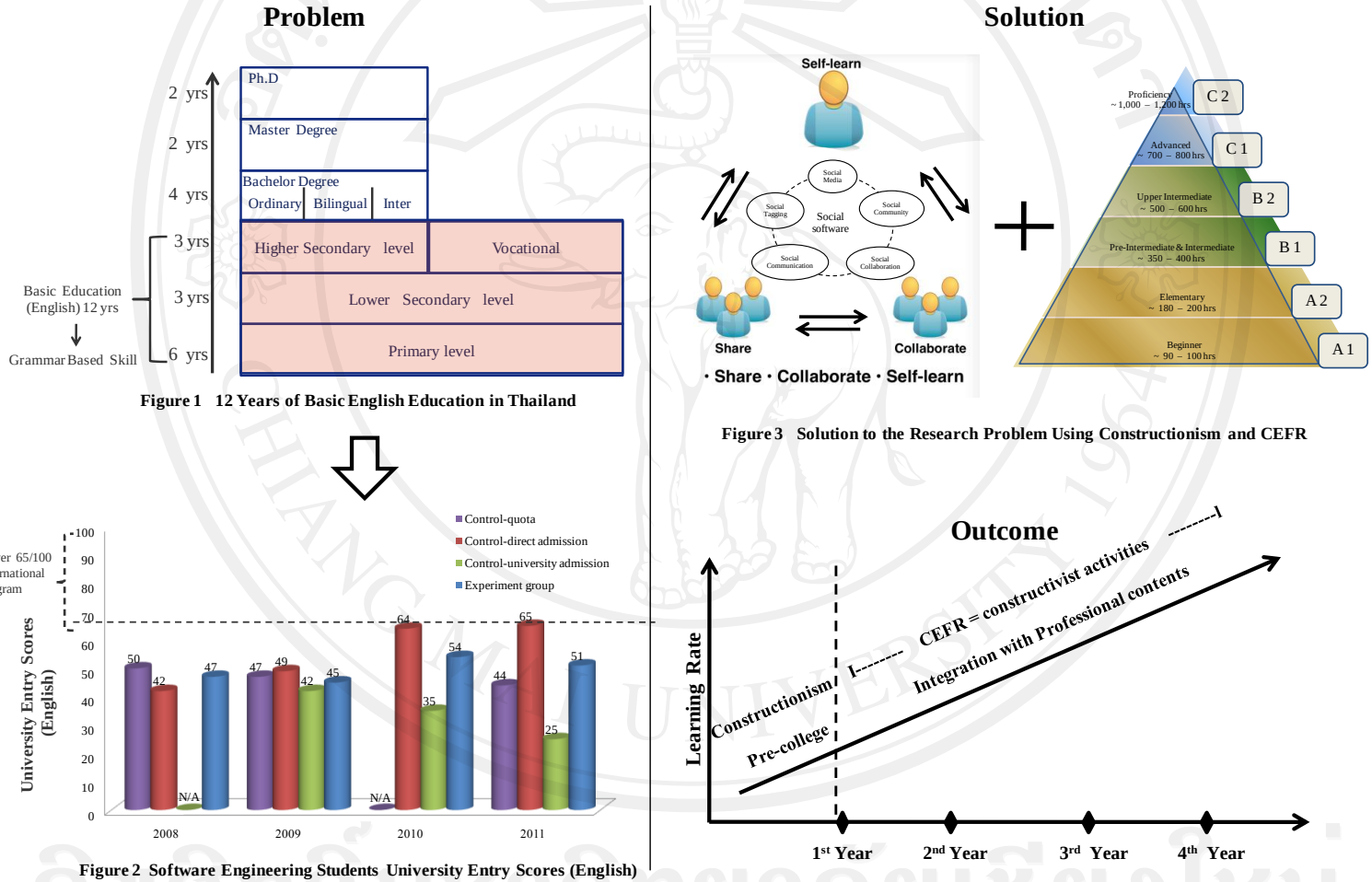

Figure 1 12 Years of Basic English Education in Thailand

Figure 3 Solution to the Research Problem Using Constructionism and CEFR

Figure 2 Software Engineering Students University Entry Scores (English) in year 2008 – 2011

Figure 4 The Outcome of the Thesis

Figure 3.1 Conceptual Framework of the Thesis

Figure 3.1 emphasizes on three domains in the thesis namely problem and justification, solution and outcome. Problem captures the research problem of English language education in Thailand during 12 years of basic education. Students have a high understanding in grammar rules, parts of speech, and a large vocabulary, most cannot integrate that knowledge to communicate effectively. Besides, Thai students have a high accuracy in specific written exercises such as multiple choices and filling in a blank, rarely write complete sentences or form a paragraph.

These problems are justified by the university entry scores of software engineering students, the target group, in year 2008 – 2011 (Figure 2). Most of their English university entry scores did not pass international program requirement standard referring to CMU international college regulation.

The solution to the research problem is using constructionism and Common European Framework Reference (CEFR) to remediate students whose English scores did not pass international program requirement to B1 level in CEFR (performance understanding 55%, writing 60% and reading 60 %). Constructionism promotes personally meaningful software engineering knowledge during the pre-college English language course and CEFR captures the immersive constructivist activities integrated with professional knowledge.

The implementation starts from the Pre-college and throughout four CAMT academic process. The expect outcome is SE students learning rate improve both common English and Professional CEF. The steps of data collection and implementation are discussed in the following section.

3.2 The Samples

The participants in the thesis implementation were the new software engineering university students who enrolled in the English remedial course during the summer semester in 2008 – 2011 at the College of Arts, media, and technology, Chiang Mai University, Thailand. The students were first year undergraduates about to begin their bachelors course. Participants were aged between 19 and 20, but in this study, sex was not controlled. Prior to participating in the research, they had been taught English as a second language in the Thai education system for approximately twelve years for four hours per week.

3.3 The Stages of Remedial Framework Development

The proposed remedial framework based on constructionism in the thesis has been developed and refined throughout four academic years (2008-2011) in order to be able to apply in Thai context. To get the better understanding on each stage of remedial framework development, the framework process is showed in Figure 3.2 as well as the information (such as data collection, pretest, implementation and posttest) is presented phase by phase for the clarification.

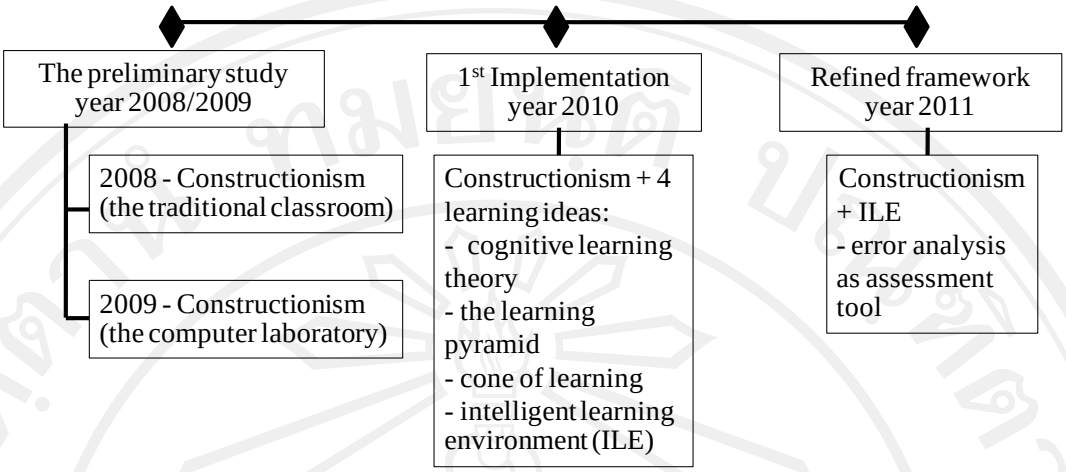

Figure 3.2 The stages of remedial framework development in year 2008 – 2011

3.3.1 The Preliminary Study in Year 2008 – 2009

Two batches of students at CAMT were used in a preliminary study (phases 1 and 2) to investigate the design of the constructionism remedial framework, and to confirm the feasibility of constructionism in the linguistic classroom in promoting students' English proficiency, assessing their problems with written English proficiency, as well as identifying and adapting to the key limitations of this philosophy.

Samples

In this preliminary phase, 36 students with mixed levels of English proficiency registered on the English course during the summer semester from 2008 and 2009.

Data Collection

In order to assess software engineering (SE) students' written English proficiency level, the data was collected from the subjects both pretest prior enroll in

the pre-college English remedial course; and posttest once again after they finish the 45 hours pre-college English remedial course.

Pretest and Posttest

To assess problems with their written English, the subjects were required to write a short paragraph with a 150 – 200 words limit and within a time limit of 60 minutes. They also sat a two hour multiple choice test which captured listening, conversation, grammar structure, reading and vocabulary skills. The core content of the pretest was taken from Cambridge preparation for the TOEFL tests, and Barron's TOEFL iBT internet-based test 2008. This international examination is a one of the most commonly used English tests for studying abroad and the purposes of international programs.

In order to compare English proficiency and improvement, the same exam paper was used for students to sit a pretest and posttest. Students' written paragraphs were then analyzed and graded manually to assess errors in their writing using the criteria of the Humanities Faculty at Chiang Mai University. Following grading of the pretest and posttest, students' key problems were identified and assessed and used as the basis of creating and constructing the remedial framework.

Implementation

The preliminary investigation took place both in lectures, and computer classes at the College of Arts, Media, and Technology. The purpose of this phase was to ascertain students' problems, their requirements and how the theoretical components of a constructionism based remedial framework could be implemented practically. In

essence the investigation in 2008/2009 acted as pilot studies prior to building and implementing the main remedial framework. The duration was 45 hours, three hours daily for three weeks. Core course content was adapted from Basic English for Computing (Oxford University Press), and audio CDs. Methods of delivery were 45 minutes of teaching content, 1.45 hours written project, and 30 minutes class presentation which covered all four English skills: listening, reading, writing, and speaking.

Listening skills consisted of practicing role play, and composing conversation. The reading section drilled reading for comprehension. Writing knowledge was captured through daily writing rules, paragraph writing, and peer review. Teachers allowed students to decide the written topic for their group. While building written projects, students were supported by a collaborative community, and computer laboratory. Each project was assigned daily, so students had to work in group to complete the project within the limited time (1.45 hours) and present their results to the class. The final 30 minutes of class was the exhibition time: to present their projects and to identify the knowledge they had obtained.

3.3.2 1st Implementation in Phase 3: 2010

Following the problem identification of the students' written English and knowledge requirements assessment during 2008/2009, the remedial framework was designed and implemented during 2010 with SE students at CAMT. This section describes the design and implementation of the remedial framework to support learners in improving their written English. Although the focus of the remedial framework was on improving students' written skills, other aspects of their English

were also expected to be enhanced. For example, written English is considered to be one of the hardest for English as a foreign language (EFL) students to effectively learn (Bennui, 2008), and thus learning to write should naturally enhance speaking and reading skills (William, 1996).

The Development of Remedial Framework in 2010

To develop the remedial framework to enhance the writing skills of the case study students, four theories: constructionism, cognitive learning, cone of learning, and the learning pyramid were integrated in order to introduce the knowledge hub, and the new learning environment.

The 'learning by doing' layer described in Figure 2.5 (section 2.5.5) promotes the concept of the 'knowledge hub', which builds on the work of communities of practice and aims at facilitating collaborative learning and knowledge sharing. The knowledge hub can be viewed as an online knowledge network designed to help students interact with each other and their peers, as well as share their problems, experiences and learning through the use of emails and chat forum services, discovery and reference materials, group work, and customized learning plans. This hub can also help integrate the four traditional activities in the remedial framework incubator: lectures, group discussion, collaborative projects, and assessment. Lectures focus on identifying and discussing current students' problems and experiences through individual as well collaborative involvement of learners and teachers. Group discussions focus on collaborative projects, which allow learners to interact socially and share their problems, strengths and experiences through chat forums and emails. Typical collaborative projects may include problem-solving strategies and knowledge

sharing, for example students are expected to use tools such as mind maps, Gantt charts, and Microsoft PowerPoint and Word (or any other familiar software) to explain specific concepts relating to their projects.

This framework in phase 3 can also be expressed as a three dimensional graph (see Figure 3.3). The X-axis represents levels of performance and competence including knowledge acquisition, comprehension, analysis, application, evaluation and synthesis, which reflects the cognitive learning model. The Y-axis shows levels of experience which start from concrete to abstract, consisting of two sections: content area and incubator. The content area focuses on helping learners to acquire formal knowledge through interaction with students and teachers in the form of lectures and tutorials, while the incubator is based on Papert's concept of the 'microworld' and is used to enhance learners' practical skills. Finally, the Z-axis measures the confidence level of learners' communication and cognitive self-production skills by monitoring and evaluating their social interaction, retention and performance.

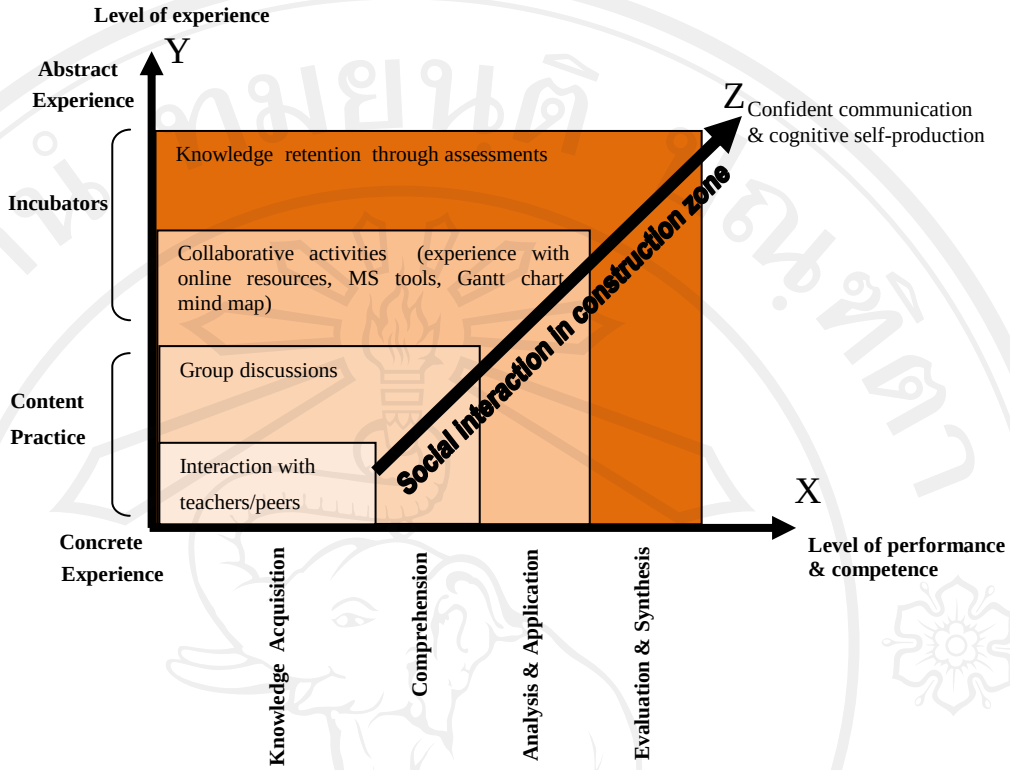

Figure 3.3 A 3D framework representation of the remedial framework in this research in 2010

Samples

The subjects of this study consisted of 23 new university students studying in a summer camp immediately prior to beginning their first year at university. All students were majoring in software engineering and studying at Chiang Mai University, Thailand. The age and sex of the participants were not controlled in this study.

Data Collection

To assess software engineering students' English abilities, students were asked to take a one hour written English test before pre-college English remedial course (pretest), immediately after the three week course (1st post-test) and then once again

three weeks after the end of the course (2nd post-test or long term test). Besides, SE students require filling up the questionnaire about the need analysis of the English remedial course.

Pretest and Posttest

The test evaluated students' knowledge of vocabulary, composition of simple sentences, and paragraph writing. To minimize the Hawthorne effect in this research, students were not informed of the novelty of the remedial framework and were not given prior information or warning about the three tests. As far as students were concerned, the three week course they undertook was a regular and unchanged part of studying software engineering at Chiang Mai University. The vocabulary used within the tests consisted of lexical computing terms which were derived from an analysis of writing from existing first year university students' on the Computer and Program Design (SE101) course. Sentence composition focused on students forming computing sentences from a choice of 20 words within the computing vocabulary, either in present or past tense. The written paragraph exercise required a short written passage of approximately 150-200 words. Writing topics were taken from commonly used TOEFL test preparation textbooks as these represent the gold standard in terms of assessing students' writing for higher education (Sharpe, 2006).

Implementation

The implementation can be classified in two parts based on the refined remedial framework 2010: first learning by doing; and second students' experience.

Part one: Learning by Doing

During the summer semester 2010, students enrolled on the English for Pre-College incubator course (the constructionist based remedial framework), learning for three hours daily for a total of three weeks. Learning activities started from concrete experience methods (direct experience) and slowly stepped up to abstract experiences, namely interaction with teacher/peers, group discussions, collaborative activities, and knowledge retention through assessments.

Teaching content was captured from online resources relating to the use of computing and software in daily life. Reading focused on reading for thinking, and comprehending the main idea. Writing activities promoted writing outlines and summaries, writing a paragraph, and writing main ideas and supporting details. Listening emphasized listening for the main idea, while speaking highlighted project presentations. Students acquired raw knowledge from direct experience and involvement and group discussion aimed to promote the conceptualization of each English skill.

Conceptual knowledge is not immediate, rather students must make active use of the learning activities to feed the cognitive process (e.g. consulting a dictionary, building a specific vocabulary database, peer review, discussion and argumentation). Consulting a dictionary generated comprehension of a reading passage, while building a specific vocabulary database generated comprehension of word classification between content and function words. This benefited students in structuring their sentences throughout the writing process. Students' own peer review served to check whether each student's written content was on the right track. Discussion and argumentation served to drive generation of sentences when students were scaffolded

by more experienced students, and group discussion enhanced conceptual growth.

Collaborative activities focused on using technology such as the Internet, mind mapping, and Gantt charts to support discussion and argumentation. Online sources contain both fact and opinion, and therefore, skills in reading for thinking, and reading for the main idea are required for students to appropriately classify online information.

In this sense, mindmapping was used to organize students' knowledge more systematically. Students sketched out ideas, mapped out visualization, and structured and organized ideas related to software. The Gantt chart aimed to promote planning of activities, clarifying jobs for group members and scheduling project time. Organized knowledge can be used as evidence in support of students' ideas and to draw valid conclusions.

Knowledge retention through assessments emphasized intellectual reasoning to construct knowledge production. This activity was self-directed, and allowed time to resolve mistakes, misconceptions, and incorrect procedures. When implementing 'learning by doing' activities, the construction zone (classroom layout and student placement) supported physical movement, and reinforced ideas in the air and knowledge sharing among classmates (see Figure 6). Physical movement and space reinforced communication and information-sharing regarding social software activities across different levels of participants and among teachers. Knowledge sharing as a peer support system exists among the class community, and individuals benefit because their learning is supported by more knowledgeable friends (Frondigoun, 2011). This cognitive conflict grows conceptual knowledge and the valid conclusions from discussion and argumentation help develop intellectual products.

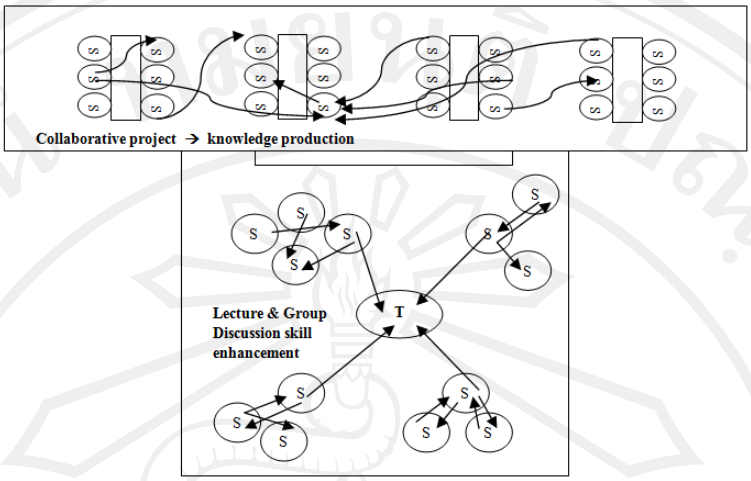

Figure 3.4 Construction zone showing classroom layout and student placement in the remedial framework

As previously stated, real and direct experience from interaction with teachers/peers brought together the necessary English skills with appropriate instructional content.

The learning activities within the framework are illustrated in Figure 3.5.

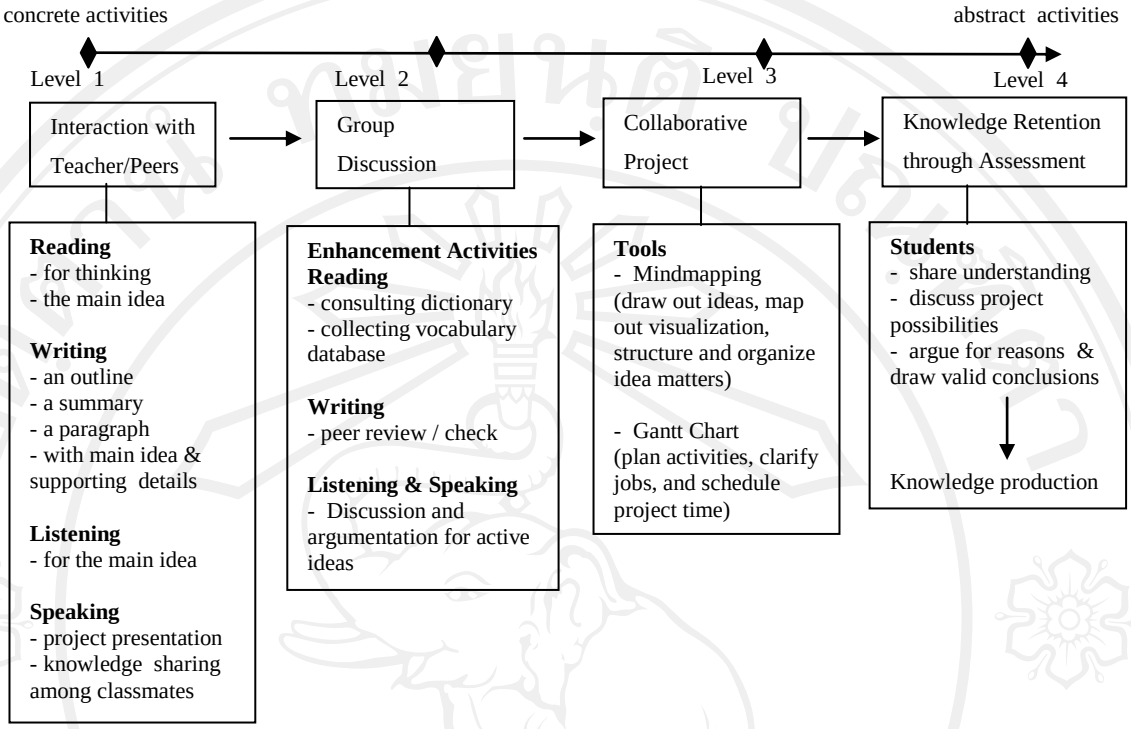

Figure 3.5 The process of learning activities within the remedial framework (2010)

The second level activities within the framework serve to exercise skills in doing, learning, and thinking. When all skills are linked, students are exposed to self-directed activity. The third level of the framework exposes practical skills by clarifying and organizing thoughts, whilst the final level serves to improve learning retention.

Part two: Students' experience

Students' experience encompasses teaching and learning, course content, delivery methods, classroom facilities, and fulfilment expectancy. In this study, students' experience was assessed via a survey at the end of the English for pre-

college course. This assessment aims to observe students' satisfaction in the English course, analyse the stages of the framework, and refine the framework. The survey questionnaire was taken from the Quality Assurance (QA) Department at the College of Arts, Media and Technology, Chiang Mai University. The survey consists of eight items, which were then ranked by the students on a scale from 1-5.

3.3.2 Refining the framework (2011)

After design and implementation of the remedial framework in 2010, it was adjusted and refined before being implemented again in 2011. Based on the results of the 2010 framework, refinement focused on three aspects which are core course contents, the learning environment and error analysis as a linguistic assessment tool.

Aspect 1: The Course Development Process

The initial step in building the revised remedial framework was the development of the course, including course content. Course content was a key area of refinement for the 2011 implementation of the remedial framework. Each stage of the course development process from 2010 to 2011 was related to the concept of 'teach less, think more' (Papert, 1980), which aims to engage the minds of learners in order to prepare them for a knowledge based society. The concept also aims to shift the focus from 'quantity' to 'quality'. Quality in the context of constructionism emphasizes the implementation of teaching higher order thinking skills rather than rote learning. Learners have more interaction, opportunities for expression, the learning of life-long skills and building of character through innovative and project based

learning. In the 2010, course content was derived from textbooks and online content, but in 2011 the course content was refined to include materials from SE professionals.

One of the central aims of the remedial framework is to provide education that meets the needs of the software engineering industry, aiming to promote writing proficiency through the use of online content, computer programs, facilitators, and social software. To construct a course aligned with the needs of the software industry, during the initial stages of the 2011 course refinement process as part of the remedial framework refinement, the skills needed in the workplace were directly captured by interviewing a SE expert with ten years experience in the software industry, and an understanding of both academic and industry requirements with direct knowledge of SE students' abilities and problems. Questionnaires were also sent to approximately 100 local and international software companies operating in Thailand to ascertain appropriate course content.

The domain knowledge from the SE expert and software companies was then categorized into three main types of English according to Figure 3.6 (daily conversation, professional business English, and specific technical English related to software engineering).

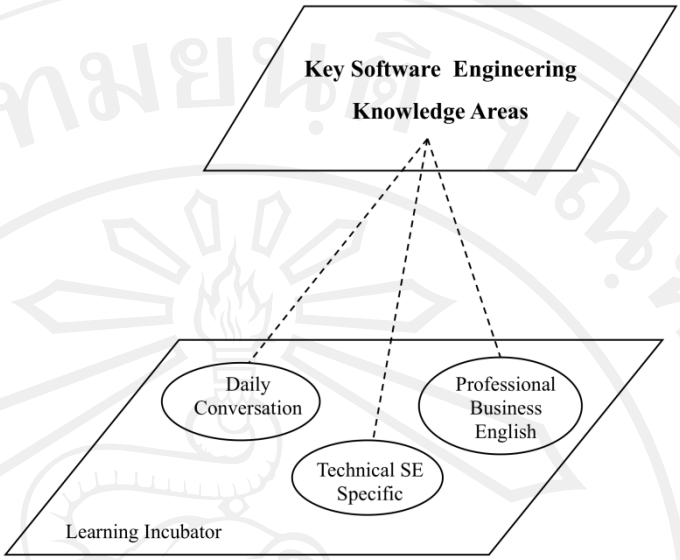

Figure 3.6 Categorization of software engineering knowledge areas into English types

After considering, capturing and classifying the appropriate knowledge for the refined remedial framework, the knowledge was then grouped into three subcategories, as displayed in Table 3.1.

Table 3.1 provides more details of the three categories of English required by the software engineering students (as presented in Figure 3.6). The three types of English are daily conversation, technical subject specific English, and professional business English. Table 1clarifies these categories by providing examples of the types of English knowledge required by the students in each of the three categories.

Table 3.1 The classification of SE Professional Domain Knowledge

Domain Knowledge of Software Engineering (SE) Professionals		
General English (Daily conversation)	**Technical / SE specific**	**Professional Business English**
Day to day communication (speaking and listening)	Software specification	Minute writing (for Meetings)
Emails	Requirements specification	Business plan
Memos	Plan	Internal Memo
	Product specification	Contract (MOU)
	Report errors	Presentation product
	Document	Report status
	Proposal	Project
	Reference	Instruction Manual
	TOR → Technical / Business	

The domain knowledge from the SE expert and software companies (Table 3.1) was then integrated with the existing constructionism theory and methods to implement the revised remedial framework.

Aspect 2: Design of Learning Environment

The second focus of refinement for the 2011 iteration of the remedial framework was the learning environment. The learning environment is defined as the 'learning incubator', which was designed to support physical movement of students, and reinforces 'powerful ideas in the air' when students interact in social communities to show, discuss, examine, and test hypotheses. This zone was also constructed on the assumption that the facilitator will minimize lecture time and increase learner participation through feedback, and guiding or scaffolding the students as they begin

planning and designing their project. Figure 3.7 compares the traditional Thai classroom layout with the physical classroom layout used in the remedial framework.

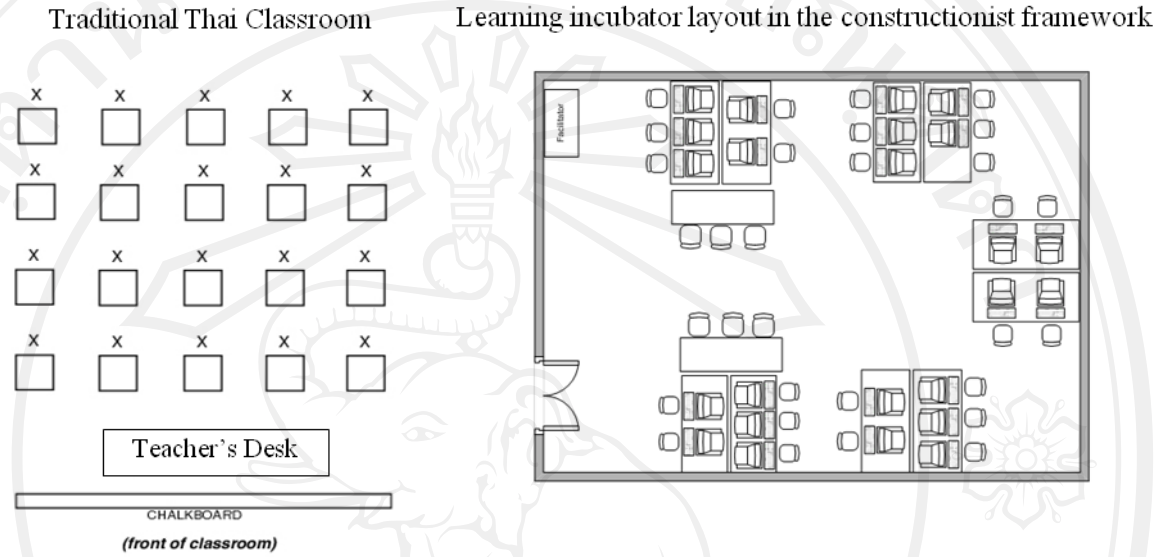

Figure 3.7 Comparison of traditional Thai classroom layout to the setup of the remedial framework

Aspect 3: Error Analysis as Linguistic Assessment Tool

The final aspect of refinement in the 2011 remedial framework was using error analysis as an assessment tool. This thesis uses error analysis as a summative assessment tool to measure the improvement of students' written English proficiency by considering the decrease in errors in the posttest compared to the pretest. Error analysis emphasizes in depth linguistic system errors. In contrast, most ESL research use pretest and posttest assessments to show an overview of language improvement and failure, rather than spotting specific points. To undertake error analysis, written passages were investigated via an in-depth analysis of the linguistic system, namely substance, text, and discourse, to discover the root cause of each error. After revising the three components of the remedial framework, including course content, learning

environment, and assessment, the process of the revised remedial framework is illustrated in Figure 3.8.

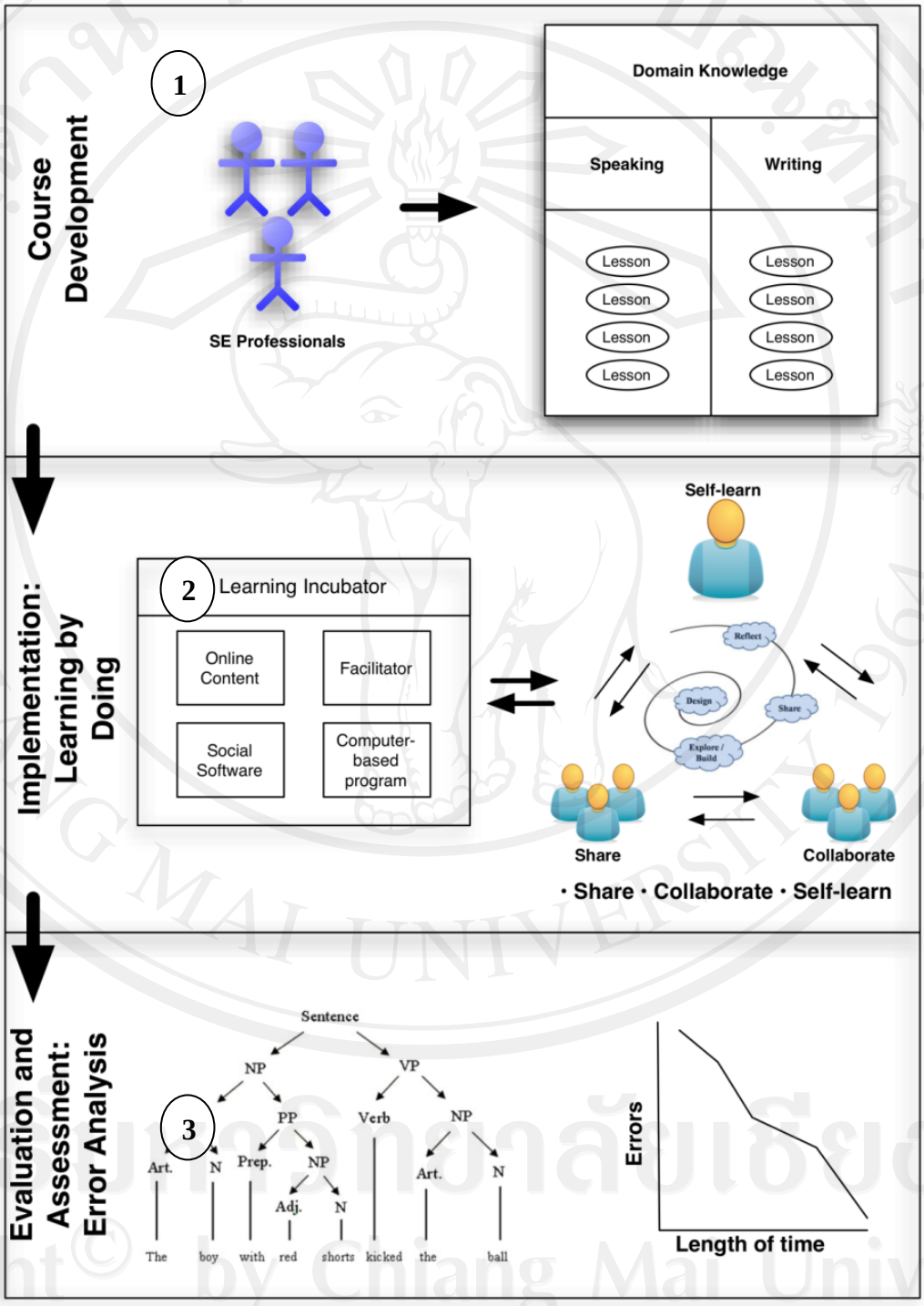

Figure 3.8 The three key steps to create the refined remedial framework to improve written English using constructionism and error analysis

Samples

The sample group consisted of 23 Thai students majoring in Software Engineering. The students were first year undergraduates about to begin their bachelors course. Participants were aged between 19 and 20, and once again sex was not controlled.

Data Collection

Data in phase 4 was collected from three sources namely interview, questionnaire and writing English proficiency test. Both interview and questionnaire emphasizes the level of English proficiency requirement from software industries. These requirements are captured from the software professionals in the industrial sectors, analyzed and construct the English remedial course contents.

Writing English proficiency test focuses software engineering students English proficiency level. To assess their English proficiency, their written English paragraph in pretest. Subjects enrolled on the remedial framework, learning for three hours daily for a total of three weeks. Posttest were collected once again after the course finish.

Pretest

To examine the initial state of students' linguistic errors in their written work, participants in the refined framework were asked to compose a paragraph on a topic related to computing consisting of 100-200 words, without consulting their dictionaries, and within a one hour time limit. This assessment took place before students began the remedial framework. The subjects' written paragraphs were then analyzed using the error analysis approach. This acted as a pretest, providing

information on student proficiency and errors before participation in the remedial framework.

Implementation

This section describes the implementation of the refined remedial framework. In the framework, students actively participate in constructing their knowledge, increasing understanding through peer scaffolding and collaboration with their environment (Higgins, 2011) as well as through trial and error, hypothesis testing and collaborative activities. The framework emphasized the constructionism concept of 'learning by doing' the personally meaningful knowledge, which comprises four elements: designing meaningful projects, using construction kits to build and explore, identifying powerful ideas, and engaging in self reflection (Figure 3.9).

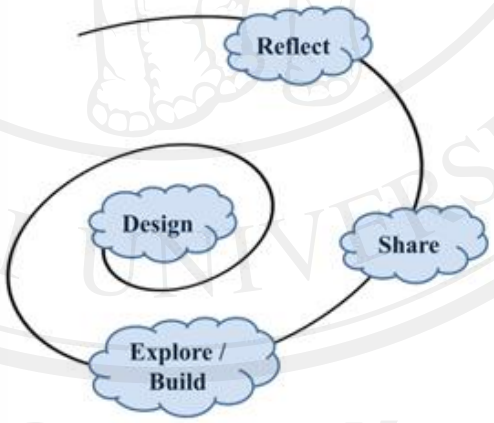

Figure 3.9 The four elements of constructionism utilized in the remedial framework

'Design' allowed students to choose any written topic within the project themes (e.g. software specifications, product specifications, instruction manual). Each project related to the knowledge captured from software engineering industry

requirements. Students were free to suggest any sub-topic under each project theme. They subsequently voted one sub-topic they would like to conduct as a group and decided on the written products.

'Explore and build' proposed the concept of 'construction kits' as key tools to drive, support and promote intelligence, while students build a new idea, and construct the artifacts autonomously within activities such as group projects, hands-on exploration, and product development. Different construction kits provided different experiences. As the target group were software engineering students, and the domain content was related to IT professionals, this research proposed tools to support domain content such as computer programs (e.g. Microsoft Office) and the Internet.

As students worked together on projects, they used construction kits to build writing skills ranging from lexical and grammatical to social meaning. These construction kits were represented by word databases and stored in a series of tables, for example, parts of speech, Thai and English definitions, synonyms, and sample sentences. Grammatical skill focuses on students forming computing sentences from each word collection within the computing vocabulary, either in the present or past tense. Social meaning emphasizes written paragraphs, which build on computing word collections, and forming computing sentences. Students learnt independently, without the aid of facilitators, and shared ideas and opinions with each other.

The 'Share' principle captured the concept of 'powerful ideas' through a peer scaffolding system. Creating an environment to encourage interaction between students and create a class community and social interaction as a group allowed students to share, discuss, solve problems, debate, and collaboratively reflect on the cognitive artifacts or products that they created. Individuals may benefit in a

collaborative group as there is an opportunity for their learning to be scaffolded by a more knowledgeable or experienced peer. In addition, the facilitator acts as a collaborative resource by (i) supporting and guiding students' learning through scaffolding and modeling, (ii) encouraging and helping students manage their learning and metacognitive processes, and (iii) helping students assess their own learning and providing feedback.

The 'Reflect' principle encouraged students to explore and be curious about their own experience and actions by answering questions on an evaluation form, for example, how they perceive academic success and failure, and how to respond to that failure.

Along with developing the proficiency of written English, the remedial framework was designed to help students explore and discover online information, and build the project, while simultaneously participating in interaction, discussion, and debate with the class community, sharing learning experiences, modifying projects, and self- reflecting on projects.

Posttest using Error Analysis

This thesis uses 'error analysis' as a summative assessment tool to measure the improvement of students' written English proficiency by considering the decrease in errors in the posttest compared to the pretest. Error analysis emphasizes in depth linguistic system errors. To undertake error analysis, written passages were investigated via an in-depth analysis of the linguistic system, namely substance, text, and discourse, to discover the root cause of each error.

After course completion, the 23 students were again asked to compose a paragraph of 100 - 200 words on a computing topic, and within a one hour time limit. In order to understand specific node errors, error analysis was used to analyze and describe features of first language (L1) interference. Three levels of L1 interference (Figure 2.1, chapter 2) were investigated (words, sentences, discourse) via students' pretest and posttest paragraphs, and analyzed through error analysis. To understand specific root causes of error, this paper uses error analysis as a key assessment tool, which aims to undertake in depth linguistic analysis by counting errors.

According to Saengchan (2006), in making error counts, individual written paragraphs were counted at the word, phrasal, and sentential levels, including: first individual lexical items; second word combinations consisting of two lexical items, phrases, a whole sentence; third multiple errors in phrase were counted separately; and fourth identical errors made by the same student were counted as one error.

In this research, students' errors were counted manually based on these guidelines. The same researcher assessed all paragraphs to maintain consistency.

Testing and Evaluating the Remedial Framework

The primary mechanism of evaluating the remedial framework was to assess student performance in terms of improvement in their written English proficiency. This was undertaken via statistical analysis of raw scores. A comparison of pretest and posttest score using a T-test as well as ANOVA allowed the determination of statistically significant difference between students' pretest and posttest scores. Long term retention was tested after three week off study. To track and assess students' English proficiency progress, the scores of English Foundation course namely Eng

101, Eng 102, Eng 201, and Eng 202 was collected from the Faculty of Humanities as well as the CEF level range was collected from British Council. This acted as a control group to compare results of these students who were enrolled on the remedial framework versus those that were not.

Chapter summary

This chapter presents the information of data collection, pretest, implementation and posttest over three phases with SE students at CAMT. 2008/2009 allowed a preliminary analysis and identification of student problems. 2010 was the initial implementation. 2011 allowed for refinement of course content, learning environment, and assessment tool. The results now show the effectiveness and weaknesses of this remedial framework.