

CHAPTER 5

CONCLUSION

This chapter summarizes and concludes the thesis with regards to the thesis objectives, the framework for language problems justification, knowledge discovered, and future work.

5.1 Thesis Conclusion

The aim of this thesis was to remediate SE students' written proficiency using a remedial framework based on constructionism to promote their learning abilities as well as bring them to an international level. The two reasons for an emphasis on written skills are firstly, that written is considered deep language structure which requires multi-cognitive abilities to transform information to the target language. Also, written ability influences the surface language structure in speech production. Secondly, written skill was emphasized as it represents a key knowledge requirement for the SE industry and is one of the key factors to compete in the forthcoming AEC 2015 market flow of labour.

To effectively conclude this research, the research process in this thesis was divided into six stages: (i) the thesis problem discovery and justification, (ii) approaches to constructing the remedial framework to address the problem, (iii) four batches of students to implement the framework, (iv) new knowledge or information

discovered and the limitations of the thesis, (v) areas for further development and research, and (vi) the novelty of the thesis.

5.1.1 Discovery of the Research Problem

To identify and explore the research problems, the thesis collected data of SE students' English learning difficulties by collecting their admission scores from 2008 – 2011, interviewing SE staff, asking SE students to complete self-evaluation questionnaires, analyzing students' written paragraph using error analysis, and sending a questionnaire asking about 'the skill/knowledge requirements for the SE workplace' to software companies in Thailand. The key problems were:

- Students had poor abilities both in written and presentation referring to the interviewing SE staffs.
- Based on the questionnaires, SE professionals in industrial workplace highlighted that most graduates lacked of the proficiency in English written and speaking abilities to document the specific English tasks (such as email, minute of the meeting, and manual).
- An average admission scores showed that SE students generally had poor English proficiency since they entered SE international program.
- The linguistic system analysis results demonstrated that of all three linguistic level (substance, text and discourse), text level interfered students written English proficiency the most. This error level also affected English communication both written and speech production.

5.1.2 Approaches to the Framework Construction

Approaches to the framework construction captured the integration of second language learning (SLL) theories namely teaching and learning approaches, language learning strategies, linguistic hierarchy, intellectual tools selection, cognitive skills and language learning measurement, and the design of cognitive learning activities which relate to the learning environment.

Aiming to serve the industrial requirement, the knowledge workers or graduates must be flexible and practical in any working situations. Constructionism (focusing on ‘teach less, think more’, ‘learning by doing’, ‘learning through design’, and ‘power ideas from community reinforcement’) was selected to modify the existing teaching and learning system. In the final stage, the improvement of students’ written English proficiency was assessed and analysed by error analysis.

The development of the remedial framework based on constructionism combined three content domain: SE professionals’ perspective, software designer’s perspective, and software users’ perspective. SE professionals’ perspective captured the software industrial requirements which were collected from both the interview professionals in the software industrial workplace and the questionnaire survey. Data from both interviews and surveys were gathered to construct the core course contents as well as design of the cognitive learning activities based on theories including: the learning pyramid and cognitive learning theory, to let students exercise their knowledge content with the class community for their better understanding.

Based on intelligent learning environment (ILE) theory the software designer’s perspective emphasized planning to link both classroom layout and social software tools to the learning contents in order to generate cognition while running project

activities. Meanwhile the software users offered an overview of social software trends in their generation which inspired the selection of ‘construction kits’. This selection of intellectual tools is grounded on the cone of learning theory.

Remediating students’ written English proficiency is the main objective of the thesis study. Remediation of any English learning disability means the act or the process of correcting a fault or deficiency in the language learning system. Therefore, the last process in the proposed framework, error analysis was used as the assessment tool to analyze students’ paragraphs in the unit of linguistic hierarchy. The analysis results clearly demonstrated the decreasing and increasing numbers of language interference errors. In future work, the error nodes will be directly remediated in the remedial English for specific purpose course.

The proposed framework was introduced to new university students from 2008 – 2011 via the English remedial course for 45 hours over three weeks during the summer semester.

5.1.3 Implementation of the Framework, 2008 - 2011

This section emphasizes the implementation of the remedial English course based on constructionism in four batches (2008-2011) as well as the background education of the target group.

The target group consisted of new university students. After they finished their high school (such as private school, government school, and international school), they entered the international SE program under four conditions, namely CAMT direct admission, Commission of higher education (CHE) entrance exam, CMU quota exam, and CAMT special condition admission (scholarship in sports, and good grades). Most

students who achieved the highest admission score often came from private school. A small number of government students achieved the highest score range, however most government students' admission scores did not pass the CHE and CMU standard (over 50 out of 100).

Based on the average admission score of SE students in 2008, their English proficiency was lower than the CMU standard, but in comparison, in 2009 – 2011 their English abilities were marginally improved. Students' admission scores were taken as descriptive data in defining their learning improvement and failure throughout the treatment stages (the knowledge input, CMU (CAMT) process, and English proficiency output).

Students' English learning improvements were tracked each year via the four phases of implementation of the remedial framework: the preliminary study in 2008/2009, the first implementation in 2010, and the refined remedial framework 2011. The first phase aimed to discover students' English learning difficulties, and to assess the possibility of constructionism in language education. The results of this preliminary phase 2008/2009 showed that constructionism in isolation hardly enhanced students' written English proficiency. Other factors affected students' learning and motivation, such as the learning environment, the knowledge gap between students' existing English knowledge and technical English content, and students' personality and background education. Constructionism in science education emphasizes physical learning and learning by doing. Directly applying constructionism structure to a language class caused a gap between students' existing knowledge and new knowledge, so bridging the knowledge gap required practicing and reviewing the lessons, and developing a learning environment.

The results of the preliminary study were used to build the remedial framework in 2010 by integrating four theories: cognitive learning theory, the learning pyramid, cone of learning, and constructionism to nurture students' English learning abilities. In 2010 small changes were also applied to the classroom design in order to support physical movement during the activities. After 45 hours in the first implementation, students' English proficiency was different and statistically significant between pretest and posttest. Classroom design supported the knowledge flow in the class community during the projects. The collaboration reinforced knowledge structure and extended students' knowledge.

The 2011 refined remedial framework kept the 2010 framework as the main template, and modified it in three sections: course content, classroom design, and English proficiency measurement in order to meet the knowledge requirements of industry and the labour market flow in the forthcoming AEC 2015. Core course contents were developed based on the industrial requirements which were collected from experts' experiences, and emphasized the knowledge and skill requirements in software companies. The classroom learning environment was designed to support both learning content and class movement while undertaking activities. A class community reinforces powerful ideas in the air which occurs when sharing visions, having discussions, and debating. Students learned from their more experienced friends which helped organize well-structured knowledge. Error analysis assessed and tracked students' English learning in each language hierarchy: lexical, semantic, grammar, and discourse. New knowledge and limitations of the research are presented according to each of the four phases (2008-2011) in part four.

5.1.4 New Knowledge and Limitations of the Thesis

This part emphasizes the key findings of each phase of implementation and the limitations of the framework. In the preliminary study, findings showed that constructionism alone did not represent a feasible application in the linguistic class, as this philosophy caused a knowledge gap which slowed down students' knowledge acquisition. This led to the adaptations and refinements in the 2010 and 2011 phases of implementation.

Key Findings 2010

In this batch 2010, both qualitative and quantitative data was collected to assess a new framework for teaching English to software engineering students. Quantitative analysis indicates that a 'collaborative knowledge sharing framework' enhanced both students' educational attainment, and retention rates. Language abilities such as vocabulary, composing a sentence, and writing a paragraph were all improved, as was oral presentation skill. In addition, qualitative data was collected from class observations. While students were processing intellectual projects, the two cognitive activities of rereading text and translation were undertaken. According to the teaching plan, the most effective aspects of the collaborative knowledge sharing framework were the following:

- the lecture method can strengthen background English skills
- the physical environment facilitates movement, reinforces communication, and knowledge sharing between students
- collaboration engendered cognitive conflict and that promoted conceptual growth

- students learnt from their project failure
- mind map and Gantt charts allowed for a more systematic structuring of knowledge

A key limitation of this study was the course duration; three weeks is a limited time in terms of knowledge transformation. English requires sensory motor skill processing, which takes time to encode and decode information. This sensory information needs to be organized and processed into a useable form in order to produce an appropriate motor or movement response in daily tasks.

Key Finding 2011

In this batch 2011, both qualitative and quantitative data relating to students written errors was collected to assess students' written English and a new remedial framework for teaching English to Thai software engineering students. Quantitative analysis and assessment of students' written work shows that the remedial framework using constructionism enhanced both students' educational attainment, and written English proficiency. In depth error analysis showed that although language errors were frequently found in grammar, and substance levels, these node errors reduced after three weeks of participation in the course.

There was an increase in some errors between the pretest and posttest, which is postulated as being related to the increased length of students written work in the posttest. A paired t-test showed statistically significant differences (at the 95% CI) between the pretest and posttest, indicating that the framework was directly responsible for a reduction in errors relating to capitalization, consonant, noun phrase, verb phrase, and coherence.

As well as quantitative analysis of the errors and their reduction, qualitative assessment of students' written English and the remedial framework was undertaken. While students were building ideas and constructing projects, the intellectual activities such as peer scaffolding, consulting online data, rereading text and translation were undertaken. The most effective aspects of the remedial framework in reducing students' written errors were:

- the learning process emphasized domain issues to prepare students for a knowledge based society
- the framework facilitated physical movement, reinforced social interaction, peer scaffolding, and knowledge sharing in the class community.
- project activities engendered cognitive conflict while exploring information, building ideas, constructing tasks, and resolving issues. These promoted conceptual growth
- Self-motivation promoted autonomous student learning and built confidence.
- students learnt how to work with a community of peers
- the constructionist based construction kits structured students' knowledge to be more systematic.

A key limitation of this study was the course duration. English study is an innate development, which needs sensory skills practice and time is therefore an important variable in this study. A three week course is a relatively short time and limited in terms of promoting both syntax, and semantic competence, especially given writing is considered the most difficult of all four English skills, whilst speaking is relatively simple (Bergh, 2007).

Key Finding once Tracking Students' Learning Rate Both Common English and Professional CEF in Year 2008 – 2011

- The remedial course promoted the active learning and retained learned knowledge over time as well as CEF active English reduced the fluctuated learning rate in Common English, kept the rate stable and enhanced the higher level English proficiency.
- The poor English abilities will bring to the international program requirement level after approximately 300 hours CEF active English treatment and 45 hours of the English remedial course.
- During 360 to 400 hours CEF active English treatment, the fluctuated learning rate is stable.
- Over 400 hours CED active English treatment, students' English proficiency is getting better.

5.1.5 The Areas for Further Development and Research

To achieve effective learning and reduce students' errors, the teacher should strongly consider students' background skills, learning environment, social interaction community (Liao, 2010), and graphical tools for the organization of knowledge. In considering English as the global language of business, and Thailand's issues with learning English, new teaching and assessment methods should be adapted and the remedial framework presented in this paper provides a useful starting point to promote discussion, highlight key student errors and shift teaching styles in Thailand from memorization and recall to higher levels of learning.

The future work is adapting this remedial framework in the construction of English for specific purpose course in different contents in order to help support learners' specific English skills as well as develop the active English learning environment with the integration of technology to enhance English proficiency both written and speech production for the 1st year university students.

5.1.6 The Novelty of the Thesis and Body of Knowledge.

Generally English learning and teaching are based on textbooks, memorization and recall which lack of acquiring experience from the real learning situations. Although the time passes by, the same textbooks are used from one generation to other generation. The classroom environment is set to face the whiteboard or the screen and has little space to run activities. Even the world has been changed; computers, which are the new technology, are used as the education tools, not intellectual tools.

To empower and innovate learning, computers are shifted from the education tools to tools to think with. Core course contents are modified to serve industrial requirement. Learning environment is designed in flexible style with physical zone for sharing, discussion, and growing knowledge. Tools to think with or intellectual tools drive the cognitive activities which design for contents practice and exercise as well as learning environment will help support students to flow their ideas while running activities in the physical zone.

The novelty of this thesis is the construction of constructionism in cognitive science to remediate students whose English ability does not pass the international program requirement and standard. Also, the proposed framework serves software

engineering industry requirement and assist students to attain an international standard of English particularly in preparation for AEC 2015.

5.1.7 *The Future Research*

This thesis constructionism and CEFR brought SE graduates whose English proficiency do not pass the international program requirement to B1 level which students has performance in understanding (listening and reading) 55%, writing 60% and speaking 60%. Future research aims to enhance students' poor English proficiency to C1 level (the performance in understanding 95%, writing 100 % and reading 100%) within one academic year via the immersive learning environment both inside and outside the classroom.

To develop an immersive communication learning environment, during the CAMT academic process all general education (GE) subjects will be changed to liberal and science under the responsibility of the native English speakers. Meanwhile tablets with all English language function and social software communities promote constructivist activities outside the classroom.