

CHAPTER 2

LITERATURE REVIEW

To understand the theoretical framework of the thesis, this chapter provides the literature reviews and critical reviews that relevant in five sections: firstly constructionism; secondly English teaching in Thailand; thirdly learning techniques and ideas; fourthly knowledge workers; and finally an overview of theoretical perspective as a description of how these theories, techniques, learning ideas and strategies are leveraged in this research and come together in synergy to create the remedial framework.

2.1 Constructionism

Knowledge is not only transmitted from teachers to students, but constructed in the mind of learners (Yasmin, 1996). Constructionism is considered as a theory of learning, and a strategy for education consisting of two key concepts, namely cognition and computing (Dale, 1991) and is built on Piaget's constructivist theory. Papert (1980) proposed ideas on how computers can serve as the material for thinking by creating incubators for knowledge or a microworld as the growing place for students' powerful ideas and intellectual development. Students not only study a domain in a microworld but they "live" the domain (Papert 1980).

Papert (1991) suggests that knowledge construction takes place when learners are engaged in building objects. Two main points are discussed: (i) in the reasoning

step, students are introduced to activities which exercise their doing, learning, and thinking, and (ii) in knowledge sharing, a self-directed project activity is introduced taking into consideration the culture and social community. By working on projects or artifacts, ideas do not appear immediately, but active use of available information and activities can improve cognition. Construction of a deeper understanding occurs in two types of cognitive activities: the projects perceived by the students, and the task environment (Bergh, 2007).

Furthermore, Papert proposes a strong connection between designing and learning. The final outcome of design is a product, while learning is a process. Design involves the relationship between building and objects. As a designer, students must find what the project means to them, and selectively connect context to that project. Later, they understand not only the project, but also its meaning. In 'Mindstorms', Papert (1980) discusses the concept of community of learners which play important roles in the learning process through the concept of discussions, collaborations, knowledge sharing, and therefore communities act as collaborators, coaches, audience, and co-constructors of knowledge. These activities support not only individual development, but also the community itself.

In conclusion, constructionism is based on the idea that people learn particularly well when making things especially things which can be shared with others. A strong emphasis is placed on created objects being external to their creator, as things 'in their world' can be 'shown, discussed, examined, probed, and admired' (Papert, 1980, 1991, 1993). Sharing a creation can result not only in its refinement, but also in the learner obtaining a deeper understanding of other people's perspectives on the object and on the ideas to which it is related.

Throughout the constructionism research, reports and essays (Harel and Papert, 1985-1990), the concept of constructionism can be extracted to three domains: problem solving situations, intellectual tools selection (LEGO/LOGO) and computer based learning environment (microworld or intelligent learning environment).

Firstly, problem solving situation captures the goal-directed, realistic and personally meaning contents or situation which no routine solutions exist. These realistic situation provide the students with a comprehensive focus and objectives in developing and compare alternative solution among their team members and the class community.

Secondly, intellectual tools selection or LEGO/LOGO is the toy which learners play and learn at the same time (Papert, 1980). LEGO/Logo builds on several decades of research on computers and children. In the late 1960s, Papert and colleagues at MIT developed Logo as a programming language for children (Papert, 1980). The most popular application of Logo involved the 'floor turtle,' a simple mechanical robot connected to the computer by a long 'umbilical cord'. Logo included special commands like forward, back, left, and right to control the floor turtle.

Later, the Logo community shifted its focus to 'screen turtles' using commands control small graphic images on the computer screen, not actual mechanical robots. Screen turtles are much faster and more accurate than floor turtles, and thus allow children to create more complex graphic effects.

Working on projects like these, children experiment with many different types of design: structural design, mechanical design, software design. LEGO/Logo might be viewed as a 'multimedia construction kit,' allowing students to build and create in several different (though interconnected) media. Since students are often interested in

writing about the machines that they have built, such LEGO/Logo is a rich environment, not only for math, science, and design, but also for language arts.

In the core idea of Papert's theory 'constructionism' (Papert, 1986), design activities have the greatest educational value when students are given the freedom to create things that are meaningful to themselves. In such situations, students approach their work with a sense of caring and interest. As a result, students are more likely to explore, and to make deep 'connections' with, the mathematical and scientific concepts that underlie the activities.

Thirdly, computer based learning environment or intelligent learning environment represents the realistic word called microworld. This word emphasizes the physical movement zone which supports the reinforcement ideas in the air while students share and discuss their artefacts or the intellectual products. Computer based learning environment encourages multiple learning styles and multiple representations of knowledge.

Intelligent learning environments aim to manipulate concepts and processes, capable of demonstrating how the concepts and processes within the world work, explaining the underlying principles, and detect students errors. The environment must include the capabilities of monitoring and guiding students as they interact with the simulation, microworld, or empowering environment for learning (Merill, 1988). In order to process the learning, microworlds, simulations, and multimedia environments are integrated for design learning environment.

Microworlds are computer programming environment for experimenting with concepts, and procedures. One of best known example of microworld in education is LOGO simple programming language which allows children to create 'turtle' graphics

and explore concepts in geometry. Simulations are devices, computer programs, or multimedia environments that model a real system or situation. Computer-based simulations are capable of recreating procedures, processes, and causal relationships encountered during real life situations. These simulations provide important learning environments which have the potential for instructional components to optimize and transfer learning.

In the field of second language acquisition (SLA), constructionist theory is applied to create 'tools to think with' or assisted learning tools and virtual communication. Schwienhorst (1998) and Peterson (2001) use a MOO (Multi-user domain, Object Oriented) system to provide a flexible, easy-to-use multiple user virtual reality that allows for the integration of language learning tools and resources in a common environment, a third place. Vaikakul (2005) develops the Junior Linguistics Club which aims at helping children to discover how their language works through playful modeling of language. In this case, computer programming is used to encourage and support children's perception in the domain of formal linguistics by providing them with rich conceptual tools and environments. Constructivism has been applied successfully in many areas, for example in teacher education (Jensen, 2000; Gray, 1997), in schools (Matusevich, 1995; Chen, 2007), in designing e-learning activities (Alex et al., 2009; Mason, 2002), instructional design (Duffy, 1992; Lebow, 1993) and language teaching (Can, 2009; Shuneng, 2004; Chun, 2000).

In summary, the constructivist approach to learning assumes that knowledge is individually constructed and socially co-constructed by the learners on the basis of their interpretations of experiences (Duffy, 1992). Constructionism focuses on learning, whilst instructionism emphasizes that teaching and new technologies can

provide a rich environment for children to think, discover important concepts and relations by themselves, and retain new knowledge not only in the field of mathematics, but also in other disciplines, in particular language learning. Ultimately, the constructionism foundation emphasizes ‘teach less, think more’, liberating technology, and knowledge relationships (Papert, 1981). The theory of constructionism is useful in this research and the proposed collaborative knowledge sharing framework as it promotes the use of technology and for software engineering students, it is particularly appropriate to leverage technology in learning.

While constructionism promotes learning through design, there is a requirement to understand how individuals acquire, process and store knowledge, and assess whether a constructionism framework can improve students’ written English. As noted earlier, this might be achieved through error analysis of students’ written work.

2.2 English Teaching in Thailand

To raise the standard of English in Thailand, the Ministry of Education launched a compulsory primary and secondary education program in 1999. English is currently one of the key subjects in the Thai curriculum and is studied during the first twelve years of basic education before students enter tertiary education (International Business Publication, 2011). Within these primary and secondary phases of education, the Thai Ministry of Education uses mainly Thai staff to teach English and while Thai English teachers often have a deep understanding of grammar rules, parts of speech, and a large vocabulary, most cannot integrate that knowledge to communicate effectively (Thomson, 2009). Even those Thai teachers who do speak English

reasonably well, often have pronunciation and syntax problems (Khamkhien, 2010), and as a result, students learn these errors. The method of using Thai staff to teach English is standard practice across Thailand, and is often cited as a causative factor in producing students with a generally poor level of English despite twelve years of ongoing instruction (Bennui, 2008).

Many studies have investigated problems associated with English as a Second Language (ESL) in Thailand, for example, Bergh (2007) reveals that the most serious problem for Thai students is their written English skills. Thomson (2009) elucidates by explaining that Thai students have a high degree of accuracy in specific written exercises, such as filling in a blank with the correct pronoun, article or verb tense, but in contrast, students can rarely write complete sentences or form a paragraph. Writing skills require students to transfer their knowledge of the subject to the target language, and in this objective, students are obstructed by factors such as language transfer, language interference, the modality of the target language production, and the instability of the learner's linguistic system (Richards, 1984).

Problems in learning English are partly related to the fact that Thais have traditionally considered the teacher's knowledge as reigning supreme in the classroom (Ugray, 2009), with the current learning paradigm in Thailand emphasising memory and recall. As a result, the body of knowledge is transmitted to students through drill and practice. Thai teaching and learning has placed high emphasis on memorization and recall for many years, even within higher education institutions (Sangnapaboworn, 2003). Memory and recall do not cultivate students' analytical and critical skills, which are crucial in today's knowledge based societies (Hoffman, 2012). This learning

strategy also results in poor English proficiency than the standard level which obviously shown in form or errors either in speech, and written paragraph.

Analyzing written error can clarify students' problems with writing, especially in the context of second language acquisition. This process enables and guides instructors to some general conclusions about the students' strength and weaknesses in the language system, also clarifies the better understanding of the language acquisition development and learning strategies.

2.2.1 Software Engineering Students' Writing Skills

Software engineering is a growing trend in the ASEAN labour market for IT professionals (Federation of Thai Industry, 2012). As a result, the case study presented in this paper is based on understanding and developing the written English skill of software engineering students.

The focus on written English skills is for two primary reasons. Firstly, writing requires effective multi-cognitive skills and is one of the hardest skills to acquire for learners of English as a foreign language (Bennui, 2008). In this sense, learning to write should naturally enhance speaking and reading skills (William, 1996). The second reason is that English is considered the working language of business and commerce, especially in the software engineering industry, and most employers of software engineering graduates have high expectations of their written English skills (Cilliers, 2012).

Thailand's weaknesses in learning English, and the challenges and opportunities presented by changes in the Southeast Asian (ASEAN) region and wider economy, represent the context and motivation for this research. The key aims are to

understand and remediate the written English composition errors of software engineering students.

2.2.2 *Significance of Learners Errors*

Language learning is a process of discovering the underlying rules, categories and systems in the language (Corder, 1973). In order to undertake this discovery, learners have to go through the processes of error making which give a clear sign on how language learners develop and internalize the language rules.

Various researchers have concentrated on those errors which demonstrate the influence of one's native language to second language acquisition. Corder (1981) pointed out that errors can be implied and provided information about one's learning strategies. Claude Hagège (1999) supports this concept in his book "The child between two languages", dedicated to children's language education. L1 acquisition and L2 learning are parallel processes, they are ruled by the same mechanisms, procedures and strategies. Learning a L2 is probably facilitated by the knowledge of the L1. As in the acquisition process, L1 learners acquire L2 by comparing their mother tongue language structure language to the target language. The similarity in language structure is transferred with ease while the difference causes the language interference from interlanguage. The negative transfer is obviously shown in the number of errors and mistakes either in written text, and speech production. As errors is evitable in language learning, Hagège stresses that there is no reason for worry if interference persists more than expected; however, this is significant to teacher, researchers, and learners about the process of acquiring a second language.

A learner's errors provide evidence of the system of the language that students are using at a particular point in the course. Corder (1981) claims the importance of errors in three aspects firstly, the teacher undertakes a systematic analysis to investigate how far towards the goal the learner has progressed and, consequently, what remains for him to learn. Secondly, the researcher uses errors as an evidence of how language is learnt or acquired, what strategies or procedures the learners are employing in their discovery of the language. Thirdly, learners themselves can regard the making of errors as a device the learner uses in order to learn. It is a way the learner has of testing his hypotheses about the nature of the language they are learning. The making of errors is a strategy employed both by children acquiring their mother tongue and by those learning a second language.

2.2.3 *Identification of Errors*

Identifying errors go beyond the explanation and distinction between errors and mistakes. This is necessary to further the process of language learning after the detection of learner knowledge. According to dictionary of Language Teaching and Applied Linguistics (1992), mistake is the cause of lacking attention, fatigue, carelessness or other aspects of performance.

Mistakes can be self-corrected whereas error regards as the faulty or incomplete learning which defines as the failure in language competence. To distinguish between error and mistake, Ellis (1997) recommends two ways namely firstly check the consistency of learner's performance, and secondly asking learner to try to correct his own deviant utterance. If the learner is inclined and able to correct a fault in his or her output, it is assumed that the form he or she selected was not the one

intended, and this can be concluded that the fault is a mistake. If, on the other hand, the learner is unable or in any way disinclined to make the correction, this assumes that the form the learner used was the one intended, and that it is an error.

2.2.3.1 Error Analysis

Error analysis is a procedure for analyzing second language data, which begins with the errors that students make and attempts to categorize and explain them. It uses the target language as the point of comparison. James (1998) classified errors into three levels; substance, text, and discourse.

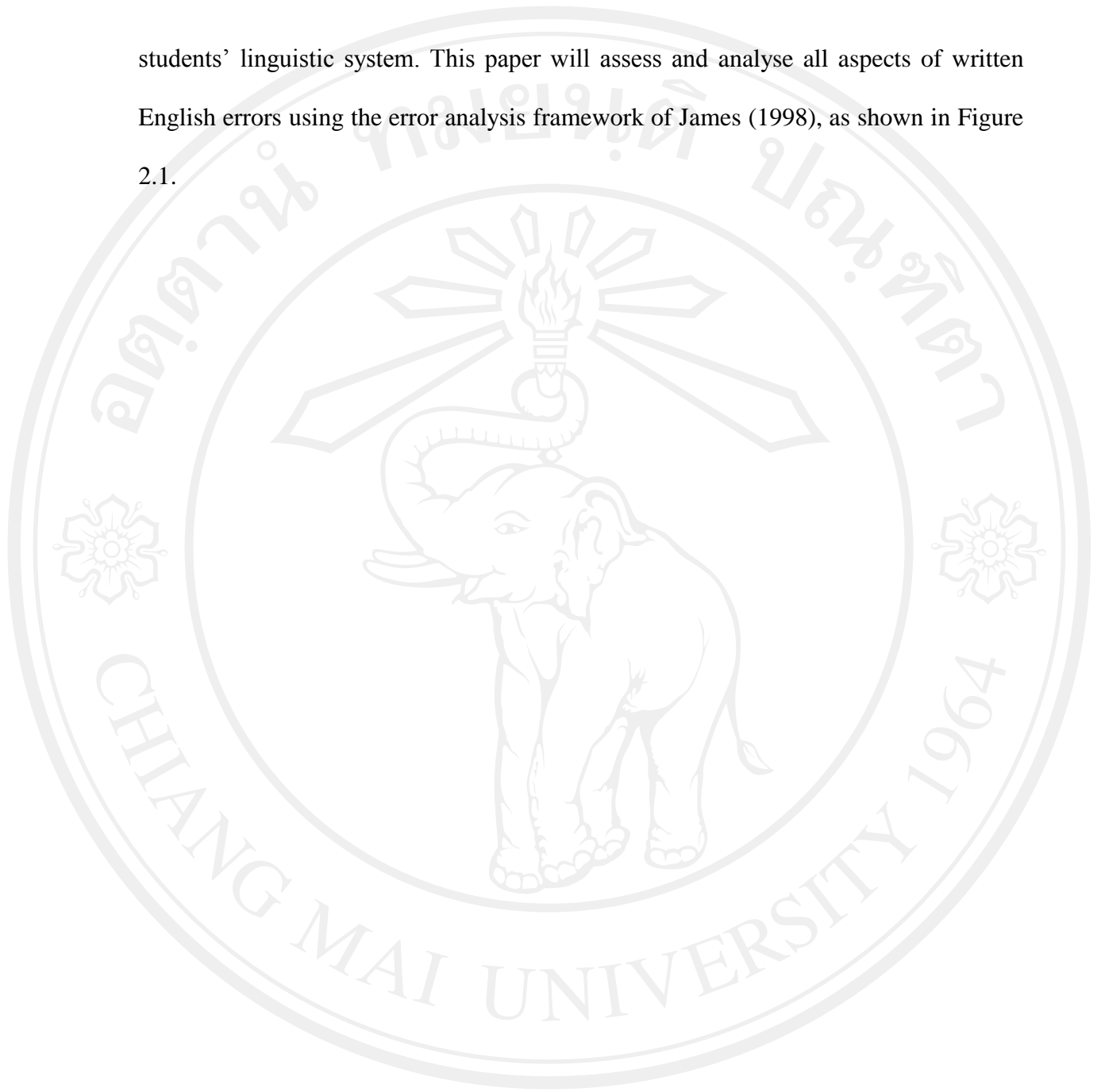
Substance errors, or mechanical errors involve both writing and speaking production. Common misspelling in writing comprises four error types; the error of punctuation, typographic, dyslexic, and confusables. Text errors capture the classification of lexical and grammar errors, while lexical errors include formal errors of lexis such as misformation, and distortion. Semantic errors in lexis are confusion of sense relation, and collocation errors. Grammar errors focus on morphology and syntax errors. Discourse errors refer to speech patterns both in spoken and written communication, and how language, dialects, and acceptable statements are used. Discourse is classified into the three main subtypes of coherence, pragmatic, and receptive.

Errors are classified according to the linguistic level of structure; the phoneme, morpheme, word, phrase, and sentence (Chomsky, 1965). Many studies in Thailand have conducted error analysis of Thai students' writing (e.g. Bennui, 2008; Saengchan, 2006; Arakkitsakul, 2008). Most studies use 'contrastive analysis' and 'error analysis'. Saengchan and Norbert (2006) focused on lexical error analysis,

utilizing error taxonomy (James, 1998), and Semantics (Leech, 1981) to analyze English compositions for lexical errors. Their study showed the most common errors to be 'near synonyms', followed by 'preposition partners' and suffixes. Students had difficulty understanding the semantic meaning of words. These errors were mainly from the influence of second language difficulty rather than first language transfer. Bennui (2008) focused on syntactic and discourse errors, analyzing and describing errors of students' written paragraphs by approaches such as contrastive analysis, error analysis, interlanguage analysis, and contrastive rhetoric. The analysis illustrated three features of language interference; lexical, syntactic, and discourse. Lexical interference showed Thai students literally translated vocabularies from Thai to English, while syntactic errors were classified in seven categories, which are word order of Thai structure, tense, subject verb agreement, the infinitive, the verb 'to have', prepositions, and noun determiners. Discourse interference was illustrated in language style, and cultural knowledge levels.

Few studies have analyzed errors in relation to particular grammar points and identified the cause of errors according to the model of error analysis and second language acquisition theory. Jenwiteesuk (2009) captured syntactic errors and studied the causes of those errors, counting every single error of each type. The four highest frequency errors were determiners, subject verb agreement, tenses, and prepositions. These errors resulted from mother tongue interference, the ignorance of the correct sentence patterns, and the lack of knowledge in grammatical rules. Previous error analysis studies generally conclude that most lexical errors originate from the difficulty of the target language (e.g. Hsu, 2007; Akande, 2006; Llach, 2005). Meanwhile syntactic errors are interfered with by mother tongue language, and

students' linguistic system. This paper will assess and analyse all aspects of written English errors using the error analysis framework of James (1998), as shown in Figure 2.1.



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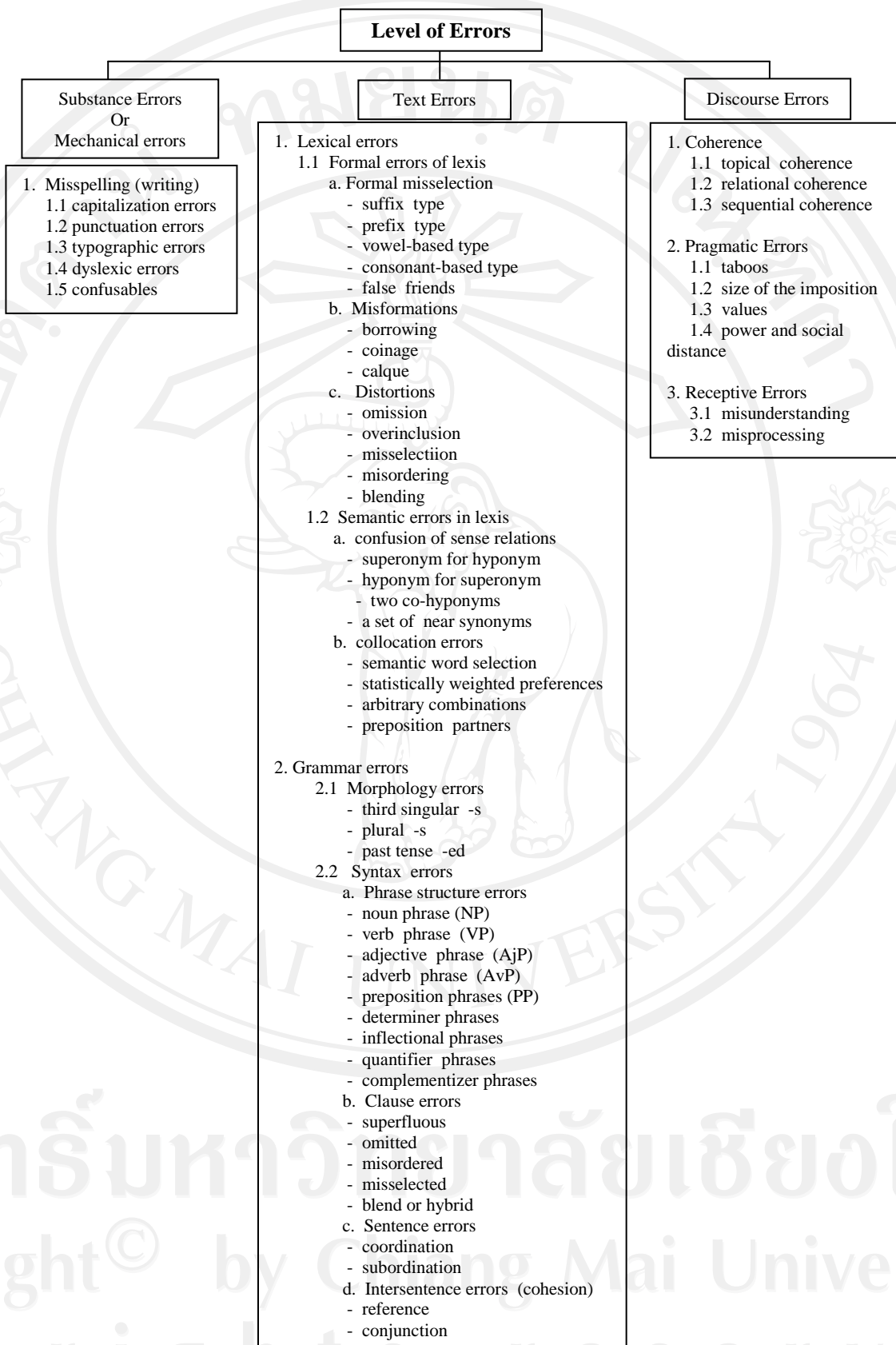


Figure 2.1 The levels of error analysis (adapted from James, 1998)

2.3 Learning Techniques and Ideas

This section presents the techniques and ideas to general learning domain. All selected ones which are cognitive learning, cone of experience and the learning pyramid, are relevance in the aspect of the knowledge development stages from concrete to the abstract.

2.3.1 Cognitive Learning

Cognitive learning is the study of mental or cognitive processes which focuses mainly on how people acquire, process and store knowledge (Baddeley, 1997). In cognitive learning, the learner acquires knowledge by listening, watching, touching, reading, or experiencing and then processing and remembering the information. The three main processes are encoding, storage and retrieval.

In order to form new memories, information must be changed into a usable form by executing a series of operations through an encoding process. In this step, people perceive objects through the five sensory organs. Then, the sights, sounds, tastes, and smells are encoded in the sensory memory through two channels: visual sign and verbal text (Baddeley, 1997). Most of the information in this step will be stored for a short period of time, and then quickly forgotten. Information which takes action or importance will be converted to long term memory with unlimited storage space over a lifetime.

Long term memory has two types: semantic and episodic knowledge. Episodic is directly sensory input and unconscious while semantic memory can be retrieved from short term memory for refreshing, and rehearsing. Learning occurs when information is stored in the long-term memory.

According to Ertmer (1993) instructional explanations, demonstrations, and illustrative examples are all important, however the cognitive approach stresses the importance of changing the learner by encouraging him/her to use appropriate learning strategies. Thus, in order to retain knowledge and reduce the habit of forgetting,

Pimsleur (1967) proposes that vocabularies and lessons should be reviewed for 5 to 10 minutes at the end of each study period, then applied 24 hours later, 1 week later, 1 month later, and finally 6 months later. Cognitive learning captures inner mental processes and in this work, the theory is used to design cognitive writing activities to generate and promote deep language structure.

2.3.2 *Cone of Experience*

Dale (1991) proposed the 'Cone of Experience' based on learners' experience. He argued that the most effective methods involve direct and purposeful learning experiences, such as hands-on or field experience. The main principle of his cone is the progression from the most concrete experiences (at the bottom of the cone) to most abstract (at the top).

Audio-visual materials, devices, and activities in teaching are selected based on the relationships of various educational experiences to reality. The cone begins from direct purposeful experiences and more gradually moves from concrete to abstract levels as shown in Figure 2.2. The hierarchy of audio-visual methods in teaching does not offer a perfect picture to be taken absolutely explain the interrelationships of the various types of audio-visual materials that influence individual learning processes from direct experience. The further the learner progresses down the cone, the greater the learning and knowledge retention. Learners retain knowledge best when they use

perceptual learning styles which are sensory based. The cone of experience is a useful tool to help instructors select the best resources and activities for learners. In summary, the Cone of Experience is a visual metaphor proposing that abstractions must be combined so that learners are provided with a rich, deep, and broad experience and understanding. It is designed to represent the importance of altering teaching methods in relation to students' background knowledge.

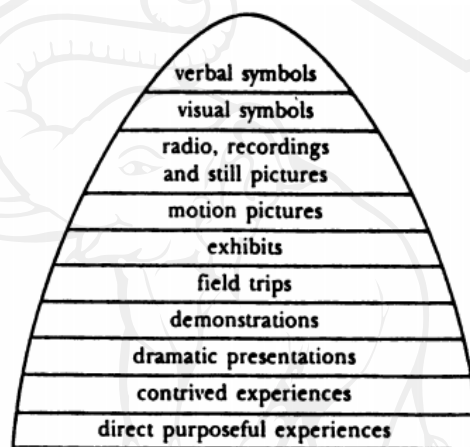


Figure 2.2 Cone of Experience (Dale, 1969)

The original cone does not include retention percentage, but illustrates the degree of abstraction (Metiri Group, 2008). Many studies applied a retention rate to Dale's model by transforming the 'Cone of Experience' to the 'Cone of Learning'. Figure 2.3 is a modified version of the cone showing approximate retention rates at each level. Dale's cone should not be used to interpret that reading and listening are low value activities; it merely emphasizes the fact that learning experiences appeal to different senses and all have a place in the learning process.

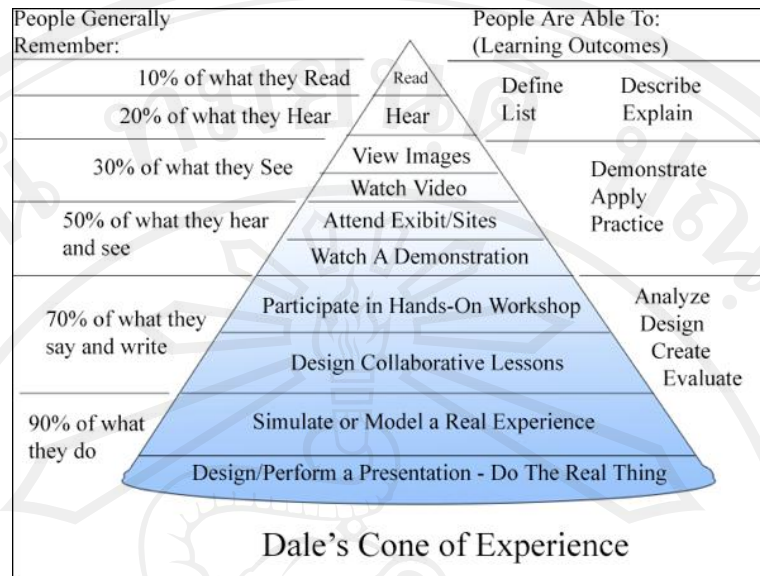


Figure 2.3 Cone of Learning (Bloomsburg University, 2003)

2.3.3 The Learning Pyramid

Similar to Dale's 'Cone of Experience', the Learning Pyramid (Figure 2.4) was devised by the National Training Laboratories in the early 1960s and provides information about the progression of activities that contribute to knowledge acquisition and retention (James, 2007). It maps a range of teaching methods and learning activities onto a triangular image highlighting their effectiveness in promoting student retention of the material taught (Farrell, 2005). The percentage comes from studies on learning retention after students were exposed to different training and teaching methods. The most effective retention comes from teaching others.

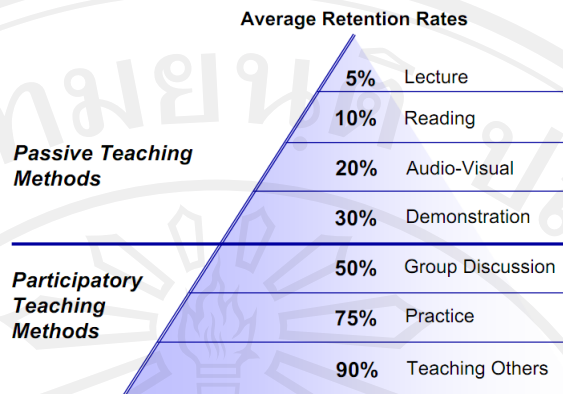


Figure 2.4 The Learning Pyramid (National Training Laboratories, 1947)

Figure 2.4 outlines two types of teaching method: passive and active teaching.

Passive teaching is when instructors lecture and verbalize information to passive note-taking students. The instructor is a ‘verbal’ textbook that reads definitions to the class. Students are considered as ‘empty’ vessels being filled with knowledge or human ‘tape recorders’. Passive learning handles only 5% to 30% of the knowledge retention rate (James, 2007). In the case of active learning, instructors create ‘a learning environment’ in which students can learn to participate, and restructure new information along with prior knowledge to create new knowledge about the content and application. In conducting active learning, instructors create a ‘learning environment’ in which students can learn to restructure new information and their prior knowledge into new knowledge about the content, and put it into practice. Active learning handles about 50% to 90% of the average knowledge retention.

The Learning Pyramid highlights the importance of students’ participation in their learning; if learners only sit and listen to a lecture they do not retain much information, hence the more they are involved in an activity, the better they learn and retain the information. This is because the human brain is a multiprocessor, and

various part of the brain work differently. When the parts work together, learning occurs at deeper levels. Language acquisition and retention are directly related to how much of the brain is used to process it.

2.3.4 Common European Framework of Reference (CEFR)

CEFR the global scales of international language is a project of the Council of European which is used as a guideline to describe the learning achievement of the learners of foreign language across Europe. The main aim is to present the method of teaching, learning and assessing which can be applied to all language across Europe as well as describes the competences necessary for communication; the related knowledge and skills; and the situations and domains of communication (Council of Europe, 2011). CEFR is classified in six reference levels of language attainment which range from A1 to C2 as shown in Figure 2.5. These days CEFR is accepted as the European standard for grading students' language proficiency.

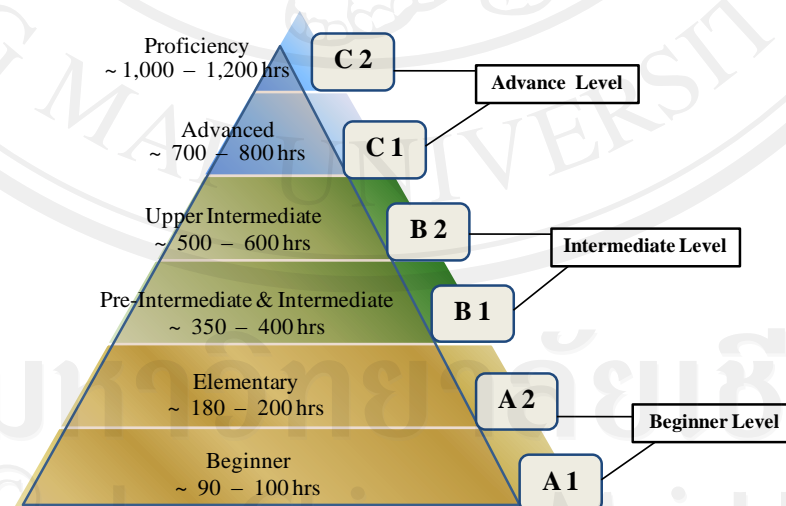


Figure 2.5 Six Levels of Common European Framework of Reference (CEFR)

(Council of Europe, 2011)

Each range refers to the level of English proficiency improvement based on numbers of hours which students enroll in immersive learning environment. CEFR promotes the experiences in communication with the native English speakers as well as transfers of the culture meaning to the students.

In order to apply CEFR in Thai context, the thesis traces back to the history of Thailand and discovers that Thai or Siam education system is influenced from American Protestant missionary, Dan Beach Bradley. He is the first person that brings the printing to Siam, publishes the first Thai newspaper as well as taking place in the education system in creating boarding schools for native children to learn in Western education setting.

Based on Thailand education history, CMU grading system is normalized to American grading system and maps to the CEFR. The proposed CEF for CAMT, CMU is illustrated in Table 2.1.

Table 2.1 The Proposal of Common European Framework for CMU Grading System

CEFR	ILR (US American Grading System)		Thai Grading System	
	Letter grade	Percentage	Mapping to Thai Grading System	Percentage
A1	F/E/I/U and N	Below 60	D/D+/F	Below 60
A2	D	60 - 66	C	60 - 64
B1	D+	67 - 69	C+	65 - 69
B2	C/C+	70 - 76 / 77 - 79	B / B+	70-75 / 76-79
C1	B/B+	80 - 86 / 87-89	A	Over 80
C2	A/A+	90 - 96 / 97 - 100	A	Over 80

2.4 Knowledge Workers

In the field of knowledge management, Drucker (1959) defined knowledge workers as the person who carry knowledge, information and ‘know-how’ skills in their heads as a key to build sustainable competitive advantage as well as be able to use such information in their daily knowledge work to solve problems. Besides, the term knowledge worker is defined in several views.

‘Knowledge worker is someone who uses IT in conducting day-to-day business and one that has direct impact on the efficiency and productivity of the job and the work process.’ (Awad, 1996)

‘A knowledge worker is someone who follows a process requiring knowledge from both internal and external sources to produce a product that is distinguished by its specific information content’ (Kappes and Thomas, 1993)

‘A knowledge worker is one who gathers data/information from any source; adds value to the information; and distributes value-added products to other’ (Kappes and Thomas, 1993)

‘Anyone who makes a living out of creating, manipulating, or disseminating knowledge is a knowledge worker’ (Bennett, 2001)

‘Knowledge worker are people who use their heads more than their hands to produce value’ (Horibe, 1999)

These various definitions have several aspects in common namely experience, innovation, creativity, and transformation of experience into knowledge productivity and services.

The preparation of the human to be knowledge workers in a competitive environment must consider these core seven competencies of the self-directed knowledge worker for example thinking skills, continuous learning, innovative teams and teamwork, innovation and creativity, risk taking and potential success, decisive action taking, and culture of responsibility toward knowledge (Awad and Ghaziri, 2007).

Thinking skills capture the knowledge workers with the expectation to possess strategic thinking skills that shed potential on the work performed or the ideas provide on the job (Awad and Ghaziri, 2007). The strategic thinking refers to leaders' abilities, which involve developing skills in creativity, problem solving, teamwork, critical thinking and flexibility, in finding alternative ways of competing and providing customer value.

Continuous learning emphasizes knowledge worker who implies innovation through continuous learning on the job, professional seminars, and working in an environment conducive to creativity and advancement (Awad and Ghaziri, 2007).

Innovative teams and teamwork refer to the collaboration, cooperation and coordination based on a knowledge sharing attitude and commitment to knowledge exchange which support management and attract rewards, both intrinsic (such as recognition) and extrinsic (such as salary increases) in the long run (Horibe, 1999).

Innovation and creativity is the spirit for knowledge worker to expand their vision and dream a new or a different product or service for the advancement of the

firm (Awad and Ghaziri, 2007). To promote that spirit requires open and equal opportunities to explore, to test and to try things out. This means a solution focus mind-set, a passion to create knowledge, and a strong desire for idea generation and follow-up in knowledge sharing environment.

Risk taking and potential success is the result of innovation and creativity which knowledge worker share and exchange together as a team (Awad and Ghaziri, 2007). In risk taking, knowledge worker has to be willing to lose as much as he/she hopes to gain. Vision, experience, a reasoned knowledge enter the picture in risk taking for the forward-looking firm. It is part of what a learning organization has to undergo to gain and advance its employees' knowledge base.

Decisive action taking means that knowledge workers should be willing to embrace professional discipline, patience, and determination. Motivation is a critical factor in keeping the focus on a product or a service for the future (Awad and Ghaziri, 2007).

A culture of responsibility toward knowledge emphasizes loyalty and commitment to one's manager or leader. Knowledge worker must consistently support their leaders, their peers, and the company as a whole (Awad and Ghaziri, 2007). When a problem arises, a knowledge worker is expected to take the problem to a responsible source, discuss or brainstorm it, settle on a 'best solution' outcome.

These core competencies provide the general view of knowledge worker who have specialized knowledge for certain problems and who are willing to provide such knowledge on call. However, the definition term of knowledge workers is different to such variety domain tasks.

As the aim of this thesis is to bring SE students' English proficiency to the international requirement level, knowledge workers in the thesis means software professionals who have a capital working experiences in the software companies both local and international.

To serve the AEC 2015 in an aspect of labour market flow, the knowledge management process designed in identification subjects' English learning problems; capture software professionals' capital working experiences; structure the remedial course based on constructionism, error analysis as well as the integration of another learning techniques and ideas; transfer the domain contents via the English remedial course to the subjects by aiming to produce the international knowledge workers.

2.5 Overview of Theoretical Perspective

Traditional Thai learning paradigms have emphasized memorization and recall for many years, even within higher education institutions (Sangnapaboworn, 2003). These activities not only obstruct the students' linguistic system, but do not cultivate their analytical and critical skills which are essential in today's knowledge based societies (Hoffman, 2012).

To promote the development of practical English proficiency skills, in this research the five learning theories of constructionism, intelligent learning environment, cognitive learning, cone of leaning, the learning pyramid, and error analysis, are integrated to form the remedial framework. Each of these theoretical perspectives is now described before the chapter explains the practical steps to design, build and test the remedial framework.

2.5.1 Constructionism

Constructionism provides the overall theoretical underpinning for the remedial framework presented in this research. The fundamental aspect of constructionism is ‘teach less, think more’, or active learning, which aims to encourage and engage the minds of students. In this research, the constructionism philosophy (Papert, 1991) captures the domain knowledge of software engineering professionals, uses a computer based learning environment design and selects intellectual tools or ‘construction kits’ as key tools to produce new ideas and construct knowledge when students are engaged in building objects or undertaking written projects. This intellectual production based on constructionism is to ensure that knowledge structure is transformed through the active construction of something outside of one’s head. In designing the remedial framework, constructionism was used to shift students’ learning in four main aspects; students’ learning strategies, knowledge transfer strategies, classroom environment, and course contents, as shown in Table 2.2.

Table 2.2 Theoretical aspects of constructionism and their and practical implementation in the remedial framework

Key Theoretical Aspects of Constructionism (see Chapter 2 for detailed description)	Components for practical implementation in this research
1. Learning through and about design	<ul style="list-style-type: none"> - Teachers facilitate movement and action around computers, such as how to use concrete objects to build and explore - Students build external and shareable written projects in group.
2. Learning in communities	<ul style="list-style-type: none"> - Students are in a continuous dialogue with their own ideas and their team members. - Students and teachers integrate the computer activities. - Class community reinforces communication and information-sharing regarding computer based activities across English proficiency levels and among teachers
3. Learning about the system	<ul style="list-style-type: none"> - Students in teams refine and modify their intellectual products - Students pinpoint the complex issues and create the solution.
4. Thinking about thinking	<ul style="list-style-type: none"> - Students identify stages in developing their powerful ideas - Students engage in self reflection after completing their projects

2.5.2 Intelligent Learning Environment (ILE)

To design the constructionist learning environment, the remedial framework relies on an intelligent learning environment (ILE). An ILE consists of a microworld, simulation, and computer based learning environment. These three components were

integrated to form the learning environment in this remedial framework, using multimedia tools to drive the learning experience.

In parallel to the constructionist learning environment, an ILE addresses the importance of a microworld, simulation, and multimedia environment for learning, which aims to facilitate students' learning through the exploration of complex problems while having interaction with a microworld, and computer-programming environments. An ILE supports both learning through reflective discovery as well as allowing students to manipulate concepts and processes through activities such as showing, discussing, examining, and providing collaborative reflection on the cognitive artefacts or products that they create (their work). A social community reinforces powerful ideas in the air as well as helping to structure a knowledge system. By learning through these learning environments, students' content area knowledge, habits of mind, and social skills will be developed (Hay and Barab, 2001).

The two learning theories of constructionism and ILE provide the fundamental theoretical underpinning for the remedial framework and are transposed from theory into practical steps within this methodology. Constructionism is used to create the learning situations in the classroom and in this research, constructionism is to leveraged design SE course contents including understanding a subjects' domain problems, drawing out issues, and designing social software lessons to help students remediate specific weaknesses.

In parallel to constructionism, the ILE is used to design a social software learning studio which seeks to imitate aspects of the real world, and selectively choose social software tools that support exploration and experimentation. Each component (such as SE domain knowledge, simulation using social software as construction kits,

and design, teaching and representation) is captured from the perspective of software professionals, software users, and software designers (see Figure 2.6). Software professionals allow the capture and specification of skills and domain knowledge requirements in the workplace, which then contributes to the core course content. Software Users offer an overview of social software trends in their generation which inspires the selection of ‘construction kits’. Software designers emphasize on planning to relate both classroom layout and social software tools to the learning contents in order to generate cognition while running project activities.

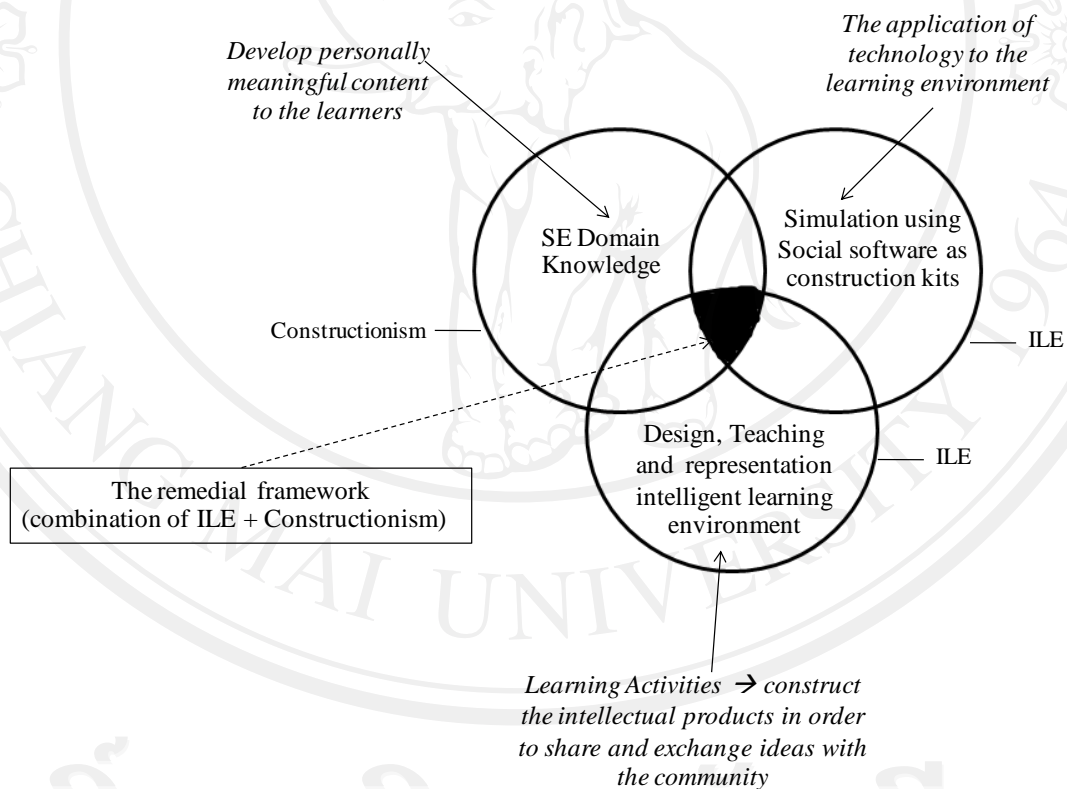


Figure 2.6 The integration of constructionism and ILE (adapted from Papert, 1991)

The theories of constructionism and ILE overlap and are used in synergy. Constructionism constitutes the main theory and ILE is integrated within the umbrella of constructionism. While constructionism and ILE form the theoretical underpinning

of the remedial framework, other theories were used in designing learning strategies and materials.

2.5.3 *Cognitive Learning (Learning Strategies Design)*

This theory is used mainly in terms of designing learning strategies in the remedial framework. Cognitive learning captures inner mental processes such as encoding, storage and retrieval, and focuses on how people acquire, process and store knowledge (Baddeley, 1997). This approach also stresses the importance of changing the learner by encouraging him/her to use appropriate learning strategies. In this research, the theory is used to design cognitive writing activities to generate and promote deep language structure by helping students to develop analytical skills and convert important tacit and explicit knowledge from short term to long term memory through learning from experience.

2.5.4 *Cone of Experience and the Learning Pyramid (Designing Learning Activities, and Materials)*

This theory is primarily used in designing the learning activities and materials in the remedial framework. The ‘Cone of Experience’ and ‘Learning Pyramid’ are similar and interrelated theories which provide guidelines for designing cognitive activities supported by audio-visual materials to contribute to knowledge acquisition and retention (James, 2007). The main principle is to drive the most concrete experiences to the most abstract by making use of resources and activities which provide a rich, deep, and broad experience and understanding. The cone of experience is used as part of the selection process of the active learning activities, while the

learning pyramid is used to design learning materials to promote retention, which in turn capture participatory teaching methods.

Four main learning theories have been outlined so far, with each theory offering a particular nuance or specific benefit to learning and language acquisition and the remedial framework. Before discussing practical aspects of constructing the remedial framework, Table 2.3 compares and contrasts each of these learning theories with regard to passive and active learning and concrete versus abstract learning experiences. Traditional pattern in teaching and learning in Thailand emphasize concrete experiences, for example memorization, and recall, which do not cultivate higher levels of cognition including: analytical and critical thinking. To produce practical graduates, active learning is proposed to shift from memorization and recall to experiential learning which promotes fruitful abstract experiences.

Table 2.3 Comparison of the four learning theories to passive and active learning, and concrete versus abstract learning experiences

Theory	Concrete		Active			Abstract
	Passive		Active			
Constructionism	Plan, design, and construct mental model			Share to get feedback	Improve	Reflect
Cognitive Learning	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Cone of Experience	Read/Hear		- View Images - Watch Video - Attend Exhibit - Watch Demonstration	Participate in Hands-on Workshop Design Collaborative Lessons Model a Real Experience Do the Real Thing		
The Learning Pyramid	Reading	Audio-Visual	Demonstration	Group Discussion	Practice	Teaching Others
Remedial Framework	Interaction with teachers/peers		Group Discussion		Collaborative activities	Knowledge Retention through assessment

Table 2.4 illustrates how each of the theoretical aspects of this research contribute to the creation of the remedial framework.

Table 2.4 The four learning theories and their contribution to the remedial framework

	Environment	Content	Activities	Learning material	Knowledge transfer methods
Constructionism	X (ILE)	X			
Cognitive learning			X		
Cone of learning				X	
The Learning Pyramid					X

2.5.5 *The Integration of Four Theories*

The proposed remedial framework integrates the four previously described cognitive theories. It consists of three layers designed to capture (i) the ‘learning by doing’ layer based on the constructionism concept, which aims at actively engaging students in constructing meaningful artifacts, (ii) the students’ experience layer derived from the cone of experience/cone of learning to improve learners’ learning and knowledge retention, and (iii) the retention layer which refers to the knowledge transfer process through cooperative and collaborative activities. Figure 2.5 exemplifies the creation of the remedial framework through these layers. This approach aims at improving the cognitive learning of students by helping them to develop analytical skills and convert important tacit and explicit knowledge from short term to long term memory through learning from experience.

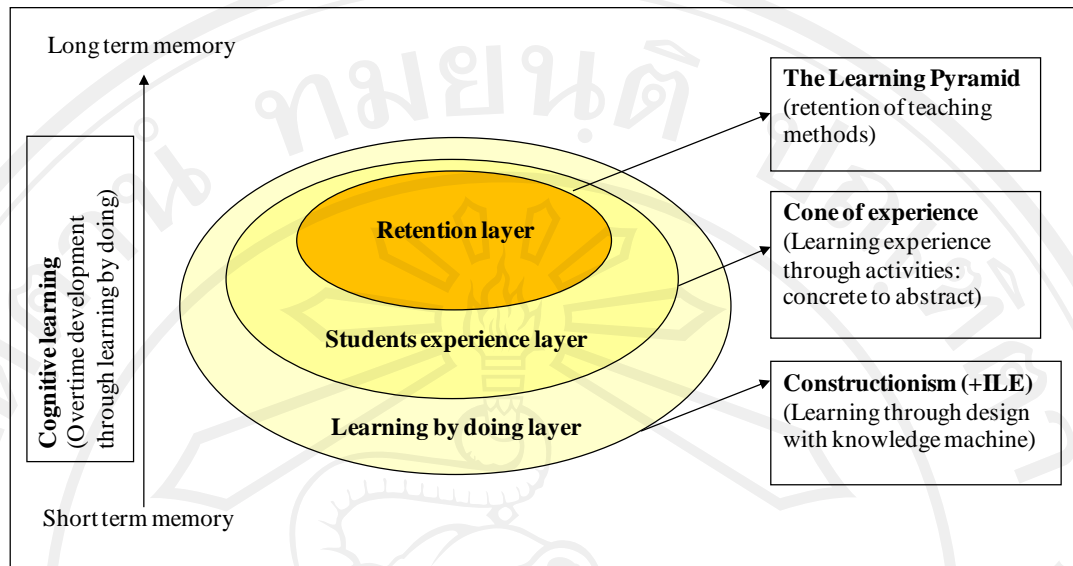


Figure 2.5 The proposed three-layer remedial framework and its relationship with the five key learning theories

2.5.6 Error Analysis (Assessment)

Error analysis is used as a means to check the effectiveness of the remedial framework. Error analysis is an ESL assessment tool used to analyze the key problems in students' written English text and analyze and describe the features of language interference which guide effective error correction (James, 1998). 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.

In contrast, most ESL research uses simple pretest and posttest assessments to show an overview of language improvement and failure, rather than spotting specific points. In

this research, error analysis is used as a language assessment tool in the final stage of the remedial framework, which aims to investigate the effectiveness of the framework as well as observe the students' language system progression.

So far, this chapter has considered the key theories used in this research and how they relate to the remedial framework. The second part of this chapter now describes the practical methodological steps of designing, implementing, testing, refining, and evaluating the remedial framework.

Chapter Summary

This chapter provided the literature review of constructionism philosophy, English teaching in Thailand and the learning techniques and ideas which were collected and built the remedial framework based on constructionism. The next chapter provides the information including the conceptual framework, the data collection, pretest, implementation and posttest throughout four year (2008 – 2011).