AN INVESTIGATION INTO LEARNERS'DECISION-MAKING PROCESSES IN SELF-ORGANIZING LEARNING SYSTEMS FOR EFL LEARNERS

Natthika Boonrasamee

A Thesis Submitted in Partial Fulfilment of the Requirements for the Degree Doctor of Philosophy in English Language Studies Suranaree University of Technology Academic Year 2018

การศึกษากระบวนการตัดสินใจของนักศึกษาในระบบการเรียนรู้ด้วยตนเอง

สำหรับนักศึกษาที่เรียนภาษาอังกฤษเป็นภาษาต่างประเทศ

นางสาวณัฏฐิกา บุญรัศมี

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรศิลปศาสตรดุษฎีบัณฑิต
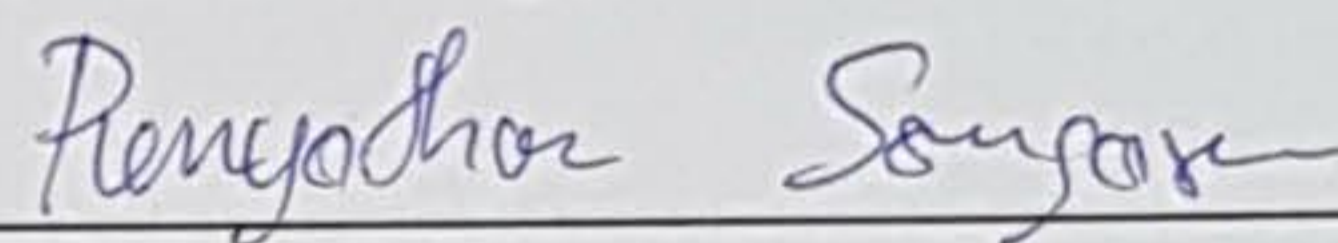สาขาวิชาภาษาอังกฤษศึกษา
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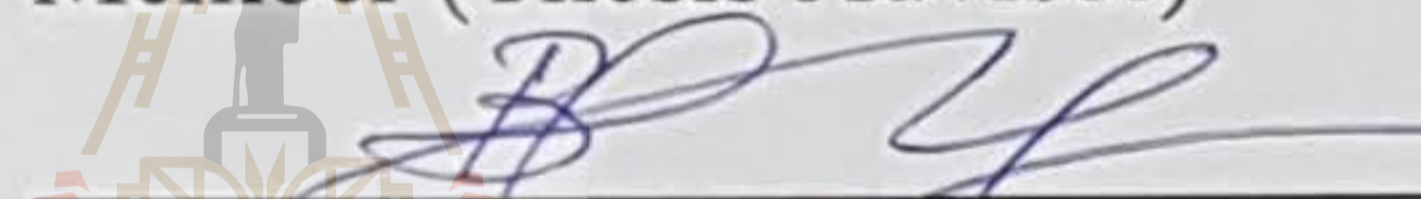
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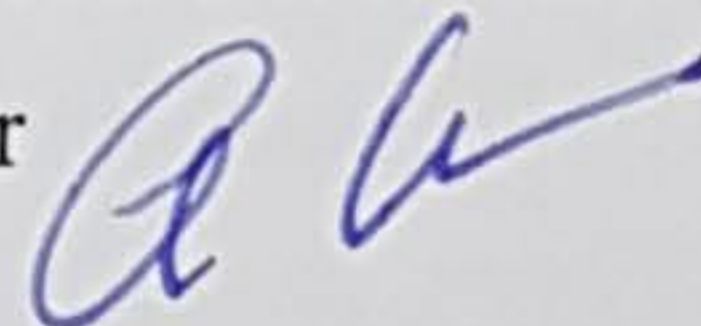
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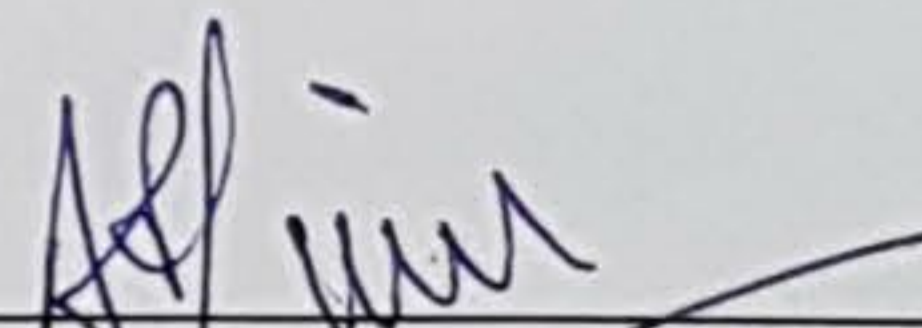
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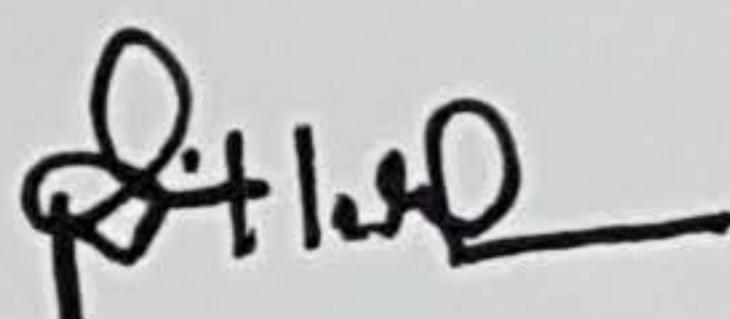
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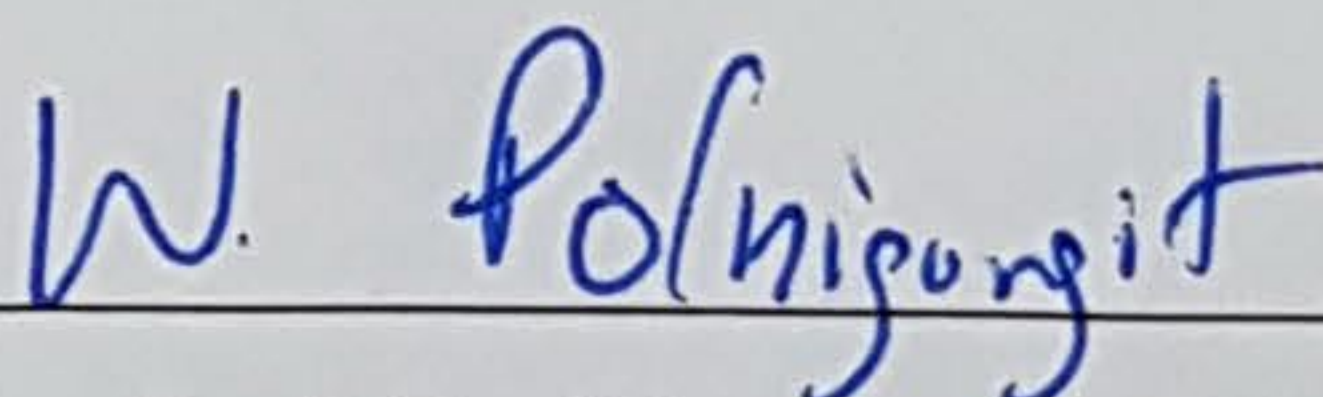
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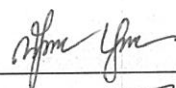
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ฉัฏฐิกา บุญรัศมี : การศึกษากระบวนการตัดสินใจเรื่องระบบการจัดการการเรียนรู้ด้วย
ตนเองสำหรับนักศึกษาที่เรียนภาษาอังกฤษเป็นภาษาต่างประเทศ (AN INVESTIGATION
INTO LEARNER'S DECISION MAKING PROCESSES IN SELF-ORGANIZING
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อัจฉราวรรณ บุรีภักดี, 203 หน้า

งานวิจัยฉบับนี้ศึกษาสิ่งแวดล้อมการเรียนรู้ของผู้เรียนเพื่อการจัดระบบการเรียน จุดประสงค์หลัก
ของงานวิจัยคือ ศึกษาผู้เรียนภาษาอังกฤษเป็นภาษาต่างประเทศมีวิธีการสืบค้นเพื่อสร้างสิ่งแวดล้อมการเรียน
เฉพาะบุคคลได้อย่างไร กลุ่มประชากรที่ใช้ในการศึกษาครั้งนี้ คือ ผู้เรียนสาขาวิชาภาษาอังกฤษ
ระดับอุดมศึกษาจำนวน 69 คน โดยเก็บข้อมูลเป็นระยะเวลา 12 สัปดาห์ รูปแบบการวิจัยเป็นแบบผสมผสาน
ระหว่างการวิจัยเชิงคุณภาพและเชิงปริมาณ การวิจัยเชิงปริมาณใช้แบบสอบถามเรื่อง *กลยุทธ์ในการสืบค้น
ข้อมูลออนไลน์* จำนวน 25 ข้อ เพื่อเก็บข้อมูลเรื่องการใช้กลวิธีในการสืบค้นออนไลน์ ข้อมูลเชิงปริมาณเก็บ
รวบรวมจากระยะก่อนและหลังการจัดการเรียนรู้ด้วยตนเองจากการสืบค้นข้อมูลออนไลน์ ผลที่ได้พบว่า
กลุ่มตัวอย่างมีความสามารถในการสืบค้นข้อมูลออนไลน์ นั่นคือ ผู้เรียนมีประสบการณ์เพียงพอเกี่ยวกับการ
สืบค้นออนไลน์ สำหรับข้อมูลเชิงคุณภาพรวบรวมข้อมูลจากแบบสอบถามกึ่งทางการ วีดิทัศน์สั้นและ
แผนภาพความคิด ผลการวิจัยเชิงคุณภาพพบว่า มีปัจจัยสำคัญสำหรับกระบวนการตัดสินใจ 4 ข้อ คือ (1)
กลวิธีการสืบค้นออนไลน์ (2) กิจกรรมการเรียนที่ใช้การวิจัยเป็นฐาน (3) ความอิสระในการเรียน และ (4)
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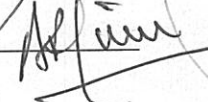
ผลการศึกษาครั้งนี้แสดงให้เห็นว่า องค์ความรู้ของผู้เรียนนั้น ได้จากกระบวนการรวบรวมความรู้จาก
กลุ่มบุคคล ความหลากหลายของแหล่งวิชาการ และเครือข่ายสังคมออนไลน์ เป็นต้น สำหรับแนวคิดนี้
สนับสนุนการจัดการเรียนรู้ด้วยตัวเอง คือ ผู้เรียนสามารถสร้างองค์ความรู้ได้ด้วยตนเองจากประสบการณ์ที่
สั่งสมมาจากการรับรู้และการเรียนรู้ รวมถึงความสนใจหัวข้อเฉพาะด้านของผู้เรียนแต่ละคน

นอกจากนี้ ผลการศึกษายังประโยชน์ให้กับผู้เรียนในระดับอุดมศึกษา คือ สิ่งแวดล้อมการเรียน
เฉพาะบุคคลมีความสำคัญในการพัฒนาตัวผู้เรียนแต่ละคนให้เป็นผู้เรียนที่มีความคิดริเริ่มในการจัดการ
เรียนรู้ด้วยตนเอง

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NATTHIKA BOONRASAMEE : AN INVESTIGATION INTO LEARNERS'
DECISION-MAKING PROCESSES IN SELF-ORGANIZING LEARNING
SYSTEMS FOR EFL LEARNERS. THESIS ADVISOR : ADCHARAWAN
BURIPAKDI, Ph.D., 203 PP.

DECISION MAKING PROCESS/ SELF-ORGANIZATION/ LEARNING SYSTEM/
RHIZOMATIC

This current study investigated a personal learning environment (PLE) of an
individual in organizing his/her learning systems. The main purpose of the study
aimed at examining how EFL learners generate their learning trajectories within their
personal learning environments. The investigation was implemented with 69 full-time
English majors at tertiary level over a twelve-week period. A mixed-methods research
design was employed. The implementation of the sequences of the study was divided
into 2 phases. The quantitative data were collected through a 25-item questionnaire:
online information search strategy inventory (OISSI). The qualitative counterparts
were from several artifacts consisting of a semi-structured interview, clips, tag clouds,
and a mind map (that was considered as a PLE). The quantitative findings from the
pretest and the posttest revealed that all participants were deemed to be a competent
online search learner. It also indicated that the participants had enough prior
knowledge about online information retrieval. With respect to the qualitative findings,
four main keys for decision-making processes were 1) online search strategies 2) the
notion of research-based course 3) freedom to learn and 4) academic mindsets of the
language learners.

Results of this current study suggested that a rhizome forms assemblages: including groups of people, various sources of the academy, network services and so on. In this view, the rhizomatic perspective exclusively reveals how knowledge can be constructed within an individual. An individual can create and construct her/his knowledge by negotiation with different social communities as well as collaborative work with other knowledgeable people. The growth of an individual's knowledge might depend upon her/his background experience that has been accumulated by acquiring and learning, as well as their particular interests upon learning content.

Additionally, the findings provide preliminary information for the learners and other stakeholders for higher education faculty. That is, the PLE is essentially important to serve any learner to develop and adjust themselves to be an active learner in the ubiquitous learning era.
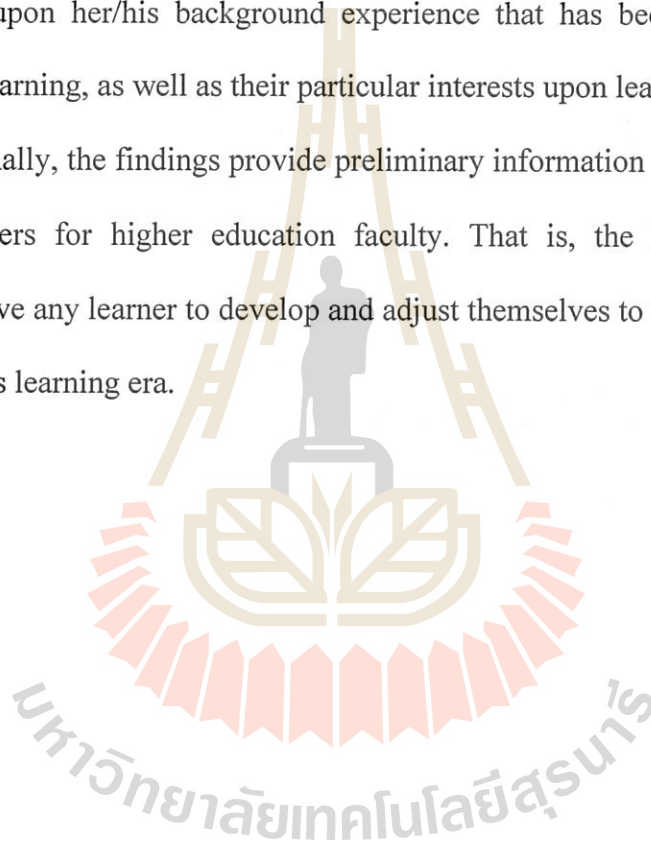
School of Foreign Languages   Student's Signature_____

Academic Year 2018   Advisor's Signature_____

          Co-Advisor's Signature_____

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would, therefore, like to dedicate my Ph.D. to my parents for their unconditional love.

Natthika Boonrasamee

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LIST OF ABBREVIATIONS

EFL   English as a Foreign Language

IOC   Index of Item-Objective Congruence

OISSI   Online Information Search Strategy Inventory

PLE(s)   Personal Learning Environment(s)

SKRU   Songkhla Rajabhat University

SRL   Self-Regulated Learning

QDA   Qualitative Data Analysis
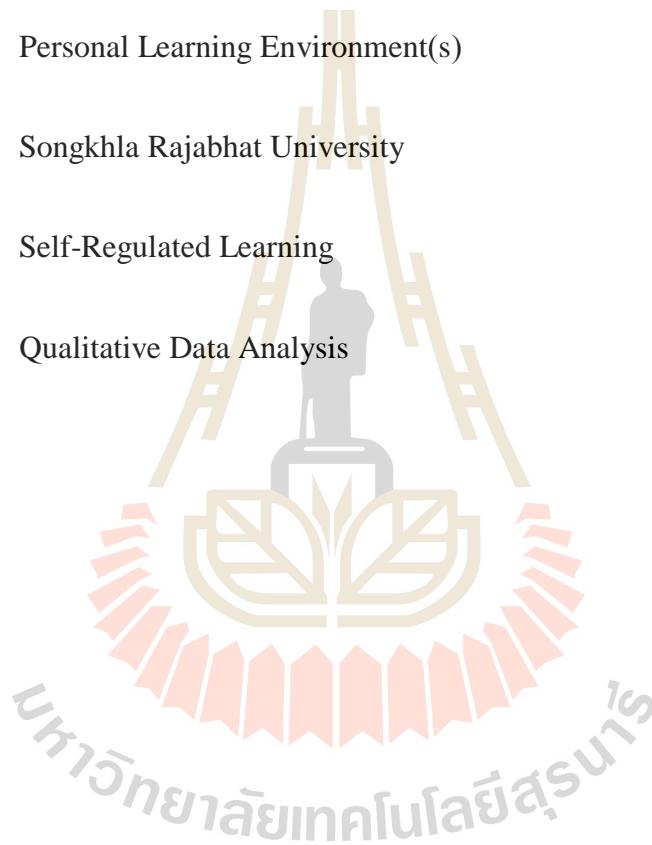
CHAPTER 1

INTRODUCTION

This chapter deals with the introduction to a study pertaining to how adult EFL learners make decisions for gathering information, rethinking and sharing materials in order to construct a comfort zone of learning, a personal learning environment (henceforth PLE) connected to technology-supported learning networks. This chapter includes essential components namely rationale of the study, purposes, research questions, significance, scope, limitations and a definition of operational terms. A summary of the chapter is also provided as the last section.

1.1 Rationale of the study

With the advent of technology, the movement of technology-supported instruction in a language learning setting leads the way to develop interaction amongst people beyond the classroom walls. Particularly in the past decade, multimedia, electronic technology, and numerous applications have tended to build a new world through asynchronous and synchronous modes of communication. For example, the *Facebook Live Chat* application provides real-time service. E-mail or discussion boards offer spaces for information sharing in the asynchronous mode. Digital technology is likely to generate positive perceptions amongst learners and teachers (Lowerison, Sclater, Schmid & Abrami, 2006). Learners expressed positive attitudes toward the use and value of technology for learning (see also Higgins, Xiao & Katsipataki, 2012; Grinager, 2006) because, the computer is capable of facilitating learning, adding value to learning materials, promoting collaboration, improving

opportunities for professional development in education, and increasing efficiency in classroom administrative tasks. Therefore, the tendency to integrate digital technology into learning is growing.

Also, technologies have potential to cause a paradigm shift in learning. Both teachers and students seem to have equal roles (or at least, less unequal roles) as they have to share both information and responsibility for learning and gain a better understanding of tasks they have to complete by collaborative activities including group discussions, problem-solving, and providing feedback. Wikis, for instance, seem to be relevant to collaborative activities in the language class. To cite some large-scale and high quality studies, Parker and Chao (2007) asserted that applications such as wikis have great potential to promote collaborative activities—group discussions, problem-solving and the provision of feedback, for instance. The researchers described wikis as web communication and collaborative tools because wikis involved learners and teachers working in a collaborative environment. In essence, wikis might have an impact on the collaborative writing process—members of a specific group could generate a topic and express what they want to present in public. Likewise, Li (2012) reviewed twenty-one past studies of wikis used in foreign and second language classes. Li found four emerging themes including collaborative writing, writing product, perceptions of wiki-based collaborative writing, and effects of collaborative writing task. These themes reflect changes in learning and teaching approaches in language pedagogy. Besides, Duffy and Bruns (2006) also asserted that blogs and wikis enabled learners to engage in a socially mobile learning environment where learners could initiate ideas, adjust learning behaviours, develop authentic learning tasks and put the writer [learner] in a central

position (Alm, 2009). Using blogs and wikis as a social activity supported by technology fosters language learner's autonomy. Findings from these studies and others like them possibly indicate that digital tools and services in the Web may encourage learners to arrange and organize learning activities on their own.

Technological devices and software applications are capable of allowing learners to achieve a learning goal by accessing specific information via inter-connected technological systems. In other words, technology tools yield useful information for language learners. For example, Facebook was used as a means to develop grammar proficiency and writing quality in the EFL learning context (Suthiwartnarueput & Wasanasomsithi, 2012); and wikis and blogs were used to promote intensive writing tasks (Li, 2012; Fuchs, Hauck & Müller-Hartmann, 2012; Aydin & Yildiz, 2014).

In particular, an increase in the range of use of technology-supported learning environments shows that technology tools make learners' lives more convenient. Online dictionaries, for example, enable language learners to search for meanings of words easily. Technology tools could fulfil learners' potential to develop their knowledge. Salaberry (2001) provided an extensive review of Computer Assisted Language Learning (CALL)—1) CALL is described as one of many learning environments. It is amenable to the creation of links that show connections between learner queries and pedagogical explanations of grammatical, semantic, and/ or pragmatic issues; 2) CALL provides an opportunity for learners to spend more time learning. It increases motivation and reduces anxiety; 3) CALL is a means of assessing second language learning and learning processes; and 4) CALL can support individualized instruction. Learners have freedom to choose levels of task

difficulty, to repeat inputs, and to get help immediately. Hence, technology enables those people to solve a learning problem.

To construct a specific community, many applications and networked tools used in accessing databases via the Internet are considered as a means of communication, collaboration, and creative expression. All these tools are operated on the Web 2.0 platform. The suffix 2.0 characterization represents openness, personalization, collaboration, social networking, and collective wisdom (Dabbage & Kitsantas, 2011). Web 2.0 technologies; therefore play a valuable role in empowering learners to take charge of their own virtual learning environment and encouraging learners to gain insights into novel information relating to their personal desires and learning requirements.

Thus, Personal Learning Environments (PLEs) are fostered by the recently-established Web 2.0 services; become an accessible area for learners; and encourage users to be active co-creators of knowledge (Liew & Kang, 2014). Those technology-supported tools in the Web 2.0 services are ready made that allow learners to communicate with people in other networked communities for synchronous (e.g. Facebook live chat and audio-video conferencing) or asynchronous (e.g. e-mail and discussion board) modes, to undertake collaborative activities (e.g. pool ideas, share materials, give feedback) and to negotiate with others in order to get their work done. Eclectic web-based tools and services may be able to create "a comfort zone" (Pineda, 2013) of learning where learners can use those tools to expose themselves to whatever understandings they need to obtain in order to achieve a learning goal. The PLE generally becomes a space for learners to connect with a particular community, to accumulate information, and to share

feedback. Similarly, Archee (2012) asserted that the PLEs play a role as "a digital space" where learners could discover a better understanding, collect digital information, and share materials across eclectic electronic sources within a network. The PLEs, moreover, promote learner-centeredness as learning environments are built automatically in accordance with an individual's need.

Summarizing the views of Archee (2012), Dabbage and Kitsantas (2011), Lian and Pineda (2014), and others, the PLEs provide some advantages for learners as follows:

a) In relation to education, the PLEs serve as both formal and non-formal education. For formal education, connections in a PLE might be pre-organized by teachers or institution. The teacher might support useful information, provide access to a database that allows learners to practise language skills (i.e., writing, reading and so on) and review what they have learnt. The PLE for formal education is like a space where teacher and learner can observe interactions, link across sources, and provide feedback. Such activities may follow a course syllabus and/ or fit requirements of the curriculum. By contrast, the PLE in non-formal education allows learners to store whatever information fits their requirements;

b) Learners can develop their learning identity and objectives. This possibly reveals a profile of their learning interests. Learners' search paths could help to identify their learning strategies because each node of information accessed presents different forms of information. Figures, illustrations, animated clips, and texts (printed or multimedia) are all examples of search results; and

c) The apparently chaotic pathways in the PLEs represent the structure of the contextualized knowledge-building attempts of learners. These

pathways represent learners' attempts to order access to a multiplicity of sources of information and capacity-building processes which will help them to solve the problems that they are facing. It could be anticipated that learners' connections may be somewhat arbitrary (learners' information retrieval behaviour might be built on a trial-error approach).

These apparently chaotic pathways depicted in the PLEs, may be described as (technology-supported) rhizomatic language learning environments. The term rhizome is a botanical term that an underground plant stem is capable of producing (new roots) networks of roots covered in a massive area. In the education field, based the work of postmodern scholars Gilles Deleuze and Félix Guattari, a rhizome can be depicted as a vast array of connections between sources of information and help with no pre-specified starting point or ending point (Deleuze & Guattari, 1987; Lian, 2004; Lian & Pineda, 2014; Lian & Moore, 2014). In other words, the paths for seeking information and the order of searches are unpredictable because trajectory identification is determined by learners' interests rather than by a predetermined policy (e.g. a syllabus). Therefore, a rhizomatic approach represents multiple connections and a non-hierarchical organization.

How does PLEs represent? A fragment of a network of connection (see below) reveals what an individual is able to access in terms of information via the Internet and/or approach experts and non-experts at a particular time. Each instance of information gathering or capacity-building can be described as a node of knowledge that might fulfil the learners' learning requirements. Each stop along the path also links other infrastructure systems, e.g. uniform resource locators

(URLs) or hyperlinks. The relationships between the lines in the PLE form a network of learning. Lian and Pineda (2014) envisage the learning network created by the nodes of the lines depicted as parts of a rhizome. The following figure (Figure 1.1) illustrates an individual's PLE based on a rhizomatic approach.

In addition, the example below shows PLE creation as being similar to a patchwork of support from both people (i.e., face-to-face communication, negotiation, and giving feedback) and technology aggregation (i.e., databases, social networks, and multi-media tools) (Lian & Pineda, 2014). Furthermore, it can be likened to *a springboard for thought* (Pineda, 2013). The critical challenge is that the learning paths in the PLE are subjective because thoughts, ideas and needs of learners are constantly readjusting.
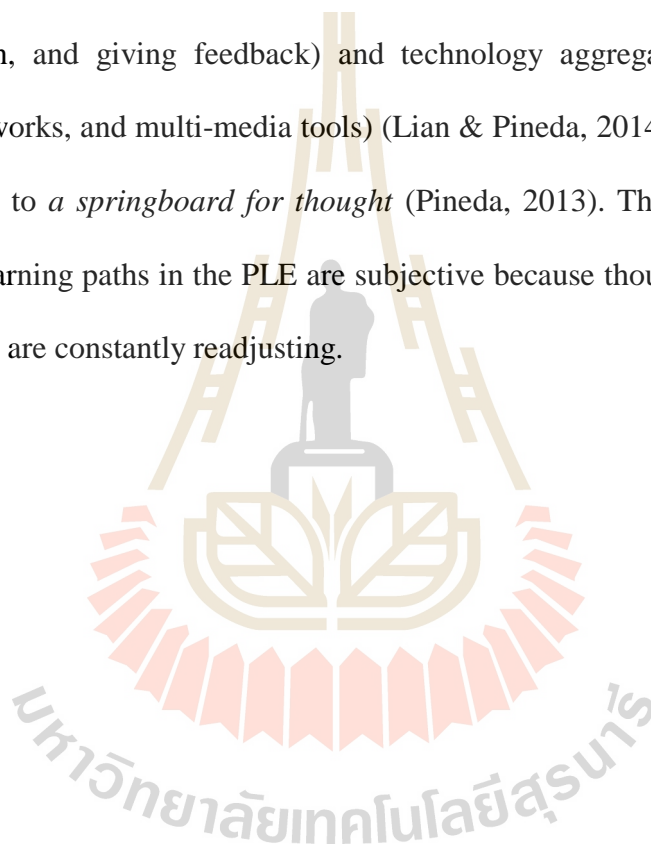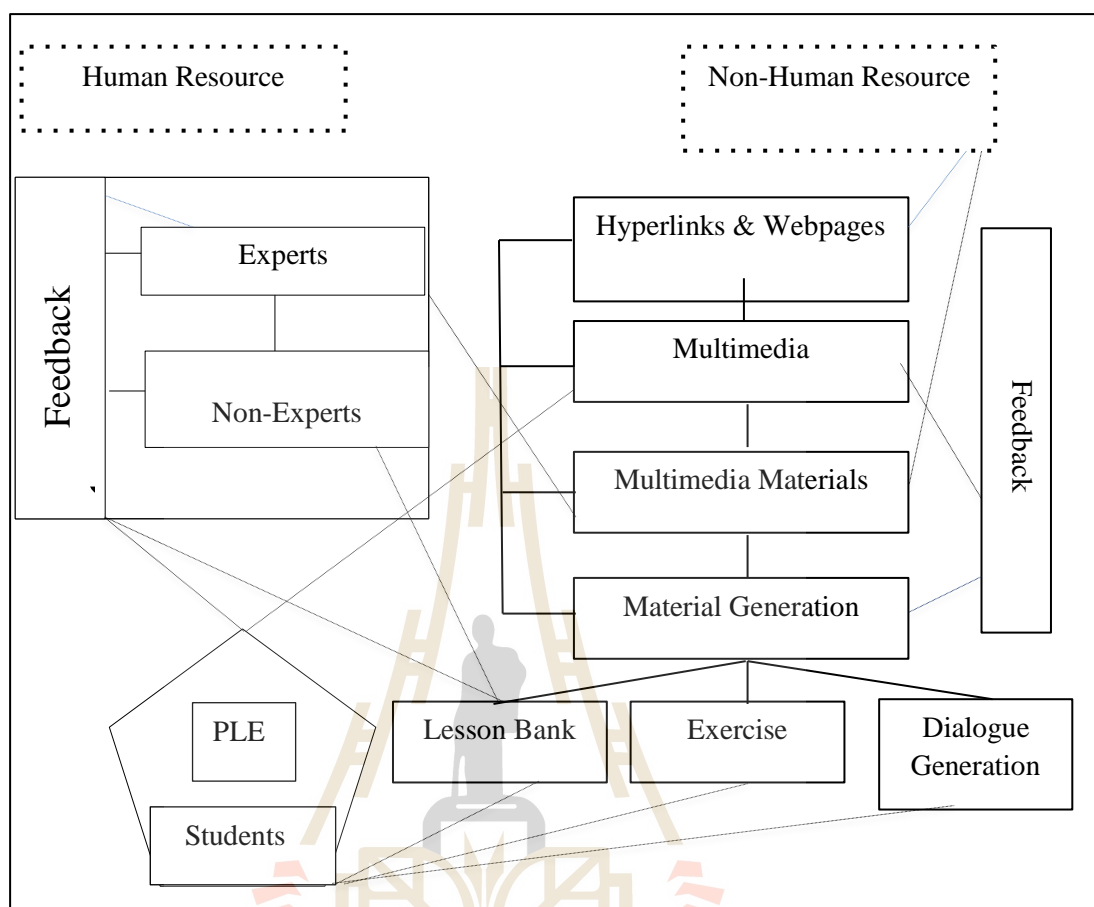
Figure 1.1 An individual's PLE based on a rhizomatic approach

(adapted from Lian & Pineda, 2014)

The above figure (Figure 1.1) represents a rhizome. It also presents two relationships—first one shows the relationship between the human PLE resource and the non-human resources, and the other portrays the relationship between the PLEs and a rhizomatic approach. As for these two resources, both learning resources provide different nodes/ points of information such as experts, non-experts (less knowledgeable people), feedback, hyperlinks and webpages, multimedia, and so on. All nodes/ points in the PLE connect potentially to every other point that an individual (a learner) captures or organizes as important sources of his/her learning

experiences. Material generation, for example, may include lesson banks, exercises, and dialogue generators. In addition, lessons, and exercises have been compiled and set as a list.

As to the relationship between the PLEs and the rhizomatic approach, a student creates his/her PLE. The PLE has been formed by the student's navigation across networks of people (human resource) and technology (non-human resource). Student's surfing on the Internet and/or dealing with human resources are indicated by dashed lines. The dashed lines represent student's learning pathways. They may be across other connections and some are repeated. These apparently chaotic ways are assumed to present how a learner constructs his/her knowledge and/ or readjusts his/her previous experience.

Within each set, learners change the direction of moves depending on several factors, e.g. time allocation, needs, and interests or curiosity (in some situations). Time allocation, for instance, is one of the causal variables. A longer time allocation allows learners to spend more time surfing the Internet or engaging in other activities in the virtual environment. Greater time allocation also helps learners feel comfortable and free to connect to other people in different communities by negotiation. Each line directed to each node accessed could provide an indication of how learners make decisions. The number of lines also reflects learners' decision-making ability (Lian & Moore, 2014). For example, a set of tools links material generation, exercises, lesson bank, and dialogue generation. Such exercises are compiled from many sources. The requirements of trajectory identification not only guide learners to situate themselves but also encourage them to develop awareness of the accuracy of rich authentic information.

According to the above description, the ability to make decisions is vital for learners to generate their navigation in the PLE. The ways in which they make decisions lead them to find ways to meet their requirements. Learners' needs are very often different. As noted by Lian (2000), the language learners need to be able to *confront, contrast,* and *contest (the 3Cs)* their understandings with what the learners have learnt. Arguably, the 3Cs reveal that each learner has a different system of internal logic and interpretation potential: the ability to understand the meaning of the world depends heavily on learners' previous experience (i.e. self-explanation). Different background experience and an understanding of forms and functions could help language learners generate their own explanation of the real world. Self-explanation is learners' attempts to understand new information that might be different to prior knowledge. Scholars such as Chi, de Leeuw, Chiu, and Lavancher (1994) claim that self-explanation is an effective way to improve the acquisition of problem-solving skills.

In respect of the PLEs, a number of studies in recent years has explored the tools on the Web 2.0 services (e.g. Duffy, 2008; Godwin-Jones, 2009; Mullen, Appel, & Shanklin, 2009; Chatti, *et.al.*, 2010), investigated the learners' perceptions toward making use of the PLEs (Guerrero, Lera, & Juiz, 2013; Guth, 2009; Reinders, 2014), constructed a framework of integration of the PLEs into learning (Kompen, 2008), and established open courses or informal education (Lian & Pineda, 2014; Mikroyannidis & Connolly, 2012; Pineda, 2013). The aforementioned studies describe important elements of the PLE including technology tools, users' attitudes, an integrated framework, and its implementation. However, little attention has been devoted to examining the assumptions or reasons, which lead learners to make

decisions in navigating between nodes and sub-nodes on the Internet.

The EFL learners are constantly engaging with rich authentic information. They need to generate understandings and interpret meanings in order to be able to learn. In order to learn, the learners have to control their cognitive and metacognitive mechanisms in order to present what their thoughts are (Lian, 2015). Logical representation of a learner could be inferred by examining the learner's PLE. In other words, examining learners' PLEs could make their unpredictable needs visible.

The current study attempts to understand EFL learners' decision-making processes in language learning as identified at Songkhla Rajabhat University. The focus of activities is on examining how the EFL learners generate their Internet navigation as well as navigation of other academic resources in their PLEs. The apparently chaotic paths of learning in their PLEs are also indicative of learners' interests and/ or preferences, technology skills, and information retrieval skills.

1.2 Background of the Study

As long as the Internet users [learners] access digital information, they can read, share and link ideas, abstract thoughts, non-verbal language and so on. The Internet provides all kinds of information that humans create for users (Last, 2013). To make use of technology-supported learning, generating comprehension to oneself could facilitate learners to integrate new knowledge into existing one. That is, self-explanation can boost self-directed learning and actively encourage learners to make sense of their experiences (Ackermann, 2001).

According to the Qualifications Framework for Thailand's higher education system established by Office of Higher Education Commission (OHEC), Thailand, the ability to engage in lifelong learning, and capacity for effective communication

are included in particular emphases reflecting the policy priorities of Thailand (National Qualifications Framework for Higher Education, 2006). Communicative language skills in the English language are useful in teaching, and research collaboration and internship recruitments. Information technology is a means for learners to access web databases. Learners need to dedicate themselves to developing both communicative language skills in English and the ability to use information technology in order to meet the institution's requirements or the education policy.

The Songkhla Rajabhat University (SKRU), the researcher's workplace, has seven faculties. *Individual Studies* is a requirement for senior students of all faculties here. With respect to the English Programme in the Faculty of Humanities and Social Sciences, 69 English majors must undertake research tasks in *Independent English Studies* (1554906). After the completion of the course, those students are able to develop research skills and evaluate academic information in both printed and digital formats. Consequently, teachers in the English programme at SKRU are trying to adjust language class activities to suit the learning goals of English language courses and fit the needs of the education policies of both SKRU and the Organization of Higher Education Committee (OHEC). While the learning goal of this course may vary in accordance with communicative skills and the specific core of the course, they share some similarities in terms of developing English language skills for effective communication.

With respect to the compulsory English language courses in the Faculty of Humanities and Social Sciences at SKRU, *Independent English Studies*[1] (1554906) is considered as the basic course for developing research skills. *Independent English*

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[1] Course Description (1554906): This course introduces information on basic research skills and provides the opportunity into practice in individual work (Registration Department, SKRU, 2016).

Studies offers an opportunity for 4th year English majors to be exposed to authentic English language by providing virtual language learning environments (e.g. Google Class) and technology-supported language learning. Furthermore, teachers in the English Programme at SKRU advocate self-directed learning. They encourage their students to undertake outside-class tasks from other learning platforms such as Learning Management Systems (LMSs), and Google classroom. Moreover, With respect to learners' ability to navigate the Internet, Google, YouTube, and Facebook are frequently accessed by both learners and teachers. Students access sites in order to retrieve information, stay in touch and undertake collaborative activities amongst friends and/or between learners and teachers. Learners have enough language resources (provided by the campus) for developing their English language skills and their information retrieval skill is satisfied and accepted.

One of the objectives of *Independent English Studies* (1554960) is to produce an individual project and research presentation. The learners have to work individually and collaboratively to produce these. That is, the learners may create their own learning environments to serve their learning requirements. The individual project is understood as a shared-learning goal and the procedures of information retrieval and website visits can be seen as micro tasks. To complete the macro-task, learners may have to explore useful ideas, gain insights into the selected issue in English language as well as techniques for completing the whole processes of the project, visit many URLs (e.g. Google Scholar, SlideShare), access academic information via e-journal databases (e.g. ScienceDirect, ProQuest, Thailist), negotiate with people in different communities (e.g. Facebook, Line), share ideas from peers, undertake collaborative tasks, and share feedback. All these activities are

ways to get work done and increase self-regulated learning. Many web visits could be connected and illustrated as a map showing pathways of information retrieval. The final outcome from these activities is the individual project report and project presentation. To clarify what the PLE from this activity might look like, the figure below (Figure 1.2) shows a *hypothetical* PLE based on facilities available at SKRU.
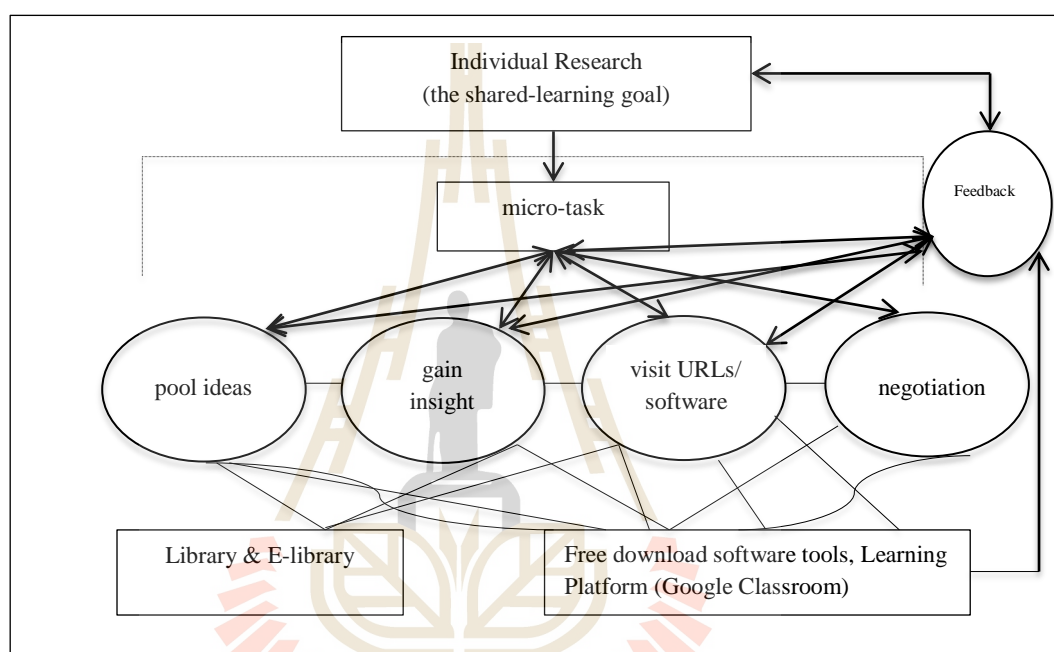
Figure 1.2 A *hypothetical* rhizomatic PLE of an individual project and project presentation

In the above figure (Figure 1.2), the lines represent connections to human resources (the course advisor, feedback, and negotiation) and technological tools (software tools, and URLs). The act of creating connections and links contains a lot of meaningful information embedded in learners' schemata including their past experience, and own knowledge. Many URLs often provide information that seems to be full of repetition. Interestingly, interpreting pathways of the coloured lines could provide mentors, teachers and learners with remarkable information for readjusting ways of thinking or increasing self-regulated learning. Reasons for

changing pathways for searching can vary in accordance with learners' preferences, information retrieval skills, time availability, learning goals, search strategies, and learners' previous experiences.

We will explore this environment to examine how learners establish connections between nodes of knowledge activity. It is anticipated that during the processes of initiating the PLEs within the rhizomatic approach, learners would gain benefits in terms of self-directed and lifelong learning.

1.3 Statement of the problem

In (language) pedagogy, we are moving more toward open, self-managed, autonomous (e.g. rhizomatic) systems. For years, learners at tertiary education have taken part in online classes and have more opportunities to develop (language) learning skills. They build a community to share knowledge and the dissemination of information, as well as access/ join some open education resources. These situations might encourage those learners to control themselves to learn as they have freedom to manage and reorganize of what they interest. Hence, the learners could create a space of learning or the system of learning all on their own.

Particularly, the learning system requires learners to make decisions about their learning activity and to make judgement about this. In fact, learners have different preferences and interests that lead each of them to justify selecting a suitable pathway of learning. When the learners construct their structure of learning, other people (teachers, friends, and other professional association) are not know any directions or information of that learner thinks (Lian & Lian, 1997). Each learner discovery could present of what s/he needs to know or ways of problem solving.

Some are simple and some are complex because individuals perceive the world differently.

In order to create the best learning context for such learners, an insight into learners' decision-making processes would be useful. Even though, there are numerous ways in creating appropriate language learning contexts, there are two common threads in evidence. First, a focus of learning contexts is commonly on an [each learner] individual's cognitive ability; that is the ability of making sense of the world logically (Collectine & Freed, 2004), and knowledge is a merit of social collaboration—it is a result of individuals' experience as well as cultural variables. Lastly, free-will learning environment provides learners multiple alternatives without being controlled by rule-based restrictions. Real-time evaluation is applied by human brains which lead individuals to be aware of choice-making procedure. Without manipulation of outside variables, being free will guide many decisions at the subconscious level (Klemm, 2012)—it is a dispositional perspective.

This current study will try to do so. With a specific focus, fourth-year English majors at Songkhla Rajabhat University have to conduct English language research, which is one of university requirements for senior learners. In the course Independent English Studies (1554906), it is one of compulsory courses of the English program at SKRU. Learners are expected to be well equipped with language skills (i.e. listening, speaking, reading, and writing), problem-solving skills, research skills, and decision-making skills. With respect to language skills, productive skills such as speaking and writing are considered as an important means to present their English language proficiency to audience. That is, they have to write a research report and present what they have done in public orally. Moreover, the ability of their perceptive skills such as

reading and listening are essentially important for their information retrieval/ search (digital and printed sources), information evaluation (digital and printed sources), and planning.

The English majors have to undertake two main tasks in getting work done—writing tasks, and speaking tasks. In both tasks, learners are allowed to retrieve online information from links and webpages and/ or approach to personal sources. Writing tasks include summarising and paraphrasing while speaking tasks are dealing with oral presentation. Each task contains many micro-tasks. To interpret these activities in depth, out-of-class mode is likely to be emphasized rather than monitoring those learners in-class mode. The learners, then, have a space for a free-will learning. The free space of learning might show how learners make a decision to pause at each node of their learning pathways.

In sum, it is the aim of this study to pay attention to support self-managed and autonomous systems that encourage English majors at SKRU to make decisions in creating [language] learning activities.

1.4 Objectives of the Study

This study aims to examine how EFL learners generate their learning trajectories within their personal learning environments (PLEs). To simplify this idea, this study intends to:

1. analyse pathways of learning taken by EFL learners as they navigate the Internet and/ or deal with other resources for language learning; and

2. seek factors influencing EFL learners' decision-making processes as

they navigate the Internet or deal with other academic resources and create their PLEs.

1.5 Research Questions

In order to fulfil the objectives of the current study, the following research questions are addressed;

1. How do EFL learners make decisions pertaining to the construction of their PLEs?

2. Are there any significant factors that influence EFL learners' decision-making processes as they navigate the Internet or approach other resources for learning as they construct their PLEs? What are these factors?

1.6 Significance of the Study

The primary significance of the current study is discovery of the range of decision-making processes by students engaged in the construction of their PLEs during language learning. In this case, this may lead to develop descriptions a decision support learning systems. Learners can conduct their learning environments based on many variables including learners' preferences, learning requirements, and information retrieval behaviour. The provision of a decision support system in learning processes may shed some light on the nature of human thinking. Learners' cognitive and metacognitive control guides what they situate themselves in learning. Prompted by Derrida's thinking, Johnson (2006) cited that "*The logic of the supplement is also inseparable from what Derrida calls the 'movement' of supplementarity, that is, any complex system open to its environment (life, language,*

technology) is always in a dynamic process of integration with that environment, in other words, there is always evolution" (p. 55). Inevitably, a decision support system in learning depends on learners' ability to integrate new knowledge into existing knowledge. We are forced to rethink and readjust ideas in order to gain insights into the real world.

Second, due to authentic-information-rich situations, learners should learn to verify understandings of what they have obtained from different sources in order to readjust knowledge from their previous experience. In addition, learners' ability of awareness development enables them to think critically. Without awareness-raising development, learners gain nothing from information retrieval. Lian (2014) claims that networks of both people and technology support awareness-raising and provide learners with a form of triangulation.

Third, the current study pays much attention to a rhizomatic approach. It is one of the great merits of learning construction. Learners customize their PLEs as a comfort zone of learning. That is, they could develop the ability to take responsibility for their own learning as independent learners. It is assumed that learners arrange learning contents and manage the plan, schedules, and evaluation for their own learning with particular learning strategies. Also, learners can construct new knowledge by gaining access to other people. As a consequence, they could maintain positive relationships between people in different communities. Likewise, Pineda (2013) claims that rhizome learning is an interest-driven approach. Besides, scholars such as Buchem, Tur, and Hölterhof (2014) posit that rhizome learning empowers autonomous learning that learners could control themselves to learn in many aspects such as control of tools (aggregates and configures tools based on learners'

preferences), control of social community (initiates discussions and collaborations), and control of tasks (arranges learning activities).

Fourth, the learners' navigation through the different nodes of knowledge could mirror learners' thinking in trying to find possible solutions through a process of trial and error. Learning pathways for each learner are unique and depend on an individual's cognitive mechanisms. In respect of education, it may be necessary to adjust curricula in order to facilitate learners developing their autonomy fully. Similarly, Lian (2004) concluded from his view on language learning that

> Learning needs to begin with authentic language in authentic texts and then be subjected to a process of investigation by the learner through the use of appropriate tools and feedback mechanisms. Some of these processes may include but will not be limited to simplification or explanation or supported observation of language acts in different contexts (p.5).

To simplify the above idea, three critical elements of language learning mechanism include authenticity, appropriate tools and feedback provision. These elements may support language learners to obtain understanding by using language tools for discovering what they need to know.

Finally, the findings from this current study possibly awaken either education policy makers or institutions in Thailand to adjust foreign language pedagogies in terms of integration technology into cross-disciplinary learning.

1.7 Definition of the Operational Terms

a) Autonomous learners

Autonomous learners refer to self-controlled learners who are responsible for all of their learning activities. Those can develop their own potential of monitoring and evaluation of what the learners obtained in and outside class (Little, 2016).

b) Decision-making

Decision-making refers to the intellectual capacity of the learners to justify their actions based on assessments made by them (Flavell, 1796, p.232 as cited in Silver, 2013, and assessment of the situation. A decision making could indicate negative and positive sides depending upon the learner's cognitive mechanisms.

c) Decision support system

Decision support system refers to the human capacity for reasoning and decision-making rather than digital technology operation of the decision-making processes. Being different from decision support systems (DSS) in information technology or computer sciences, decision support systems here are an arrangement of information retrieval, choice selection, and implementation of selected choices. The choices can be from people negotiation and information retrieval.

d) EFL learners

The term EFL learners refer to the English major student from the Faculty of Humanities and Social Sciences at Songkhla Rajabhat University, Thailand. All are enrolled in *Independent English Studies* (1554609)—a compulsory English course for developing basic research skills.

e) Metacognition

Metacognition refers to the ability of human beings to monitor and control their

own cognitive mechanisms derived from learning and experiencing the world. Besides, metacognition plays a vital role in guiding judgements and decisions (Strle, 2012). With respect to education, the learners develop the ability to set a plan, to organize activities, and evaluate outcomes from the beginning to the final stages of the learning processes.

f) Personal learning environment (PLE)

A personal learning environment is depicted as an individual organization of learning through negotiating ideas with people both knowledgeable and less knowledgeable. In addition, this learning environment can be described as a map derived from making use of multiple technology-supported tools and application software. The PLE can foster learners' self-regulation and self-accountability in higher contexts (Dabbagh & Kitsantas, 2011), and become involved in engagement and collaborative activities (Buchem, Tur, Hölterhof & Group GET, 2014).

g) Rhizome structure (in education)

A rhizome structure refers to the multiple connections of rich and authentic information through human and technology-supported networks. The rhizome structure also encourages the learners in awareness-raising and widens views of meaning making (Lian, 2014, 2015).

h) Technology-supported rhizome

Technology-supported rhizome refers to the networked technology that is able to connect the learners and resources through application software and web databases.

i) Web 2.0 (Web version 2.0)

Web 2.0 is one of the crucial components in gaining access to digital information—asynchronously and synchronously (Read / Write web (Duffy, 2008; McCarty 2009). Web 2.0 also is an important service for establishing learning environments for the learners as well as enhances the web users in a community to work collaboratively. Common tools in Web 2.0 include weblog, wikis, audio/video casting, Twitter, and social networking sites (Richardson, 2010).

1.8 Scope and Limitations of the Study

The current study shows the disposition of EFL learners at tertiary level to make decisions in identifying trajectories during PLE creation. A limitation reveals that the analysis of this study tends to reify an essential concept, trajectory identification, by using the PLEs rather than describing how to create the PLE or construct a model in using the PLEs in language learning. However, the participants are 4th-year English majors at SKRU. The limitations indicate that the participants might not be representatives of those of other English courses, and the results of assumptions emerging in this study might not be applicable to use for English majors of other universities.

1.9 Summary

This chapter describes technology-supported decision-making processes for EFL learners. A rhizomatic approach is employed in order to introduce concepts of multiplicity and uncertainty in decision-making. A personal learning environment (PLE) is a means to elaborate how EFL learners use their own learning strategies to retrieve information. Consequently, we can see the relationship between the PLE and technology-supported language learning. The PLE is created in order to simulate ways of learners' thinking as they navigate the Internet and/ or deal with other academic resources e.g. knowledgeable and less knowledgeable people. Different pathways of trajectory also indicate how EFL learners control their cognitive and metacognitive mechanisms and how they make decisions.

CHAPTER 2

LITERATURE REVIEW

This chapter provides a review of the literature related to this current study. This review contains three main parts. First, it discusses the notion and recent trends of previous studies on technology-supported language learning environments and the essential components in decision-making in higher education. The final part describes the learning theory, and of particular interest are a postmodern aspect in learning and its practice in language learning. The understanding of technology-supported rhizomes in language learning environments is briefly reviewed; personal learning environments (PLEs) comprise the majority of this section. A summary of the whole chapter can also be read in the conclusion.

2.1 Technology-Supported Language Learning Environments

2.1.1 Technology movements towards language learning

Technological tools in a classroom situation are widely used to support learning activities and form themselves as applications for producing learning, for example, gathering, storing, displaying and sharing information (Cunningham & Allen, 2010). Computer technology provides various options to users from interactive tasks to sharing information on the Internet. The growth of technology in the language class has gradually developed for language learners from making a connection between form and meaning (Chapelle, 2007) to decision-making. Since the early

1960s, computer technology in pedagogy has presented itself as computer-based programs. It has also effectively influenced teaching pedagogy as live teaching (Kulik & Kulik, 1991). Subsequently and more specifically, CALL (Computer Assisted Language Learning) was established in order to expose learners to a target language (Chapelle, 1998) using repetitive language drills, text reconstruction program and simulations, and integrative CALL (Warshawer & Healey, 1998). Hence, the learning process has also been adjusted due to the great changes in computer technology.

At present, we stand to benefit most from a dramatic growth of social networks–a large area of an information space where people develop an understanding toward s communication and co-operation (Fuchs et al., 2010) by creating, sharing, publishing, and collaborating information. Web 2.0 demonstrates that this platform is essentially important to developing social interaction. By definition, Herring (2004) described Web 2.0 as:

> Web-based platforms that emerged as popular in the first decade of the 21st century, and that incorporate user-generated contents and social interaction, often alongside or in response to structures and/or (multimedia) content provided by the sites themselves (p.4).

Web 2.0 platform presents itself as a chain of collective intelligence rather than a package of software applications. Collective intelligence, according to Wikipedia, is "shared or group intelligence that emerges from the collaboration, collective efforts, and competition of many individuals and appears in the consensus decision-making" (Collective intelligence, 2016). New applications, services, and tools allow users to more directly share the bulk of information with others. In this decade, it is undeniable that there is a paradigm shift in second language learning from a cognitive-related approach to a social-related one. With the great potential of

Web 2.0 services or Read/Write Web (Thomas, 2009), the bulk of the study relating to Web 2.0 services integrated into language learning has become remarkable in terms of learners' preferences, the shift of teaching approach, and knowledge discovery.

With respect to learners' preferences, results of many empirical research studies concerning integration of Web 2.0 services into second language learning reveal why L2 learners express affection for advantages of Web 2.0 services, especially in blogs and wikis in second language learning. Blogs and wikis are almost always used to improve writing and reading skills of second language learners. In essence, the great potential of blogs and wikis expose learners to reading, writing, and listening (audio-blog) (Alm, 2009). In other words, blogs and wikis represent as multi-literacy (Raith, 2009) in the Web 2.0 services. As a riter, a blog writer needs to have competency of contextualizing culture. Wikis and blogs mediate learning environments that are flexible for learners in sharing information as well as negotiation. Most results of studies on wikis and blogs in language classes indicate that these tools increase learners' motivation (e.g. Dohn, 2010; Parker & Chao, 2007; Wang, 2014), and promote writing-reading skills (e.g. Mark & Coniam, 2008; Hsu & Wang, 2010; Rahimi, van den Berg, & Veen, 2015; Wichadee, 2010). Richardson (2006) concluded that weblogs and wikis are applicable to use as a collaborative space. Furthermore, other tools incorporating audio (Skype,) (Mullen, Appel & Shanklin, 2009), photo (Flickr) (Benson & Chik, 2010), and video (YouTube) (Duffy, 2008) also facilitate L2 learners to search for insightful information.

Aside from the tools in Web 2.0, web services have led to the shift in teaching approach. The great potential of technology has caused a pedagogical reform of second language learning because of its rich and authentic information as well as its accessibility. Consequently, learner-centered, self-regulated, and learning autonomy have been promoted in order to serve the exponential growth of digital information.

These learning approaches depend on individualization. That is, each learner performs differently in terms of schemata organization, experiences, and needs. Hence, the external intervention activities of one learner may be not suitable to another (Lian & Lian 1997; Lian, 2000).

With respect to knowledge discovery, learners (or the Internet users) access information via the Internet in order to search for what they need to know at a particular time for a specific interest. That is, the unpredictability of individual's needs (Lian, 2015) lead the Internet users to share information for solving similar problems. The aggregation of structured information is organized fragmented information and stored it in a form of a community or collected intelligence (Gruber, 2006; Guerrero, Lera & Juiz, 2013).

In summary, technology movements involving language learning reveal a critical challenge for both learners and teachers to increase awareness in learning processes rather than being dominated by teacher and syllabi. The growth of technology gets along with individualization in learning processes. With the diversity of individuals, learners possibly direct themselves with sufficient knowledge by selecting a suitable learning environment to fit learning requirements or a shared-goal.

2.1.2 Personal learning environments (PLEs) in Learning

Personal learning environments have been very beneficial to not only learners (Reinders, 2014) but also as a representation of a virtual authentic-information space for all learners. The common characteristics of PLEs show the aggregation of numerous digital and knowledgeable resources in both synchronous and asynchronous features selected by the learner to support the different views in a particular learning activity. In Attwell's (2007) view, the PLEs encourage learners to make a learning environment visible and explicit to support a personal purpose of

learning. The PLE, hence, describes itself as a map of the learning path that presents multiple connections of the learners' preferences supported by technology (Pineda, 2013).

According to the previous information, certainly, positivity towards making use of the PLEs amongst learners and teachers has dramatically increased in terms of developing problem-solving skills in a social context (Thomas, 2013), such as promoting: lifelong learning skills (Attwell, 2007; Juarros, Ibanez, & Crosetti, 2014); self-regulated learning (Garcia, Gros, & Noguera, n.d); and autonomous learning (Reinder, 2014). Furthermore, Downes (2007) illustrates PLEs as a "the door to the world" (Downes, 2007, p.608 as cited in Souza, Farinelli, Jamil, & de Vanconcelos, 2014), where learners can widen their view from sharing information, creating instances according to their preferences, and interacting with others in various networks. Hence, PLEs can be understood as a friendly-managing organizer for learners on the Web.

However, a few challenging concerns have been expressed over the use of the PLEs. First, PLEs are one of the platforms on the Web containing various links and different software, thus it is necessary for learners to be able to raise awareness in using the Internet. Second, an insufficient sense of self-regulated learning is also a concern. Self-regulated learning is probably stressful for those who are familiar with the teacher-oriented class as the students need to control themselves in order to study (Hakkarainen et al., 2004 as cited in Valtonen et al., 2012). And lastly, Taylor and Burgess (1995) asserted that the orientation session of using social networks is essential for students because they can familiarize themselves with self-directed learning practices. According to these concerns, the shift of learner's and teacher's roles has been considered when PLEs were introduced to them.

From the perspective of learning, three remarkable terms emerge namely: lifelong learning, self-regulated learning and autonomous learners. In addition, PLEs, have become ubiquitous in language learning. Lifelong learning seems to be a popular term in the language learning aspect.

- Lifelong learning

Lifelong learning, according to European Parliament and Council (2006), is defined as follows: Lifelong learning means all general education, vocational education and training, non-formal education and informal learning undertaken throughout life, resulting in an improvement in knowledge, skills and competence with a personal, civic, social and/or employment-related perspective. It includes the provision of counselling and guidance services (p.10).

Lifelong learning comprises learning strategies in cultivating understandings of the real world, not only inside and/or outside class, but also involving formal and informal systems in education. Also, lifelong learning represents equity in education in that it provides an opportunity and a challenge for literacy development for all learners at any time and in any place. The best example is the Hole-in-the-Wall Education Project and Free Computer-access Project inspired by "Slumdog" (Sidner, 2009) established by Sugata Mitra in 1999 and 2013, respectively. Learners from Sugata Mitra's project have a chance to maintain the learning strategies such as negotiating, interaction, knowledge discovery, knowledge sharing, and learning management (Mitta, 2012). These aforementioned learning strategies serve a purpose of lifelong learning– learning to know, learning to do, learning to love together, learning to be, learning to change, and learning for sustainable development (Charungkaittikul & Henscheke, 2014).

- Self-regulated learning

Self-regulated learning also supports the idea of the PLEs and lifelong learning. In Zimmerman's (2008) view, self-regulation driven by impersonal forces for mastering of academic performance skills such as writing and reading, is a remarkable self-process in learning. Furthermore, self-regulation is really considered as a proactive process that learners use for learning acquisition. Similarly, researchers as Zumbruun, Tadlock, and Robert (2011) described some core learning strategies in self-regulation including students' metacognitive strategies (Pintrish & Groot, 1990), goal-setting, planning, self-motivation, attention control, self-monitoring, help-seeking, self-evaluation (Zimmerman, 2008), and cognitive strategies (Mayer, 2008; Boer, Donker-Bergstra & Kostons, 2012). These manifold strategies are embedded into everyone, albeit with a different degree of motivation, and direct a possible solution for all learners to cope with academic tasks.

With the flexible style of the PLEs, it is undeniable to claim that the PLEs are congruent with self-regulated learning, involving the use of software applications, services, and communities which serve as an individual platform so learners may pursue their academic achievements. Learners will certainly pool ideas on a blog site, Google Docs or undertake reading tasks on a webpage, such as SparkNotes. More specifically, Dabbagh and Kitsantas (2012) argue that PLEs require the development of self-regulated learning skills, namely learners should take charge of their own learning (Strang, 2013). The PLEs, according to the previous studies, promote self-regulated learning within the realm of the social cognitive perspective in as much as learners execute some particular strategies for getting work done. Such strategies include clear and specific learning goals, self-motivation, outcome expectations, attention focusing, experience satisfaction, performance adjustment, and so on (Kitsantas, 2013).

More specifically, Zimmerman (2000) proposed a cyclic model of self-regulations including three phases, namely the forethought and planning phase, performance monitoring phase, and reflection on performance phase. In the forethought and planning phase, learners explain learning tasks in detail in order to share a goal-setting that will lead a way to approach the tasks. In second phase, learners undertake tasks by monitoring their learning progress and use appropriate strategies to complete the tasks. Lastly, learners use self-monitored outcomes to evaluate performance on learning tasks. Self-regulated learners keep working on this loop till they cope with all learning tasks.

Consequently, Dabbagh and Kitsantas (2011) and Kitsantas (2013) adapted Zimmerman's (2000) three-phase model to support self-regulation in PLEs. They develop Zimmerman's model into three levels: 1) personal information management, 2) social interaction and collaboration, and 3) information aggregation and management. In level 1, social media tools in the PLEs can be used as a personal space in order to set a plan, organize (course) contents. For example, a blog can be used as a private journal; Google calendar is for a schedule setting; and social network sites are for creating a personal profile. In level 2, peer feedback and sharing information play a remarkable role because the Internet users or learners have a great opportunity to negotiate with each other though the web sites. Negotiation seems an important reaction amongst learners to pool ideas relating to a learning goal. For example, a blog, Google calendar, and the sites simply allow both learners and teachers to share and edit information. In level 3, learners are guided by the instructor in order to configure information in a blog, as well as adding a blog into an RSS feed, and archiving the personal and group schedules. Dabbagh and Kitsantas (2011) and Kitsantas (2013) claimed that PLEs have significant influence on learners with regards to managing their self-efficacy and scaffolding.

- Learner autonomy

Learner autonomy is another expectation for scholars and researchers in the field of education. Although it is not our attention to enter into a detailed theoretical discussion of these issues, there is an interesting commentary on revealing some characteristics of autonomous learners working in the PLEs situation: To start with Holec (1981) who is normally cited for his seminal contributions to this field, states that "to take charge of one's own learning" is to have "[…] the responsibility for all decisions concerning all aspects of this learning […]. (p.3 as cited in Little, n.d.). A critical reflection is dealing with self-management in learning and metacognitive abilities such as sharing responsibility for learner involvement, and learner reflections. To Holec, being an autonomous learner relates to a learner's responsibility for their own learning.

Little (1981) also deliberated his efforts to define a working definition of autonomy. He understood autonomy as belonging with one of the functions of (adult) education for increasing a sense of awareness. It could be anticipated that adult learners could develop a learning ability in a participative style of learning. He also theorized that autonomous learners can learn in collaboration with others, reflect a progression of learning, and be proactive in self-management (Najeeb, 2013).

In Benson's (2006) term, autonomy in language learning refers to "a capacity to take charge of, or take responsibility for, or control over your own learning" (p.1). In other words, learners in this aspect can show a disposition to take responsibility for study.

Briefly, learner autonomy retains its primary meaning of "self-governance" (Ryan & Deci, 2006, p. 1562) meaning that the learner becomes conscious of what is suitable for fostering one's own learning style and accepts a particular adjustment in achieving learning outcomes.

Therefore, the development of learner autonomy in the setting of PLEs could be vividly outstanding due to the flexibility of learning environment creation and a freedom in arranging learning tasks. No matter how the learner gains insights into a communicative activity in the language being learnt, the learner accustoms himself to heighten a linguistic awareness of the target language in particular (Lian, 1993).

2.1.3 Previous studies on technology-supported language learning environments and factors for the EFL learners creating their own learning environment

This section is intended to present the relevant studies involving the integration of technological tools into language learning environments and facilitating PLEs in classroom situations. Additionally, these studies in the review cover empirical findings on the creation of the personal learning environments of EFL learners. Specifically, the effectiveness of PLEs to solve linguistic problems is in focus as it has great potential, which could help learners re-establish their aggregation of archived knowledge.

Wild et al. (2010) established a draft framework of skill requirements needed to create a PLE. They claimed that PLE creators need to be equipped with five competences, which are planning, reflecting, monitoring, acting, and interacting. The continuum of the five competences triggers the different levels of interaction. In the phase of planning, learners need to complete their own portfolios. Reflection is the second phase in which learners review their past experiences and former retrievals in order to raise their awareness and make sense of the world. Monitoring, the third phase, enhances learners to be self-regulated as they have to build up criteria for self-evaluation and giving and/or receiving feedback. In the acting phase multiple skills are

required such as digital literacies and a positive attitude towards information they retrieved. The last phase is interacting. This extended social skill is significantly important for learners. At this stage, competence in decision-making is also needed.

- Pedagogy aspect

PLEs are presented as a blueprint of an academic pathway for an individual's preferences (Pineda, 2013). Each PLE serves a specific learning need revealed in Pineda's (2013) study. The course design of Pineda's (2013) open educational resources was conducted by using a firm underpinning of a rhizomatic approach that illustrates diversities of learners' preferences and flexibilities of re-thinking processes. All labels and terms used by her second-year students represent not only their interests but also technological literacies and self-regulated performances. She also found that the comfort zone of each learner showed an academic path that the learner designed for his/her learning. Besides, a map of learning diversities in the learning network tends to be useful for teachers or facilitators to keep balance in a learner's comfort zone of learning. That is a teacher/ facilitator will be able to intervene, if a students' learning network causes concern.

Likewise, Del Barrio-Garcia, Arquero, and Romeo-Frais (2015) advocate establishing PLEs in higher education in order to promote learner autonomy as well as develop lifelong learning capacity. The researchers developed the Technological Acceptance Model (TAM) for PLEs and they confirmed that tools on Web 2.0 were suitable to create a PLE and also have positive impact on learners' experiences in four aspects which are collaborative learning, content learning, active learning, and communication skills. Furthermore, the findings indicated that of the favorite tools on Web 2.0, Facebook was the most popular social media as it was considered as having high potential to affect a group of people in a specific area and to develop their careers.

Moreover, the integration of PLEs into the learning processes should be planned well as presented in Väljataga, Pata, and Tammets's (2011) study. The researchers examined the perception social media in terms of its affordability. This was considered as cues of action evoked by making use of tools on Web 2.0. Findings revealed some prominent suggestions that learners should develop navigation skills and raise self-confidence while creating their PLE. Noticeably, students' perceptions of the affordability of PLEs changed and they followed their teacher who guided the navigation on the screen. The researchers remarked that learners lacked self-confidence in making use of social media for PLE creation.

PLE development is possible when used as an indicator of learning activities as showed in Rahimi, van den Berg, and Veen's (2015) study. The study aimed at examining how PLEs affected young learners getting involved with learning environment construction. According to the findings, they confirmed that introducing a variety of web applications and tools from Web 2.0 possibly encouraged the learners to make choices and use them to make sense of the world. The researchers also established the PLE-based functions lying within the student's control: (a) broadening technological and content choices; (b) feeling ownership and taking more responsibility over learning processes; (c) practicing digital responsibility; (d) improving the students' ways of learning; (e) improving students' technical and web skills; (f) supporting collaboration and networking; (g) practicing web-based cognitive activities; (h) promoting communication about technology; (i) supporting the establishment of a student-centric learning environment; and (j) increasing the student's awareness about the learning benefits of Web 2.0 tools. Moreover, the extraneous findings were parallel to others in terms of advantages of the PLEs in learning processes supported by Attwell (2007). In that study the PLEs comprise

digital tools that enabled learners to act as content producers, socializers, and decision makers. In addition, learning autonomy development, as described by Van Harrmelen (2006) indicated that learners could use eclectic tools from Web2.0 to increase ownership, and connectedness. Furthermore, the student-centric instructional approach, as explained by Drexler (2012) shows that web applications empowered learners to achieve a purpose of independent inquiry. One remarkable aspect was scaffolding and negotiation between the teacher and learners, which was likely necessary for discovering the affordability of PLEs; affordability is paramount in choosing content.

However, PLEs do not restrict learners to language learning only as they are also applicable to other disciplines. For example, Drexler (2009) shows a clip entitled "Welcome to My PLE!" available at https://www.youtube.com/watch?v=YEls3tq5wIY. One of Drexler's students showed her PLE in biology and the comparison study of the achievement in using the PLEs between the groups of mathematics and computer students conducted by Harding and Engelbrecht (2015) which presents an alignment with collaborative activities of the two groups. The participants also expressed a positive attitude towards PLE implementation: the PLE offers sense of belonging, raises motivation, provides a chance to express reflections and opinions freely and functions as a means to cultivate different academic skills.

PLEs in the pedagogical aspect produce positive results in learning requirements that encompass personalizing, participation and the knowledge-pool (the 3Ps) (Chatti, Agustiawan, Jarke, and Specht (2010), and also encourage learners to create a DIY learning framework (Lian, 2000) in order to fulfil the gap of learners' insights into learning.

From observing the findings of several studies, technological ability is likely to cause a critical challenge for learners in creating their own PLE (Chatti,

Agustiawan, Jarrke, & Specht, 2010; Guth, 2009; Väljataga, Pata, & Tammets, 2011; Van Harrmelen, 2006; Rahimi, van den Berg, & Veen, 2015; Del Barrio-Garcia, Arquero, & Romeo-Frais, 2015). Though PLEs sometimes do not deal with applications on the Internet, exploring websites and sharing materials is possibly a common practice in the creation of a PLE.

- Rhizomatic Aspect

As found in Pineda's (2013), and Guth's (2009) studies, the researchers made the PLEs visible as a blueprint (Pineda, 2013) and a student's mind map (Guth, 2009). PLEs reflect the idea of the rhizomatous approach based on the postmodern scholars Deleuze and Guattari. Each point where there are links is represented by lines, similar to the rhizomes as described in the botanical term. The chaos of lines could represent multiple tracks of negotiation that allow people in a community to pool and share ideas. With respect to the PLEs in education, many scholars commonly focus on what applications or web services enable learners to share information, negotiate with others and undertake collaborative activities. Many scholars analyze activities in PLEs in order to present that the PLEs could promote autonomous, self-regulated and lifelong learning. However, the number of studies on PLEs involving a student's decision-making and trajectory is limited. Therefore, this study intends to establish reasons why learners move between a point and another point of their retrieval.

2.2 The Current Trend in Technology-Supported Language Learning Environments

Previously reviewed literature dealing with computer technology shows that there seems to be an influence on language learning environments. This section will present a remarkable learning environment associated with Sugata Mitra and a noteworthy solution for taking full advantage of deploying technology supporting the learning

environments. Mitta is the founder of School in the Cloud where children can undertake learning tasks without any supervision. The scene of an autonomous and self-regulated learning in Sugata Mitra's experiment of minimal invasive education in 1999 is known as Hole-in-the-Wall, and it describes the free will of learning in as much as that learners willingly perform learning tasks with natural ease. Mitta's (2015) quotation, *Education is a self-organizing system, where learning is an emergent phenomenon*, may be interpreted thus: skills, imagination and creation tend to develop along with the ability to manage one's own learning. A broad outline of the learning processes is summarized as follows: 1) a discovery was made when learners explored a way to deal with a computer and graphical user interface situations; 2) the procedural skill of using computer was shown when the learners figured out how to use computer by a process of trial and error; 3) the skill of memory was revealed when they practiced using a computer and accessed the computer software; and 4) a social collaboration occurred when they naturally assembled a team to do exercises and to share knowledge (Mitta, 2012). Furthermore, the result of this project certainly provides a good example of how to reduce anxiety in learning and how to facilitate a self-regulated learner as well as an autonomous learner.

Another method is Do-It-Yourself (DIY), (Lian & Pineda, 2014). This acronym describes a creative way to design learning activities by learners themselves. Certainly, each learner has a different learning style and knows what information one requires to accomplish a learning goal. Also, learners not only encounter the feeling of difficulty in a different context but also a degree of satisfaction, which is changeable depending on motivations and preferences. Lian (2014) claimed that learners need to use an academic resource at a specific time in order to solve a particular problem and for the sake of learners' academic requirements. He posits 3-just phases namely just in time, just enough, and just for me. The 3-just describes that learning happens when learners need and resources are accessible and available, also,

the quality of resources and information should useful and suit the learners, needs. The DIY method is a new hope for educational stakeholders during an era of increasing of technology.

In summary, learning appears to be in a state of in flux because of technology. Free-will in learning is likely to be a fashionable aspect of education – technology also enables learners to create academic circles for developing learning skills such as discovery, social collaboration, and so forth. With the style of free-will learning, two remarkable underpinnings are that learning happens for a specific purpose for a certain person and an awareness of information retrieval is considerably concerned. The expectation of scholars and researchers in using technology supported learning environments is to foster language learners to be either self-regulated learners or autonomous learners.

2.3 Theoretical Concept

The popularity of learning theory in the language class has been adjusted and established with respect to the mainstream school of thoughts involving technology and development. The advent of technology has led to the collapse of the behavioral approach in language learning situations. Trends of language teaching in many schools of thought have recently waxed and waned in popularity. Subsequently, the integration of technology-supported networks into language teaching has directed learners to gain insights into the real world from multiple sources.

With the ease of information retrieval, learners have arranged learning strategies to accomplish learning tasks and meet social requirements. Learners have become involved in a particular community, and at the same time, facts and information are

relatively accessible. Therefore, an intellectual ability to interpret meanings and generate understandings of the real world is really vital for those learners.

This current study primarily focuses on what language is sensible to those who interpret the real world with signs. Language, hence, is one of the signs representing a thing in a specific place at a glimpse of time. Following the citation established by Lian (2000), he remarks that the object in linguistic study is not language. His idea seems compatible with the use of a metaphor (Eaglestone & Glendinning, 2008) in Derrida's view. Thus, the concept of what learning is needs to be rethought (Lian & Pineda, 2014; Bi, 2014).

2.3.1 The Notion of Decision-Making

Prior to describing what decision-making is, this study endeavors to ascertain why the Internet users (EFL learners) make a decision to move from one point to another and what factors encourage them to do that. The action of choosing is in line with the postmodern perspective where ideas and justification are linked in a "one-size-fits all" system" (NZCER, 2009). A central idea of rhizome deals with multiplicity and non-hierarchical entry and exit points in data representation and interpretation. Therefore, the notion of decision making in this section will touch upon the plausibility of what rational reason can support.

Actually, we experience many situations that arouse us to make a decision several times a day. As there are so many decisions, people need to think about impacts such as cost, time, feelings, and relationship. Human decision, hence, can be described by integrating rational imperatives into emotion (Coricelli, Dolan, & Sirigu, 2007) that is, making a decision normally deals with intuitive thoughts or perceptions

and cognitive processes (Kahneman, 2013; Fletcher & Carruthers, 2011). For example, the feelings of knowing are grounded in metacognitive experience and are also based on unconsciousness, heuristics, and inferential processes, which could influence some biases and framings when facing risky situations (Efklides, 2005). Making a decision relates to not only human behavior but also human brain systems. Below are empirical studies in the field of psychology and neurosciences:

Psychologists such as Daniel Kahneman, Amos Tversky, and Steven Sloman agree that a two-system account for reasoning and deciding is acceptable. The dual-system modes of decision-making refer to type System 1 (henceforth type §1) which is known as the brain's fast and type System 2 (henceforth type §2) as the mind's slower (Kahneman, 2013; Fletcher & Carruthers, 2011). In other words, type §1 is unconsciousness-related but it might produce biases and systematic errors while type § 2 is rule-based, or under intentional control and guided by normative beliefs.

To clarify the dichotomy of the decision-making mode, Sloman (1996) provides characteristics of two forms of reasoning. Naturally, people rely on type §1 by default (Fletcher & Carruthers, 2011) to reach a decision as the primary source of knowledge is from experience. Gigerenzer and Regier (1996) argued that the justification is sometimes prone to sources of biases and mistakes when people could not associate themselves with correct generic concepts, images, and feature sets.

On the other hand, people make decisions by applying a number of processes such as strategic memory, visual imagery of potential action, and so on. The result of operating type §2 is probably a fallacy. Whenever these two modes work in harmony, impressions turn into beliefs (Sambandam, 2012).

Although the dual-system concept of decision-making has been accepted by those aforementioned psychologists, a particular system could not be isolated for

decision-making. Decision-making is a cobbled-together skill (Fletcher & Carruthers, 2011; Strle, 2012) including various metacognitive experiences (feelings of rightness and difficulty) and strategies such as self-management, planning, and reflection, and these strategies are accumulated and acquired by individual and cultural learning (Fletcher & Carruthers, 2011).

To interpret the dual-system in decision-making into language learning, a brief synthesis of the system can be elaborated as follows:

First, a starting point of the dual-system relates to the interplay between an associative aspect and normative counterpart. In other words, the relationship between cognitive procedure and metacognition plays a remarkable role in decision-making. When people faced with the needs to decide on a specific possibility, they tend to make a choice based on type §1 as it suggests an easy choice but not an optimum option for decision-making (Kanehman, 2013). Hence, the easy choice produces a feeling of pleasure; people are more likely to choose it (Gonzalez, Dana, Koshino, & Just, 2004). Then, the working harmony between an associative aspect and normative counterpart yields a benefit for confident judgements and error monitoring (Yeung & Summerfield, 2012). In a learning perspective, self-confidence is really important and that could motivate learners to approach trial-error treatments for fostering their problem-solving. Likewise, Etizioni (2006) claimed that "What most societal actors use as knowledge… include a mixture of facts and common sense, sciences and folklore, empirical observations, insights, and evaluations," (p.39, as cited in McWilliams, 2006).

Second, though type §1 leads people to behave voluntarily, it provides an immediate impression of many features of what you understand. People might select a choice in accordance with a familiarity with experiences. The availability of an

heuristic approach gives way to, "If you think of it, it must be important," (Kanehman, 2013). With regard to what underpins a learning situation, Burden (1998) also asserted that "The effect of our beliefs upon our actions has been considered with regard to the acquisition of thinking skills and strategies" (p.7). That is, the feeling of knowledge produced intuitively influences a learner's performance in choosing a possible solution for a specific situation.

Finally, type §1 is a mode of storytelling as it is really sensitive to the immediate situation, such as accidents or signs of danger. Type §1 could remain in sub-conscious as visual and audio experiences could trigger memories of an accident. Though the ability of making sense of type §1 is not as similar to type §2, those memories enable an individual to set an outline of the story as well as remind an individual of what happened in the past.

The dual system of making-decision reveals a systematic combination of metacognition and cognition in decision-making. Previous experiences are likely influential in selecting choices as the depiction of events has been embedded in a decision maker's intuition, and that could possibly justify decision-making and enhance its effectiveness.

Likewise, most people approach decision-making from previous experience or hindsight that enables understanding of what causes contextual knowledge related to decision-making. Simon (as cited in Humphreys and Jones, 2008), presented a linear process of decision-making, namely intelligence, design, and choice. Each process presents a step of cognitive development. Intelligence in particular indicates some conditions that trigger off a reaction to making a decision. Design emphasizes how a decision maker creates the optimum solutions for decision. Finally, the stage of choice presents how the decision maker selects a particular course of action from the

previous stage. Hence, the process of decision-making could be considered as a problem-solving. In addition, Nappelbaum (as cited in Humphreys & Jones, 2008) initiates the spiral vortex of the circular logic of choice (shown in Figure 2.3).
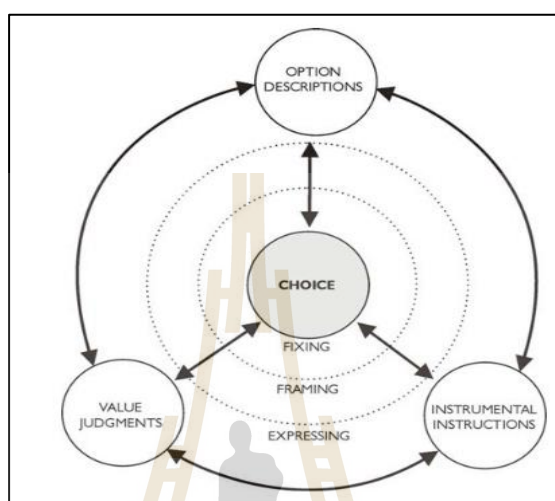
Figure 2.3: The circular logic of choice (Humphreys & Jones, 2008, 119)

The above figure presents information that the context of choice consists of three layers. The outset of decision-making is to understand what the problem is. To do so, the decision maker needs to find the solution from option description, value judgement, and instrumental instructions. Each layer of the core of choice represents the degree of reducing discretion. This figure would succeed in demonstrating how the decision-maker selects an optimal choice in decision-making in business and clinical treatment. Also, this idea would be suitable for use in language learning situations or even in this current study. When the learners identify the way to move to a different node, they need to realize which node of knowledge could be useful and analyze the discourse when undertaking a negotiation.

According to the rhizomatic approach, making a decision is one of the activities in developing problem-solving skills. Learning related to the rhizomatic

approach presents uncertainty to the class. Hence, making a decision with the rhizomatic approach is to be involved in a community by connecting the persons in that community. It could be anticipated that making a decision using the rhizomatic approach needs four elements to deal with it. The elements are people, a community, a connection and trial-error actions. Communicating with others might obtain a possible solution. Sometimes, the attempt to solve the problem ends in failure but an agreement amongst people in a group could bring a possibility at last. The agreement from others in the community is likely to be analyzed by those who have background and have experienced that problem before.

2.3.2 The Notion of Learning

–Concept of *Habitus*

Habitus, a sociological term developed by Bourdieu (1990), is defined as

> A system of durable, transposable dispositions, structured structure predisposed to function as structuring structures, that is, as principles which generate and organize practices and representations that can be objectively adapted to their outcomes without presupposing a conscious aiming at ends or an express mastery of the operations necessary in order to attain them (p.53).

The habitus is comprised of the internal dispositions, schema, and forms of know-how competency (Swartz, 2002). The internalized process is gradually developed by accumulating experiences from various situations in a society. Such experience enables a person to make choices when provoking a response from a society. Each person, of course, performs a different role according to one's disposition of habitus. The different performances are initiated by an internal drive

that leads the way for people to make sensible decisions and fosters those people readjust to the cognitive and motivating structures (Bourdieu, 1990). The cognitive process also suggests ways of thinking and leads those people to react against a normative rule that they have conform to. Likewise, the competency of know-how provides directions for people to negotiate or compromise social properties. In summary, the habitus is an embodiment of the internalized disposition and the accumulated understanding of past situations. Hence, it provides an opportunity for people to reproduce and to make sense of the world on the basis of one's personal history.

To interpret the habitus related to learning, the idea of habitus probably rejects behaviorism in terms of factors of behavior. Behavior, in respect of the habitus, is basically cultural and is motivated by past learning that is adaptive to external structure (Swartz, 2002) whereas behaviorism focuses on stimulus-response sequences. Furthermore, habitus enables learners to arrange their own learning path. That is, each learner experiences learning properties differently. Consequently, the learning outcomes are also different based on the learner's habitus, or personal experience. Presumably, although learners share a learning goal, the learning production is actually various. As the idea of DIY (do-it-yourself) (Lian & Pineda, 2014) describes how and when learning is acquired, learning happens when a learner can control an attainment in order to solve a specific problem. Simply, learning can be acquired everywhere, for example, The-Hole-In-the Wall launched by Sugata Mitra (Sugata Mitra & The Hole In the Wall - 2013 TED Prize winner, 2016) where learners can learn and experience the real world in favor of the learner's preference.

- Postmodern View of Education

With great changes in the world, the progressive replacement of local culture by telecommunication technology such as television and the high demand for new

technologies are examples of the impact of the postmodernist era (Cahoone, 2003);

the perception of education also swings away from one pole and toward another. A

number of influential thinkers and scholars, for example Jacques Derrida for

philosophical and literary methods, Michel Foucault for social and political thought,

and Fèlix Guattari as well as Gilles Deleuze for the provocative nomadology (ibid,

p.222), view knowledge differently. Knowledge is an individual verification and

incorporates collaborative learning experience into a personal knowledge creator

with a mutual learning goal (Cormier, 2007). It could be anticipated that an

individual's knowledge could not be shared as each person has a different realm of

knowledge. Knowledge, hence, in the postmodern perspective seems to be a

daunting challenge for educational stakeholders.

2.3.3 Metacognition and Cognitive Reflection

> And both that morning equally lay
> In leaves no step had trodden black.
> Oh, I kept the first for another day!
> Yet knowing how way leads on to way,
> I doubted if I should ever come back.
>
> ("*The Road Not Taken*"— Robert Frost)

The above stanza of "The Road Not Taken" by Frost directly reveals an easy

aphorism in human beings– reverberations are an opposite opportunity for people to

justify and make a decision. People sometimes hesitate to think what is behind in an

accretion of choice and chance. We often need to rely on our hindsight for

justification. In sum, making a decision almost always makes people's life meaningful.

Metacognition is an ability to apply prior knowledge to select an appropriate

strategy for tackling a problematic situation, justifying a decision and evaluating a

result of the action. John H. Flavell (1976) originally coined this term and provided a comprehensive definition of metacognition as "one's knowledge concerning one's own cognitive process and products or anything related to them, e.g., the learning-relevant properties of information or data" (p. 232, cited in Kaplan, Silver, Lavaque-Manty & Meizlish, 2013). Many scholars and researchers, later, simplified its definition and understood it as "cognition about cognition" or "thinking about thinking" (ibid, p.147; Lai, 2011). Metacognition mainly benefits learners in critical thinking development, for example, planning how to complete a task, monitoring others and oneself with comprehension, implementing suitable strategies, and evaluating progress of the task (TEAL, 2010), facilitating intelligent behavior (Kleitman & Stankov, 2007) and enabling learners to become successful in a learning pathway. Strategies directly influence cognitive control because they direct the way to select alternative choices to make a decision. Strategies, according to the view of Pressley, Forest-Pressley, Elliot-Faust, and Miller (1985, as cited in Borkowski, Chan & Muthukrishna, 2000), are defined as follows:

> [strategies]… are composed of cognitive operations over and above the processes that are a natural consequence of carrying out [a] task, ranging from one such operation to a sequence of interdependent operations. Strategies achieve cognitive purposes (e.g., memorizing) and are potentially conscious and controllable activities. (p.4)

Metacognitive knowledge and metacognitive experience are essentially important for metacognition as people manifold metacognition which probably leads them to being critical thinkers. Monitoring (Livingston, 1997; Oz, 2005), a cue-familiarity heuristic (Metcalfe, Schwartz, & Joaquim, 1993), and thinking management (Fletcher & Carruthers, 2012) dynamically operate people's brain while

undertaking a task of a decision-making. The monitoring component controls self-regulating and skills associated with the prefrontal cortex (Coutlee & Huettel, 2012; Fleming & Dolan, 2012) working in concert to control human personality. Researchers in the field of functional neuroscience as Coutlee and Huettel (2012) argue that decision-making requires controlled processes to select the possible actions. Along the same lines, those from educational psychology convincingly argue that monitoring one's cognition enables that learner to gain insights into individual experience and also to increase awareness of accuracy of a previous understanding. In other words, monitoring helps learners revisit relevant background knowledge in order to establish a connection between the previous and current understandings (Weil et al., 2013). According to both views about monitoring, it could be anticipated that monitoring is an essentially significant component of metacognition that encompasses multidimensional features of a cognitive capability.

Besides, the understanding of sign interpretation is an affective factor in decision-making. Metcalfe, Schwartz, and Joaquim (1993) posited that the cue-familiarity heuristic has an effect on perception and making judgement. Certainly, a heuristic commonly relates to an uncertain quality and its results deal with an approximation, and biases. Becoming familiar with the cues probably makes choices and chances for the justification reliable. Furthermore, the cue-familiarity heuristic could enhance the capacity of metacognition.

Particularly, metacognitive experience could foster people to find a possible solution to overcome hardships as we encounter uncertain situations at different times. In other words, the different hardships we experience trigger the metacognitive experiences (feeling-of-knowledge, feelings of rightness, feelings of difficulty, and lead us into cognitive control and strategy selection (Metcalfe, Schwartz, & Joaquim,

1993; Spehn & Reder, 2000; Strle, 2012). The feelings of knowledge and a production of monitoring one's cognition are significant elements of the metacognitive experience as that could direct a possible way of judgment.

As for clarifying a whole picture of how metacognitive operates in learning, the below diagram describes the metacognitive system, see Figure 2.4. This diagram was developed by Borowski, Chan, and Muthukrishna (2000), and it illustrates how metacognition develops in an individual's learning and suggests key elements of metacognition on the basis of learning experiences. These elements include 1) task— an query for learners to solve; 2) strategy use—the learner acquires knowledge how to undertake the task by using specific strategies; 3) performance— the learner bridge a gap between the task and strategy use by monitoring performance; 4) executive processes work as an indicator of strategy selection in accordance with the task; two notable results also emerge: (a) specific strategy knowledge appears as a result of a dynamic process of strategy use (Element 2) and performance (Element 3) and (b) the learner gains an understanding of self-regulation; 5) domain specific knowledge– the learner obtain insights into the importance of strategies being used; 6) personal-motivational states— the learner makes an effort to overcome a learning difficulty and also realizes that mental competencies could develop self-directed action; 7) feedback will be provided for idea adjustment; and 8) self-knowledge is really sufficient for solving problems.
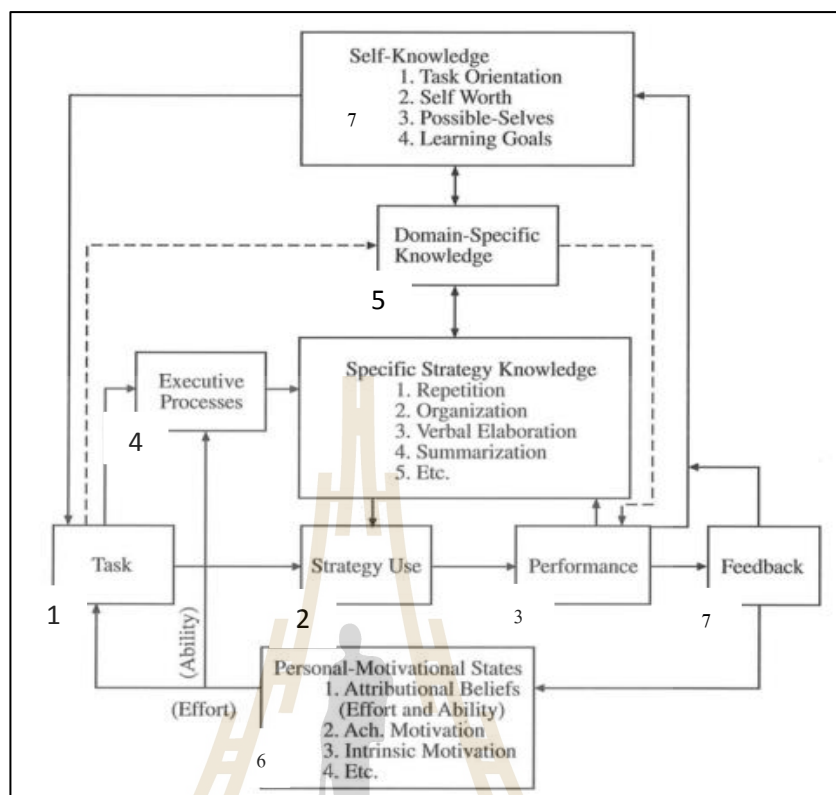
Figure 2.**4** Model of Metacognitive System (adapted from Borowski, Chan, and

Muthukrishna, 2000, p.10)

In summary, strategy use in this model is really important for metacognitive development as it develops the quality of self-regulated learner. Strategy deployment also encourages learners to reshape ideas and adjust learning styles to be suitable for specific strategy knowledge. Furthermore, mental competencies also play a remarkable role for seeking out new information for obtaining understanding of a real world.

2.3.4 Meaning-Making

The primary concern in this section is how people interpret the meaning from what they perceive differently regarding to postmodernism. The real world seems to be chaotic with different meanings of interpretation. Images, situations, messages and concepts compel people to interpret those signs of others with scientific and reasonable endeavor of communication. What factor makes the interpretation difficult is language. Language is considered as the most difficult to interpret or to convey a certain meaning (Bal,1994) as it appears as an abstract. One of the main figure in contemporary philosophy is Jacques Derrida (1930-2004) whose works help people gain insights into the philosophies of language, aesthetics, and phenomenology (Powell, 2006; Cahoone, 2002). Recently, Derrida elaborated more on the uncertainty of meaning with his concept of sign and significance (signify and signifier) (Fuery & Fuery, 2003).

In order to deal with how language learners interpret meanings, the assumptions of making meaning is shown that it seems complex to everyone to gain understanding because the feeling of understanding belongs to individuals depending on inferences and the ability of heuristics. In fact, people represent the act of understanding through negotiation and interaction with others (Lian, 2015). Also, perception does not indicate that they understand a whole chunk of conversation.

2.3.5 Brain and Decision-making

The interaction between mind and the brain can work seamlessly. People respond to implicit and explicit stimuli simultaneously because of the implicit processing of neurones. With respect to learning, the brain mediates in all learning processes. It is of no matter from where learners obtain knowledge or in what way

they experience a situation, the incoming information is assimilated into the learning process via the brain system. Hence, the input is probably a remarkable element in learning. The brain codes the incoming information differently depending on the properties of sensory signals, for example, visual property codes the orthographic information. The incoming information and exiting information are operated by neurones located in the frontal lobes.

More particularly, the frontal lobe works in orchestra with other cortical areas of the human brain and ascribes to the prefrontal cortex. It performs diverse functions relating to a variety of higher cognitive functions such as planning, decision-making, personal expression, and instinctual behavior (Buchbaum, 2004), while the lateral prefrontal cortex works in harmony to governs the domains of behavior, cognition and language during late maturity. The three domains work in association to govern the structures of movement that are different from what the prefrontal area works at during the stage of pre-maturity. Language development is a good example for describing the temporal integration of the cognitive domains (Fuster, 2002). The area of the prefrontal cortex plays a crucial role in cognitive control and in behavioral control.

In addition, the prefrontal cortex also serves as the important neurone substrates of working memory (Braver & Cohen, n.d.). Working memory operates the sensory information existing in the brain for goal-directed tasks and mental activities, such as language comprehension, thinking and reasoning (Baddeley, 1986). It becomes apparent that there are a number of studies in the field of cognitive neurone sciences and psychology concerning the positive relationship between the prefrontal cortices and working memory. Spatial-temporal information of the delay-

period activity produces a productive result for information storage (Fuster, 1997; Curtis, Zald, & Pardo, 2000; Curtis & D'Esposito, 2003; D'Esposito, Cooney, Gazzaley, Gibbs & Postle, 2006) whereas an accidental situation (a gambling task) impairs working memory capacity (Bechara, Damasio, Tranel, & Anderson, 1998). However, a conclusion cannot be drawn that the prefrontal cortices dissociate working memory. The gambling tasks represent the condition of gain and loss for decision-making. The impairment in selective attention was shown in the gambling task in order to fit human desire. Hence, working memory, in the fields of neurone science and psychology, is probably incompatible with making a decision without any delay.

2.4 Summary

In this chapter, three main topics have been reviewed. The personal learning environments describe the recent trend of language learning supported by technology. The essential components in decision-making consist of background of knowledge and making use of connections. The theoretical concept in this current study mostly relates to the rhizomatic approach that could be simply presented as the free will of learning.

CHAPTER 3

RESEARCH METHODOLOGY

The purpose of this chapter is to discuss implications of research design, based on essential elements of the study including rationale and background of the study, research objectives, and research questions. This section begins with the research design including participants, instruments, pedagogic consideration, and a description of the investigation. Next, research tools in this study include the personal learning environments (PLEs) of students, tag clouds, students' written diaries, the online information searching strategy (OISSI) questionnaire, observations, and a semi-structured interview. Finally, this chapter ends with a framework for data generation and data collection.

3.1 Research Design

Generally, a research design provides a comprehensive plan and procedures for dealing with data collection in a research project. Burn and Grove (2003) asserted that a research design was like a blueprint for conducting a study with maximum control over factors that might interfere with the validity of the findings. Similarly, Singh (2007) affirmed that research design was a plan, structure and strategy of investigation conceived, to obtain answers to research questions and to control variances. The study which the researcher drew upon here was conceived within a sequential transformative design (Cresswell, 2003). This framework is characterized by its aim to verify assumptions about trajectory identification in the PLEs rather than

generate theory, and by naturalistic rather than experimental research designs. From this perspective, knowledge is constructed and described scientifically. Also, the research design intends to achieve purposes of a project, and to answer a specific inquiry of the study. Specifically, this study started out to investigate characteristics of EFL students' decision-making processes in identifying their trajectory of Internet navigation. Queries related to personal information of the subject including gender, age, education, weekly online searching hours, and favourite search engines. To discover the answers to these questions, a questionnaire seemed to be a suitable form of information collection. The following inquiries sought critical factors influencing the learners to make a decision about the selected hyperlinks or trajectory identification in the PLEs, and to verify learners' assumptions about decision-making processes during PLE creation.

According to the first inquiry, the researcher intended to investigate factors influencing EFL learners into visit hyperlinks during their online searching and dealt with knowledgeable/ less knowledgeable persons. Paths of each learner's trajectory identification were obviously different due to learner diversity. Breen and Candlin (2001) argued that learners could reach particular learning objectives through diverse routes—similarly, Lian (2000) touched on "unpredictability" (p.47). Rethinking and reordering sequences of information retrieval were significantly important to learners in learning nowadays. Roughly, we attempted to observe and/ or keep records of what EFL learners actually did during online searching. As mentioned in Chapter 2, metacognition was comprised of thinking processes and decision-making procedures. Many scholars have attempted to collect data from learners' memories and cognitions (Flavell, 1979), as well as learners' behaviour based on an individual's own accounts

by using questionnaires, interviews (Veenman, Van Hout-Wolters, & Afflerbach, 2006), observation and think aloud protocols (Sandí-Urena, 2008). However, Scott (2008) claimed that think aloud protocols might not work well in a particular situation such as online class situations or in lab conditions because learners could not fully concentrate on tasks while a researcher was collecting his/her data. Therefore, qualitative data (interviews, and observation) and numeric information (questionnaires) were useful to measure learners' metacognition.

Furthermore, learners' PLEs were also considered as an artefact of qualitative data. Why were the PLEs important to this study? The PLEs were like a map that showed how learners thought while making online information searches or understanding new knowledge. Also, they were understood to produce a more concrete representation of learners' decision-making processes. Powell (2010) argued that mapping was a visual medium and it was worth using for evoking ideas and thoughts. Maps are powerful means of rendering elusive forms of individuals' experiences. Likewise, Mitshell (2005) remarked that visual media provide metaphoric information. They enable readers (learners) to develop thinking about particular concepts. To make sense of the real world, Powell (2010) viewed that using mapping in association with using written data while making the map was more meaningful rather than using it alone.

In respect to the second inquiry, verifying assumptions about decision-making processes during PLE creation was also focused. Assumptions of making a decision in language learning in this current study were emerged from qualitative analysis.

To achieve the objectives of this study, data analysis was presented in multi-dimensional forms. This led to a discussion of mixed-methods procedures.

- Mixed-methods perspective

Mixed-methods research is an approach to theory and practice that works in association with multiple viewpoints of both qualitative and quantitative aspects. Mixed research contains philosophical assumptions and methods of inquiry. The philosophical assumptions guide the directions of data collection and data analysis from both quantitative and qualitative methods in a single study (Creswell, 2003). Likewise, Strang et al. (2006) posited that mixed methods or multi-methodology entailed quantitative and qualitative approaches in order to generate new knowledge and could include either concurrent or sequential uses of these two classes of methods to follow a line of inquiry. Again, Creswell (2011) incorporated many diverse viewpoints and suggested that the researcher in mixed methods

> "gathers and analyses both qualitative and quantitative data thoroughly; integrated the two forms of data by merging them, embedding one form of the data within the other; gave priority to one or both a single study or in multiple phases of a programme of study; frames these procedures within philosophical worldviews and theoretical lenses; and combined the procedures into specific research designs that direct the plan for conducting the study" (p. 5).

The above mixed method processes were a primary concern to gather and analyse data from two different research paradigms. Quantitative data revealed evidence of numeric information while qualitative ones explore in-depth details of phenomena in a particular situation.

With respect to research paradigms, a mixed-methods approach embraces the concept of pragmatism. Johnson and Onwuegbuzie (as cited in Teddlie & Tashakkori, 2009) asserted that pragmatism revealed workable solutions between post-positivism

(deductive logic or reasoning) and constructionism (inductive logic or reasoning). Knowledge in pragmatism could be both constructed and based on the reality of the real world—observation, experiments, and experiences were useful methodology to obtain insightful information of people and the real world. It could be argued that a mixed-methods approach integrates outstanding features of both deductive and inductive reasoning by using both qualitative and quantitative methods in order to develop causal explanations, understand complex phenomena, and make predictions.

Furthermore, Maxwell (as cited in Teddlie & Tashakkori, 2009) viewed that a mixed-methods approach was applicable to increase validity. He argued that obtaining qualitative data for causal explanations was not easy. Quantitative methods in this aspect could help deal with plausible interpretations of any proposed causal explanation. Similarly, as Teddlie and Tashakkori (2009) cited Richardson and St.Pierre, a mixed-methods approach was also workable to explain complex phenomena. Qualitative methods were used to interpret historical and ongoing phenomena while their quantitative counterparts were used to keep records of frequencies. To make predictions, typically quantitative methods were involved in prediction of important criterion variables in nature. Teddlie and Tashakkori (2009) argued that qualitative techniques such as interviews were also appropriate to make predictions.

The previous explanation showed a few perspectives and arguments of how a mixed-methods approach can be used for conducting research in social and behavioural sciences. A mixed-methods approach also ensures that gaps of information were filled because inquiries have been found from many perspectives.

- Mixed-method strategy implementation

As mentioned earlier, the initial intent of the researcher was to see a wide range of how participants experienced digital information retrieval and knowledge discovery under investigation. A questionnaire was used to collect the participants' information in terms of personal data, and online information search strategies. Subsequently, in order to strengthen evidence of participants' decision-making processes, qualitative data was collected by interviews and observation. Therefore, data of both quantitative and qualitative methods were taken to mix at the stages of data analysis and interpretation. An array of qualitative data such as themes and codes were transformed into descriptive information and interpreted. The research design of the current study, hence, was described as a sequential transformative design (see also Figure 3.1). Cresswell (2003) elaborated four critical factors of mixed methods—vision, advocacy, ideology, and framework.

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Quantitative ——→ Qualitative

Vision, Advocacy, Ideology, Framework
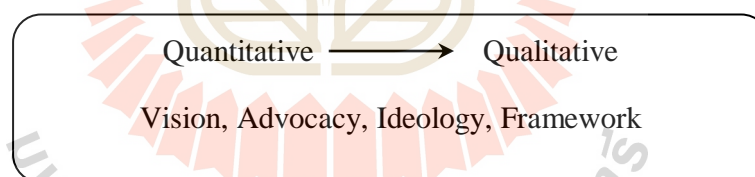
Figure 3.1 Sequential Transformative Design (Cresswell, 2003, p.213)

The implementation sequence of the quantitative and qualitative data was that the data was collected in phases. The quantitative data were collected first. The reason was to explore some relevant topics from the participants in the research site. Then, the qualitative data were collected in order to elaborate on circumstances in the group of the participants. This way, the researcher obtained a whole picture (vision) of the subjects.

Priority of data analysis in mixed methods occurred and led a researcher to extend treatments of data and made use of a theory to support a research framework. The researcher's intention, inspiration and the group of research audience (faculty committee and professional association) (Cresswell, 2003) were critical keys for advocacy.

Integration of quantitative and qualitative data involved transforming survey (close-ended questions) results with interview (open-ended) results on a study or vice versa. Consequently, data interpretation section showed mixing stages of the research procedure (i.e., transforming themes (qualitative approach) into headings of quantitative approach). A theoretical perspective or a framework guided the researcher and audience of the study in the research design.

3.1.1 Participants

The research participants, conducted during the 2017 academic year, in this study were 4th year English majors from the Faculty of Humanities and Social Sciences, Songkhla Rajabhat University (SKRU), which is the researcher's workplace. All participants (n = 69) were students in a first semester English course (intermediate level). The students used English as a foreign language and had an average experience (6 terms within 3 semesters) of English language learning on tertiary level. They were enrolled in *Independent English Studies* (1554960). This course is a compulsory course for 4th year English learners. The distribution of the participants is shown in Table 3.1. The table shows the profile of the participants.

Table 3.1 A Profile of the participants **(**n = 69**)**

Gender		Age			Weekly online searching hours			
Female	*Male*	17-19	20-22	23 & up	1-3	4-6	7-10	more than 10
55	14	-	59	10	16	24	13	16
Total = 69								

The above table (Table 3.1) provides basic information of the participants. In terms of gender. Female participants (n = 55) significantly outnumbered than male counterparts (n = 14). The range of age was between twenty and twenty-two years old. A majority of the participants spent time from four to six hours per week searching online. The most favourite search engine amongst the participants was Google.

Sampling focused on those learners who dealt with online searching and personal negotiation. Sampling was performed using the following two specific qualifications 1) EFL learners must be enrolled in *Independent English Studies;* and 2) Learners are English majors from the Faculty of Humanity and Social Sciences, SKRU. Hence, in the first phase of the study was assigned the online information search strategies (OISS) questionnaire to 69 English majors.

Regarding the second phase, a semi-structured interview and observation provided the qualitative data collection methods. Purposive sampling was used for observation due to the aim of the research in terms of time, and events. Consequently, ten of the participants were invited to the semi-structured interview. Multimethods in qualitative approach provide combination of data collection procedure. The followings show reasons to deal with visual data.

1) The PLEs (mind maps) were collected and analyse each stop of participants' preferences. In doing so, the participants recorded their online searching behaviour by making use of a screen record software application provided by the university (SKRU). Then, the clips from the screen record were uploaded in the researcher's channel on YouTube. All clips were set in the privacy of the researcher's channel due to ethical considerations.

2) Labels, and tag clouds (Pineda, 2013) were applicable to examine what were the participants' interests during online retrieval and who the participants dealt with.

To clarify the whole sampling picture of the current study, the following figure (Figure 3.2) shows how sampling in both qualitative and quantitative methods work.
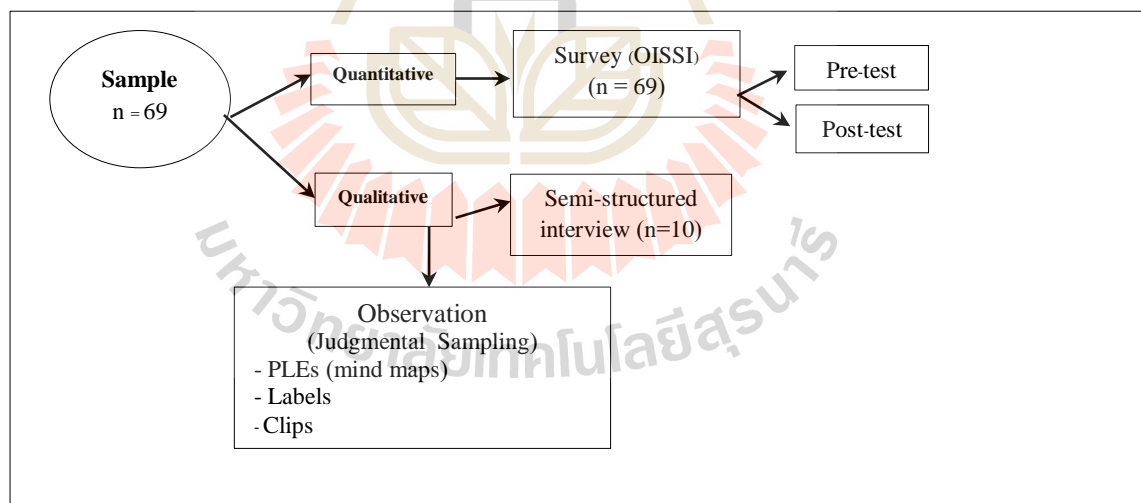

Figure 3.2 A sample frame

3.1.2 Variables

The purpose of this two-phase, sequential mixed methods study was to investigated participants' views. The intent of using this information was to obtain

quantitative results from a sample and then follow up with a few individuals to probe those results in more depth. The first phase was a quantitative investigation of online information search strategies by collecting scores of online searching strategies from 69 English majors. In the second phase, qualitative interviews and observations were used to explore aspects of EFL learners' decision-making processes in trajectory identification. Thus, according to the objectives and research questions of the current study, the independent variable was (a) EFL learners' decision-making ability, and (b) EFL learners' ability at PLE creation. The dependent variable was student's output in a form of a macro-task, and their perceptions of PLE creation.

3.2 Pedagogical Procedures

Teaching and learning activities were discussed in order to provide an overall picture of what participants needed to achieve at the end of the course and during the conduct of this study. At the beginning of class activities, the concepts of a rhizomatic approach and decision-making processes were fully considered. Sequences of pedagogic activities were divided into two phases—inside-class activities and self-study activities. However, the current study emphasized outside class activities rather than monitoring EFL learners in class. With respect to EFL learners' priorities, learning activities followed the flow of lessons and teachers' teaching plan (see also Appendix D). The researcher observed what trajectory identification was revealed during EFL learners' navigation of the Internet and/ or during any personal negotiation of pathways though the learning system.

- Classroom activity (inside class)

Activities in class almost always flowed from the teaching plan. One of the learning objectives was to *evaluate information on electronic databases and the*

Internet and present work using electronic networks. Assignments (weekly progress report), a project report, and a project presentation (weeks 15-16) were learning outcomes. The topics were considered as shared-learning goals. Some considerations were 1) understanding /knowledge cannot be shared with or absorbed by other people's heads (Lian & Pineda, 2015); and 2) people perceive meanings differently. Therefore, the participants needed to be equipped with Internet-based skill, and information retrieval skills. There were three steps in this session.

Step 1: Students were asked to pool ideas related to search engines and search directories, software applications, multimedia databases (institution-provided), social networks, hyperlinks in the cloud drive, and a name list of English language experts and non-experts. In response to learning needs, all these sources could widen learners' views about online and offline language resources. Collaborative activities in learning are motivated by social constructivism (Järvela & Jäevenoja, 2011; van Harmelen, 2006). Discussion is an example of collaborative activities because it could foster active individual knowledge construction (Schellens & Valcke, 2005).

The learners were expected to use Google Classroom at the beginning of the course because they had been trained to use Google Classroom since the 2015 academic year. The Google classroom was used as a hub for feedback from the course advisor as well as of a discussion board amongst the participants.

Step 2: Students and teacher shared an understanding of how to use technology applications. The sharing of ideas elicited ways of using technology and provided a chance for the participants to evaluate language tools on the Internet.

Step 3: In order to keep a record of where students had navigated, students were asked to record a screen capture and sent files to the researcher. Probably, prior

to moving to *Step 3*, the researcher (the researcher was not involved in teaching) distributed a consent form to the participants. In the meantime the researcher informed them of the objectives of the study and allowed them to spend (approximately 5 minutes) to finish completing the consent form.

Three steps of in-class activities were considered to be the scaffolding because it was difficult for learners to undertake this task without any introduction. At the same time making use of visuals could enhance language learning system. Bamford (2003) argues that visual literacy is necessary to help understand meanings of what others are trying to convey and raise more meaningful outcomes of communication.

It was anticipated that these three steps might not be fixed in order. Learners were free to search online information, make face-to-face discussion, and create a PLE mapping.

- Self-study activity

Self-study was described as outside-class activities. This course (*Independent English Studies*) provided 6 hours per week for learners to undertake self-study tasks in both a language lab and at home. E-Journal databases, librarians, and language experts were well-prepared to serve EFL learners' needs. This assisted learners to be self-directed and autonomous.

3.3 Research Instruments

Data collection inevitably entailed making use of different research instruments. In this case, these consisted of online information searching strategy inventory (OISSI), and student's semi-structured interviews.

3.3.1 Online Information Searching Strategy Inventory (OISSI)

The OISSI as developed by Tsai (2009) contains 25 items covering three domains—behavioural, procedural, and metacognitive. The behavioural domain describes basic skills in Internet navigation. The procedural domain involves a content searching skill. The metacognitive domain concerns self-monitoring and judgment of information retrieved from the Internet. However, question items used in this current study were all adaptations of Tsai's (2009) framework. A majority of items aimed at seeking to identify factors influencing EFL learners to make decisions about their trajectory identification. The 25-item test was evaluated by five experts in the field of English language teaching with the use of the test quality and the index of the Item-Objective Congruence (IOC) forms. It was found that the OISSI (adapted version) with IOC analysis was between 0.5-1.0, while test items with an IOC lower than 0.5 must be revised (Tuangsujarittam & Intrasai, 2014). So, all items of OISSI (adapted version) were deemed acceptable. Test items for each IOC level are presented in Appendix B.

Experts in IOC analysis were invited to examine the relevance of the objectives of the current study and the inquiries of the questionnaire. There were five of them from different institutions and each had more than 5 years of experience in using technology in the classroom. They were considered professional IOC raters. Four of them were Thai and the other was a foreign teacher.

The OISSI instrument consisted of two parts. The first part was about personal information including gender, age, education, faculty, years of studying English, weekly online searching hours, and favourite search engines. With respect to gender, some studies relating to online information searching mentioned that gender

differences might influence online searching (Tsai, 2009; Li & Kirkup, 2007). Moreover, age, education, and faculty were the basic information to collect details of individuals that might bring new variables to the current study. According to Tsai (2009), the information about years of English study and online searching strategies showed a positive relationship. That is, more experience in searching information online might yield better searching strategies on the Internet. The last information was the favourite search engine. The favourite search engine provided some details about making use of keywords for searching, which was useful in determining what users thought as they retrieved information online.

The second part of the OISSI instrument had 25 items including the perceptions of online searching strategies. The 25-item questionnaire was on a scale 1-5, going from "not at all like me" to "very much like me", presented as follows: 1 = not at all like me, 2 = not much like me, 3 = neutral, 4 = somewhat like me, and 5 = very much like me. These scale descriptions were also adopted from Tsai (2009).

The OISSI questionnaire was administered in 2 phases. The first phase was used in order to collect preliminary information of the participants. The second phase with the same instrument was for investigating the participants' development in searching online information. The results of the second phase yielded insightful information of searching online strategies.

3.3.2 Students' Semi-Structured Interview

To obtain insights into the myriad factors that create a range of decision-making, semi-structured interviews provided rich and detailed information that allowed the researcher to gain insights into the participants 'thought.

The semi-structured interview was conducted within the first half of the first semester. In order to explore a wide range of views and provide a comprehensive portrait of responses to online information searching, all interview questions were subjected to IOC analysis by five experts in order to make sure that all questions were relevant to the objectives of this study. The findings of the IOC analysis showed that question number (9) should be deleted as it was likely to be irrelevant to the objectives of the study and it also repeated other interview questions. The total number of questions used in the semi-structured interview was twelve (see also Appendix C). All questions in the semi-structured interview were translated into Thai because it would be convenient to respondents. Time allocation for the semi-structured interview was about twenty minutes.

However, sample sizes in qualitative studies were still controversial amongst scholars (e.g., Creswell (2003), Morse (1994), Green & Thorogood (2004)), because reaching saturation in qualitative research possibly depended on time, budget, and study approaches (ethnography, case study projects, grounded theory studies, and so on). This proportion of interviewees (n = 10) seemed adequate and sufficient to draw a broad inference from particular observations. Furthermore, a small case was more manageable for phenomena that generally appeared once. Therefore, there were ten interviewees for this study. Purposive sampling was used to select the interviewees. The decision to use purposive sampling was to ensure that all participants had a chance to be observed.

3.3.3 PLEs (mind maps)

As the term PLE seemed strange to the participants of this study, "a mind map" was the term used to introduce the concept of PLE. The mind map

couldn't be like a diagram or a flow chart. The mind map was initially created instead of the PLE.

3.3.4 Learning Materials and Sources of the PLEs

This study was undertaken within the structure of the course entitled *Independent English Studies*. The academic resources included in *Independent English Studies* (1554609) were Google classroom and e-journal database. The main objective of these resources was to share information, assign work and projects, as well as improve English communication and negotiation.

3.3.5 Screen Capture Software

Screen capture software was used to observe the participants' online searching behaviour. The outcome of using the software application provided useful information about how the participants made decisions during Internet navigation. For example, keywords, phrases, as well as social networking services were shown. This study made use of the software application provided by Songkhla Rajabhat University (SKRU).

In sum, the current study used a sequential mixed-methods approach. It aimed to analyse reasons why the EFL learners generated their trajectories or established connections of stories depicted as a rhizomatic illustration found in the personal learning environments. Participants (n=69) were from the Faculty of Humanities and Social Sciences, SKRU. To clarify the whole process of this study, the flow chart below (Figure 3.3) describes the conceptual framework of this project.
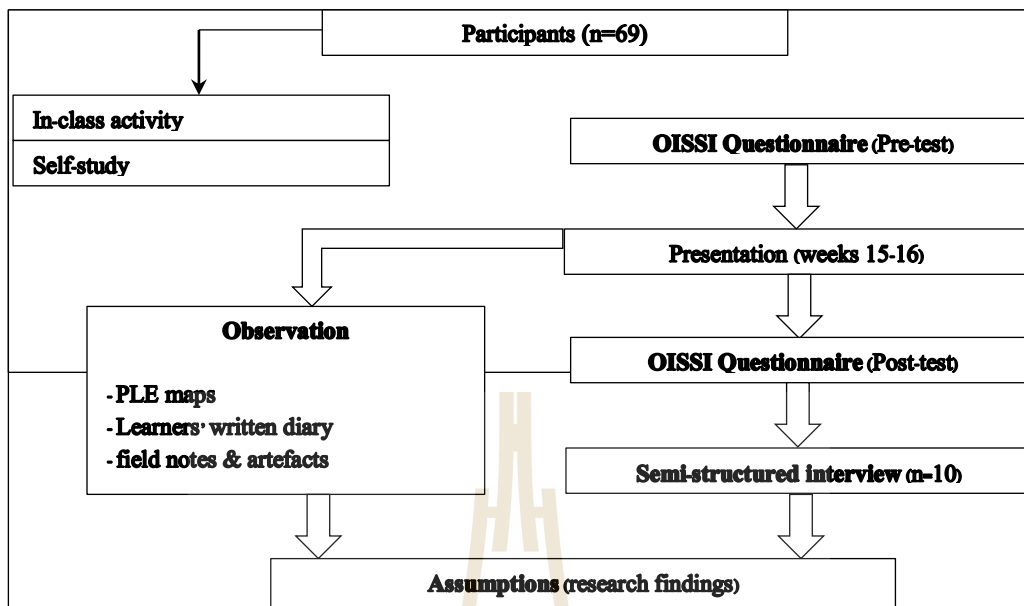
Figure 3.3 Conceptual Framework

Figure 3.3 shows the conceptual framework of the current study. To achieve the objectives of the study, time allocation was important to elaborate because it affected both research findings and EFL learners' achievement. Each semester at SKRU covers 16 weeks—14 weeks for learning and teaching activities and 2 weeks for midterm and final test.

With regard to the teaching schedule, the researcher collected qualitative and quantitative data twice with the participants. The OISSI questionnaire was administered twice: the pre-test (week 2) and the post-test (week 9). The first session of class observation was on July 5th, 2017; this was the first week of the semester. The PLEs were recorded and uploaded on YouTube. The size of each clip was so large that it was difficult to revisit it. Hence, unlimited space of a channel in YouTube was suitable for keeping several clips from the participants. Then, the participants (n=10) were invited to semi-structured interviews in weeks 5, 6, 10, 11, 12 and 14. Time allocation of searching behaviour of each participant was approximately 30-40 minutes.

In order to answer research questions qualitatively, judgmental sampling was used to collect PLE maps and other artefacts. Marshall (1996) argued that judgmental sampling was appropriate and the most common sampling technique in qualitative research.

3.4 Data Collection Procedure

Data in the current study were gathered and collected in order to answer the research questions—1) How do EFL learners make decisions pertaining to the construction of their PLEs? and; 2) Are there any significant factors that influence EFL learners' decision-making processes as they navigate the Internet or approach other resources for learning as they construct their PLEs? What are these factors? To find the answers to these two research questions, the following shows how the data were gathered and analysed.

3.4.1 Analysis of students' online searching processes: Quantitative data analysis (pre-test and post-test)

Personal data obtained from the first part of the OISSI questionnaire was firstly coded into numeric information and treated to produce preliminary findings of survey results. Frequencies were commonly used to count up numbers of the responses in the levels of a nominal scale. Raw frequencies were converted and presented in a brief detail of the participants.

The second part contained 25 items that yielded to count up numbers of the responses. To enhance the presentation of the data, valid numbers of counting were presented as a bar chart and a histogram. The bar chart was used to compare overall scores between the pretest and the posttest. The pretest scores were presented by using

a red bar while the posttest was a blue bar. In examining the overall movement of respondents opinions, the histogram displayed a trend of respondents' opinions which related to changes of online behaviour between the pretest and the posttest.

3.4.2 Analysis of significant factors in identifying trajectories of learning procedure: Qualitative data analysis

Qualitative data were collected from a semi-structured interview, students' written diaries, and video clips. As mentioned above, some questions in the semi-structured interview were treated as quantitative data while the rest of them—question items 3, 4, 5, 6, 10, 11, and 12—were qualitatively analysed using a thematic analysis method.

a) Field Notes

Field notes were also used in order to analyse visual information of what was observed. In order to gain insights into trajectory identification, the researcher needed to play her role as both a participant and an observer. All actions in students' online searches were recorded as field notes and clips that were uploaded on the researcher's channel on YouTube. A software application for screen capture was provided by the campus that is the researcher's work place. The participants were asked to capture all actions done during Internet navigation. In the meantime, all actions in class were observed and jotted down. After that, data from the screen capture were uploaded into the researcher's channel on YouTube.

b) Students' Written Diaries

A written diary is one of the most important introspective tools in second language learning research (Nunan, 1992). Students' descriptions could be kept as a growing body of literature about classroom activities, thoughts and opinions towards

learning and teaching, as well as some salient situations. Importantly, diaries encourage learners to keep records of what they have obtained in class, provide productive discussion amongst peers, promote negotiation development between teacher and learner, and illustrate a first person point of view in learning situations (Curtis & Bailey, *n.d.*). That is, students' written diaries provide insightful information to learners, teachers, and researchers.

To make students' thoughts visible in identifying trajectories on PLEs, the participants were required to complete open-ended questions in the form of student's written diaries every week. Students' written diaries were really useful for keeping track of activities and work progression toward teaching the learning activities (Ortlipp, 2008). The participants were asked to write their reflections in Thai so that they could provide their experiences and expressed their reflections thoroughly. The written diary of each week should be as long as possible. Entries in the written diaries commonly focused on significant activities or working progress that described work styles, and problems during inside- and outside-class tasks. The following were a guideline and provided the participants with opportunities for discussion (1) What were your major sources of online search today? (2) Why did you visit these URLs/ hyperlinks? (3) Did these URLs/ hyperlinks provide exact information for your search? If not, why not? ; How did you solve this problem? (4) What was your expectation of your searching today? And, (5) How was your work progression today?

To analyse qualitative information, raw data from 10 interviewees, field notes, and students' written diaries were coded line-by-line and measured by the researcher, 10 informants and the experts. The coded data from these sources were summarized.

Then, the informants were invited in order to examine their interview in a translated version (English). If data in English version were distorted, the informants could adjust it immediately. Subsequently, a set of interview data was systematically recorded by using a software application called qualitative data analysis (QDA).

Consequently, the themes were identified. Although thematic analysis is theory-free, Braun and Clark (2006) claimed that thematic analysis provides flexible and rich details. The six processes of thematic analysis (Clark & Braun, 2006, 2013) are elaborated as follows:

- Familiarizing data

Transcription of data was collected by interviews and field notes. Rereading through entire data, reviewing notes, generating possible patterns of words or chunks of data and writing down initial ideas were essentially important to gain some insights into collected data (Braun & Clark, 2006).

Regarding this study, interview information, field notes, and students' written diaries were read and reread by the research, informants, and experts. Each party worked individually and sent them back to the researcher. Subsequently, information was recorded by using QDA software application. The experts revisited the data in QDA file.

- Generating initial codes

Punch (2005) defined *codes* as *tags, names or labels* (p.199). Pieces of codes might be individual words, small or large chunks of data. Glaser and Strauss (as cited in Punch, 2009) argued that descriptive codes were necessary as a first stage of coding because descriptive codes provided a wide range of information during interviews, or conceptual topics developed by the researcher. The researcher could organize his/her

data into categories. Braun and Clark (2013) suggested three pieces of key advices—

(1) coded for as many patterns as possible because some data might be interesting

later; (2) coded extracts of data inclusively; and (3) individual extracts of data could

be coded several times. Little surrounding data should be recorded because it might

reveal some prominent themes later. It was necessarily important to retain accounts

which departed from the key issue of the analysis.

Regarding the current study, each sentence of qualitative data was reread and

coded by using different colours. For example, a sentence containing "visit Google"

was coded as *Google*. Another example showed that three initial phrases are "search

more information", "used a different word search", and "changed many keywords".

These three phrases conveyed relevant meanings to each other. The following

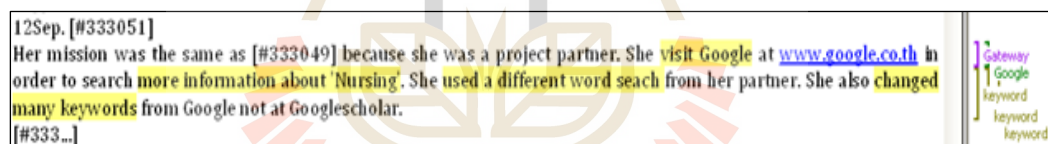example is used to clarify the whole picture of the generating initial codes procedure.

Figure 3.4 An example of generating initial codes procedure

- Searching for themes

Theme analysis at this stage is looking at the relationship between codes,

between initial themes and between different levels of themes—main theme and sub-

themes (Braun & Clark, 2013). Inferential themes might emerge after all data have

been collated. At this point a collection of predominant themes of data is refocused,

refined and combined.

Regarding the current study, sentences containing relevant information were

reread and grouped together. As shown in the previous example (Figure 3.4), three

phrases--"search more information", "used a different word search", and "changed many keywords"--seemed relevant to each other. Consequently, these phrases were collated and identified a code. Its code was *keyword*, for instance.

- Reviewing themes

Code extracts and full-text data are checked. The researcher could collapse two themes together or split a theme into two or more themes or discard candidate themes or begin to develop new themes. Thomas and Harden (2007) argued that this stage was the most difficult to do because it depends on the researcher's judgment. Themes should have a clear distinction. Braun and Clark (2013) also claimed that defining themes involved two levels. On a first level, a researcher needed to review all levels of coded data extracts. Collated extracts for each theme appeared to form a coherent pattern. And on a second level, the researcher considered the validity of individual themes.

In respect of the current study, main themes were examined by the researcher and the experts. All collated extracts of main themes were considered. Relevant candidate themes were grouped together while irrelevant themes were excluded. Labels of each theme were established by an agreement between the researcher and the experts.

- Defining and naming themes

The name of a theme depends on the researcher's interpretation and narrates details to readers. The essence of each theme is to construct a concise name. Define and refine themes, according to Braun and Clark (2013), refers to identifying what aspect of each data in each theme is captured.

c) Video clips

Screen capture software application was used to keep records of participants'
bahaviour during Internet navigation. The participants sent MP4 files after they
finished working online of each session. Subsequently, all MP4 files were uploaded to
the researcher's channel on YouTube.

The clips were collected as many as the participants could do. In the end, there
were 16 clips on the researcher's channel. The length of each clip was approximately
an hour and twenty minutes on average.

The collected clips were revisited several times. In order to make the
respondent's search behaviour visible, a mind map (PLE) was drawn by hand as well
as by using a mind map generator software application. In the meantime, the software
named "MindMaple" was deployed. Subsequently, mind maps were sent to the
experts, the participants, and the researcher to re-examine. In doing so, each clip was
replayed and checked any stop of the respondents' preferences on the mind maps.

3.5 Data Collection

The following table (Table 3.5) presents a summary of research questions and
research instruments.

Table 3.5 A summary of research questions and research instruments

Research questions	Research instruments
1. How do EFL learners make decisions pertaining to the construction of their PLEs?	- OISSI questionnaire (the pretest and the posttest)
2. Are there any significant factors that influence EFL learners' decision-making processes as they navigate the Internet or approach other resources for learning as they construct their PLEs? What are these factors?	- semi-structured interviews - students' written diaries - students' PLEs (mind maps) - field notes - participants' video clips (YouTube)

3.6 Trustworthiness

This current study employed several strategies to help ensure that it had credibility and was rigorous. Three strategies were used namely being there, triangulation, and participation validation (member check), respectively (Heigham, 2011).

- *Being there*: this current study was conducted and observed at the research site for seven months (from March to October). Prior to conducting this current study, all participants were observed in various settings, and speaking with a range of people. The participants gradually developed a good relationship with the researcher. Very often, the participants spent a whole day with the researcher.

- *Triangulation*: a variety of data was obtained. To clarify the implementation, the behaviour repertoire was taken from observation, and investigation. Furthermore, clips, student's written diaries, and interview descriptions were useful repertoire that helped the researcher seek to understand the phenomena.

- *Participant validation*: the emerging findings were sent back to the participants in order to elaborate and explain the desired meanings.

3.7 Ethical issues

Since the participants were required to record their screen capture during the Internet navigation, Personal information and live chats were revealed. Prior to collecting research data, a consent form was sent to the participants. Furthermore, privacy and confidentiality were considered. For example, clips of a screen capture

were uploaded on YouTube and the privacy option was set as *only me*. The participant's names were coded and used anonymously.

3.8 Summary

This chapter discussed the research methodology employed in this current study. This study used a mixed-method research design. A quantitative approach was used in order to investigate the participants' ways of searching online information. The OISSI questionnaire was administered twice (the pretest and the posttest). Qualitative information was gathered from semi-structured interviews, students' written diaries, observations, and artefacts. The next chapter provides data analysis of both quantitative and qualitative approaches.
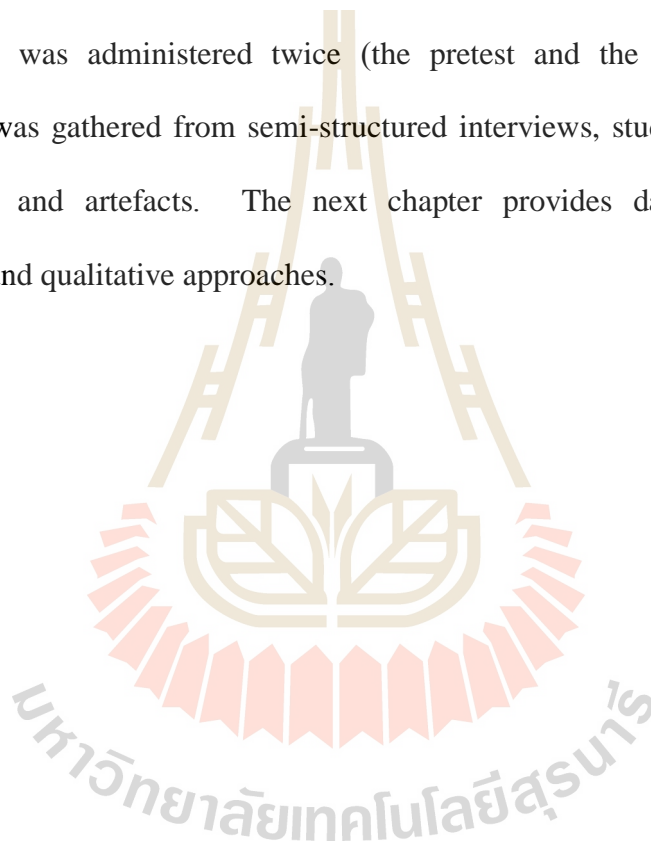
CHAPTER 4

DATA ANALYSIS

4.1 Introduction

This chapter aims at presenting the findings of this current study in response to the research questions postulated in chapter 1. The results were generated from the data collection in both quantitative and qualitative approaches of the main study. This chapter will end with ethical considerations and a summary.

4.2 Findings

4.2.1 <u>Research Questions 1</u>: How do EFL learners make decisions pertaining to the construction of their personal learning environments (PLEs)?

This research question primarily intended to examine online search strategies of the participants. Each category contains items that indicated specific strategies of online information retrieval. To measure the development of the Internet navigation, they were required to respond to the questionnaire (OISSI) twice as a pretest and as a posttest. The mean scores of both the pretest and the posttest were statistically compared to examine whether or not the participants performed to their capacity.

Table 4.2 The average scores of the pretest and the posttest

Category	Item	$\bar{x}$ Pre	Level of perception*	$\bar{x}$ Post	Level of perception*
Trial & Error	-I try some possible entrance websites when I cannot find enough information.	3.70	High	3.68	High
	-I try other databases when I cannot get any enough information in one database.	3.77	High	3.65	High
	-I try some other search engines when my search is not successful.	3.64	High	3.67	High
Select Main Idea	-I usually think about what keywords I can use in advance	3.49	High	3.86	High
	-I select main ideas provided on each webpage as possible as I can.	3.71	High	3.77	High
	-I look through titles or hyperlinks in a web in order to find each major information.	3.35	High	3.58	High
Evaluation	-I think of how to present and organize the data that I have obtained from the website.	3.38	High	3.55	High
	-I keep on evaluating the relationship amongst the information searched from the website.	3.26	Moderate	3.49	High
	- I compare information that has been gathered and collected from different websites.	3.74	High	3.93	High
	-I decide if the information provided in a website is notable for reference.	3.88	High	4.01	High

Table 4.2 The average scores of the pretest and the posttest (Cont.)

Category	Item	$\bar{x}$ Pre	Level of perception*	$\bar{x}$ Post	Level of perception*
Purposeful Thinking	-I usually understand the goals of information retrieval before starting my online searching.	3.64	High	3.97	High
	-I keep on reminding myself of the purpose for searching online. -I think of how to utilize the searched information. -	3.75	High	4.09	High
	Sometimes, I pause to think about what information is still lacking.	3.42	High	3.80	High
		3.55	High	3.75	High
Problem Solving	-I usually give up searching when I come up with an unsolved problem.	2.96	Moderate	3.14	Moderate
	- I think of some resolutions when I am frustrated with searching problems.	3.46	High	3.52	High
	-I do my best to resolve any problem occurring during a search.	4.06	High	4.07	High

In order to answer the first research question, it is necessary to clarify the items of each selected subscale. These are Trial & Error, Select Main Idea, Evaluation, Purposeful Thinking, and Problem Solving respectively. The arithmetic average of each subscale in both the pretest and the posttest were presented in Table 4.2.

As can be seen in the Table 4.2, the average scores of the pretest and the posttest were not much different. The range of levels of perception indicated a high level of performing the online strategies. Notably, an item of online search strategy used-- "*I keep on evaluating the relationship amongst the information searched from the website*"--in the Evaluation Category showed a high level of perception (see also Figure 4.1). The narrow range of the average scores of online strategies on the Evaluation

Category showed gradual development, although it revealed how the participants selected a choice during online information retrieval.
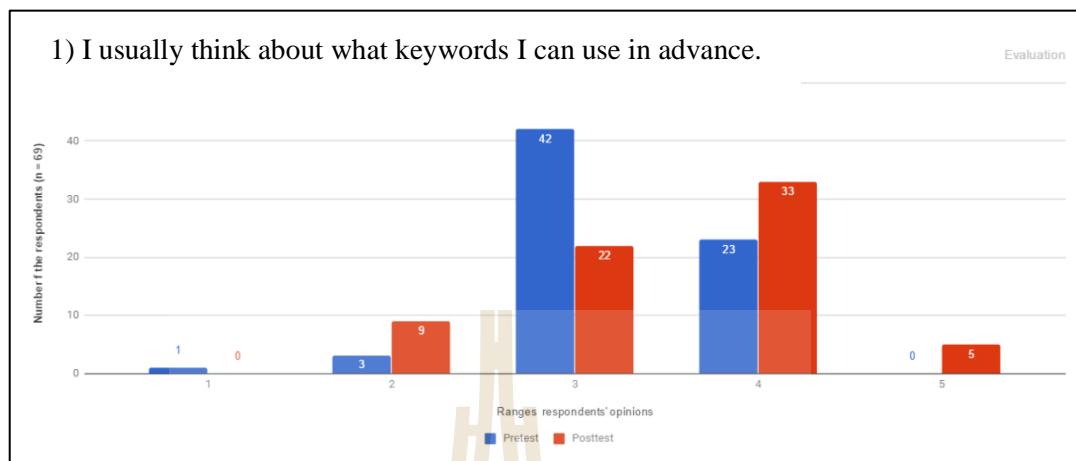

Figure 4.1 Evaluation 1

In order to clarify the whole picture of the participants' performance of online information retrieval, trends of graphs could provide helpful information. An example of graphs and trends in the Evaluation category is shown in forms of both a bar chart and a histogram (Bar chart 1, and Histogram 1). As can be seen from the above chart, it provides comparative data about evaluating online information from various sources.

With respect to the pretest, only one item is found in the lowest range and a small increase appears in second level (n = 3). By contrast, an outstanding upward trend is seen in neutral level of opinions (n = 42). Then, a sharp drop occurs in the fourth range (n = 23). None is found in the highest range.

As for the posttest, none is found at the lowest range of respondents' opinions. In the second range, the number of respondents becomes bigger than that of the pretest (n = 9). Compared to the pretest, a sharp drop is obviously seen. Twenty of them moved to other ranges (see also the following histogram, Histogram 1). Focusing on the fourth range, the bar of the posttest shows an increase in numbers of respondents. At the highest

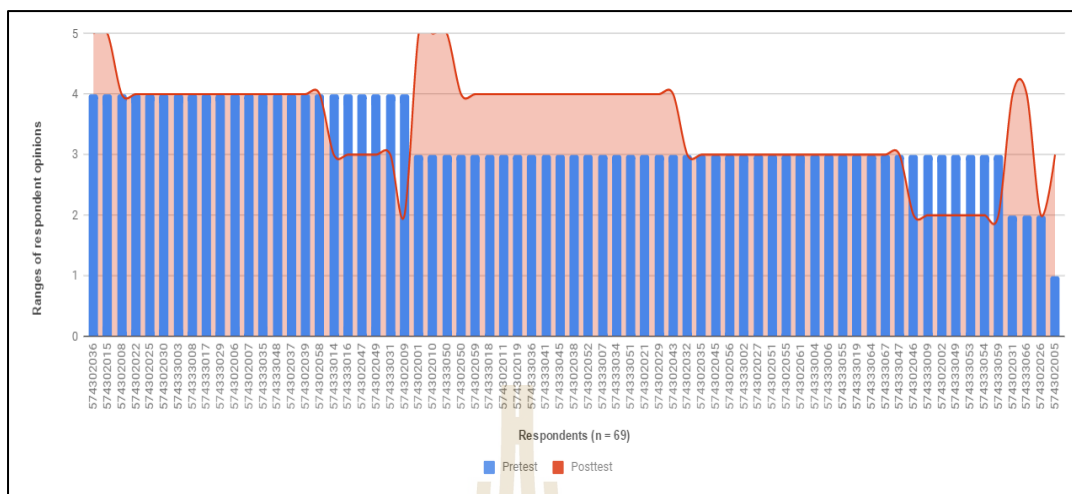range, a growing number of respondents is revealed (n = 5).

Figure 4.2 Movement of Evaluation

The above histogram reveals the movement of responses of evaluation strategies. An obvious change of responses can be seen between the fourth and the third ranges. At the fourth range, fourteen of respondents remained stable while six of them moved downwards, two went up to the second range and three of them moved to the third range, respectively. Focusing on the third range, five respondents moved upwards to the highest range. Thirteen of them went up to the fourth range. By contrast, three respondents went downwards. The overall movement shows exponential growth of the responses. It means that a majority of respondents could employ the evaluation strategy for comparing online information from the website.

The above example shows that all participants have enough experience to construct a personal learning environment (PLE) with technological support. Graphs and movements of all items are shown in Appendix D.

Additionally, visual data reveal how participants constructed their PLEs during online information retrieval. Below, shots of clips portray evidence of information retrieval of the participants (Figure 4.3). Each shot provides different directions and/ or search stops (the Internet navigation) of one participant making a decision in learning.
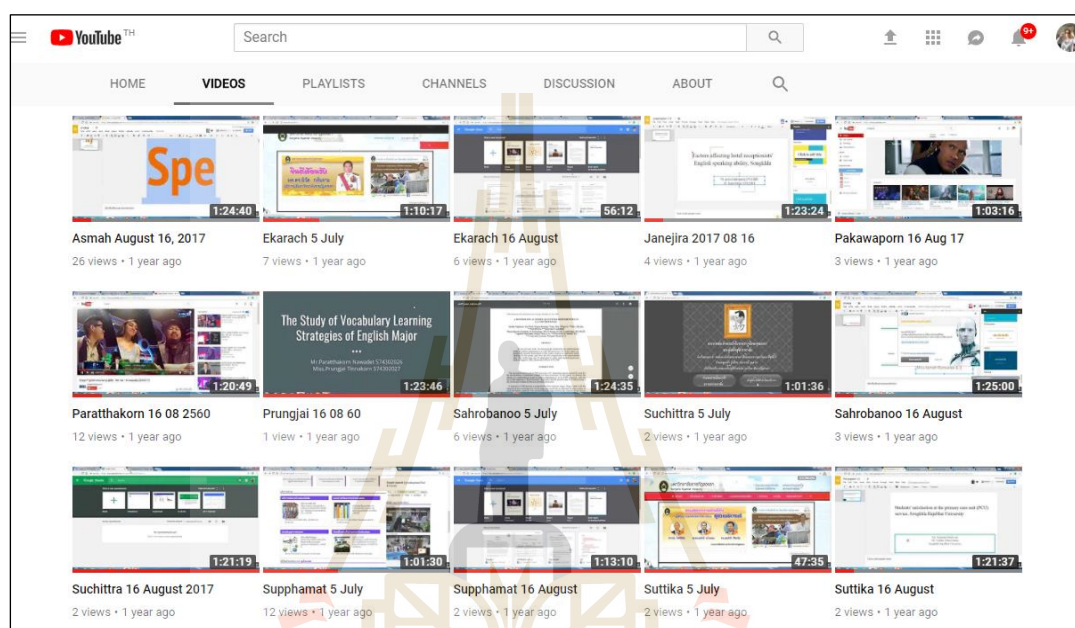

Figure 4.3 Visual evidence from the participants

The above figure (Figure 4.3), provides a learning output of participants. They spent approximately an hour to finish online searching. Google was a jumping-off point for all participants. That is, they started accessing the Google search engine at the beginning of the Internet navigation. Arguably, the Google search engine was considered as the gateway to continue online searching because this search engine gave word/ phrase hints. The hints also made the participants' Internet navigation easy. For example, the below mind map (Figure 4.4) shows a learning pathway of one participant when he undertook a writing task.
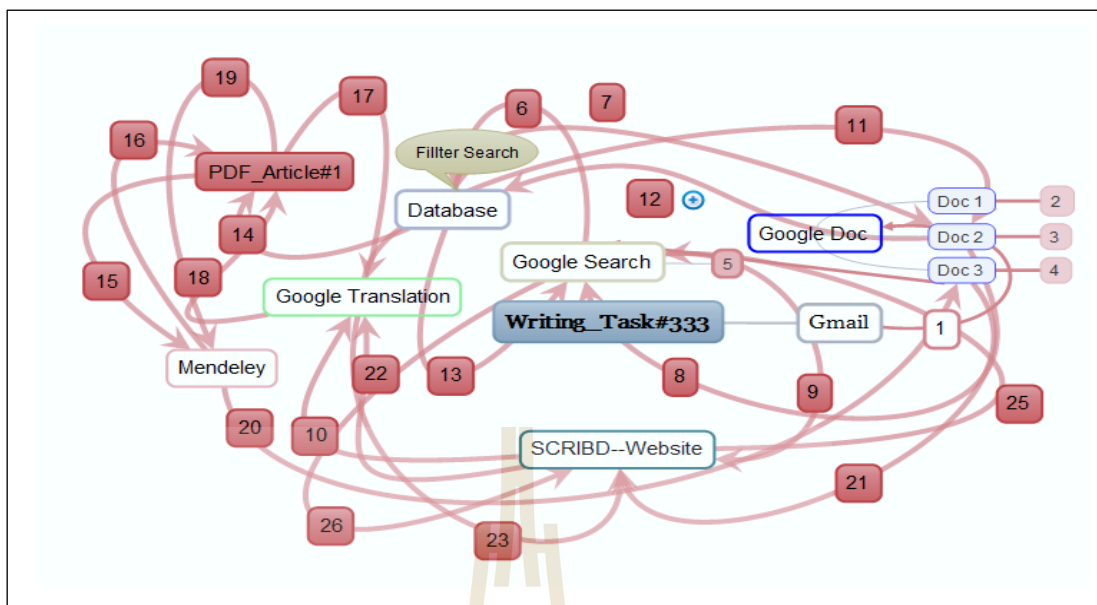
Figure 4.4 A mind map of one participant for a writing task

As can be seen, there were totally 25 stops of this search. A participant started online searching by accessing Gmail inbox and followed by using the Google search engine. The participant visited the Google search engine at least 3 times in order to find suitable web sites. The participant put some words on a space provided for search. Then, he got some hints that were relevant to his previous search. That is, he deployed several online search strategies to achieve a learning goal. With respect to a written task, he went back and forth to visit Google documents, Google translation, Mendeley, and SCRIBD site, respectively. It could be said that the participant understands the learning goal very well because he visited two websites providing him articles as well as a translation tool (Google translation).

In fact, trajectories of each participant seemed divergent in terms of learning paths (websites). Consequently, a mind map of some of the participants was definitely different because the participants did not gain the same level of understanding about a learning goal.

In sum, the way of decision-making of all participants depends on what they preferred, what they understood, their learning goal (requirements), and time allocation.

4.2.2 Research Questions 2: Are there any significant factors that influence EFL learners' decision-making processes as they navigate the Internet or approach other resources for learning as they construct their personal learning environments (PLEs)? What are these factors?

As can be seen from descriptive statistics previously, online search strategies are one essentially important factor influencing the learners' decision-making processes. Five notable search strategies were (1) selecting the main idea, (2) evaluation, (3) purposeful thinking, (4) trial and error, and (5) problem solving.

Furthermore, other factors could be elaborated by qualitative analysis (textual and visual data). The findings revealed that learning with research-based activities could help the learners design their own (learning) requirements that were relevant to a shared-learning goal. Other factors were academic mindsets of the learners and freedom to learn. The following sections show evidence and corroboration of qualitative data.

4.3 Data analysis

This section provides information about how qualitative data were analysed. The current study collected qualitative data from several sources as mentioned in chapter 3. The set of qualitative data can be divided into 2 categories--(A) textual data, and (B) visual data. Textual data include student's written diaries, and semi-structured interviews. Visual data cover clips from screen capture, and students' mind maps (PLEs).

4.3.1 Textual Data Analysis

To answer this research question--(a) Are there any significant factors that influence EFL learners' decision making processes as they navigate the Internet or approach other resources for learning as they construct their PLEs? What are these factors? It is necessary to clarify the following points.

The participants (EFL learners) were assigned to undertake 2 main tasks of the course (*Individual English Studie*s). Firstly, a written task was designed to assist the participants to write their study including 5 chapters[1]. The participants were allowed to work in pairs. Details of written tasks in *Individual English Studies* were shown in the table (Table 4.3) below. Lastly, making a presentation task was also designed to encourage the participants to present their project to the public (the class). A timeline of a presentation task was provided in the tables (Tables 4.3, Table 4.4). An output of the course was a term project and a term report. It could be said that this course focuses on achievement goals rather than behaviour goals.

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[1] Five chapters include Introduction (Chapter 1), Literature Review (Chapter 2), Research Methodology (Chapter 3), Findings and Discussion (Chapter 4), and Conclusion (Chapter 5).

Table 4.3 Written tasks in *Individual English Studies*

Written task	Learning Goal	Time allocation	Remarks
Write Introduction of the project (Chapter 1)	1. the students were required to complete chapter 1 including rationale, objectives, significance of the project, and summary of the chapter.	3 weeks (1st - 3rd Week)	pair work
Review literature (Chapter 2)	2. the students were assigned to review related literature on at least 5 topics.	4 weeks (4th - 7th Week)	pair work
Methodology (Chapter 3)	3. the students proposed the methodology of the term project.	3 weeks (9th - 11th Week)	pair work
Findings (Chapter 4)	4. the students read and reported the findings.	3 weeks (12th - 14th Week)	pair work
Conclusion (Chapter 5)	5. the students made a conclusion of the term project together with giving some possibilities for further study.	1 week (15th Week)	pair work

Table 4.4 Presentation tasks in *Individual English Studies*

Written task	Learning Goal	Time allocation	Remarks
Proposal presentation	1. the students were required to present a project proposal.	A week for preparation and 15 minutes for oral presentation (8th week)	pair work
Project presentation	2.the students were assigned to present the output of the term project.	A week for preparation and 15 minutes for oral presentation (15th week)	pair work

The above tables (Table 4.3 and Table 4.4) reveal two main tasks in *Individual English Studies*. The written tasks required participants to write a project report. The tasks were divided into five subtasks. For example, the written tasks began with writing an introduction to the term project. The allotted time for each task was approximately 3-4 weeks. In regard to a presentation task, two subtasks shared similarities in terms of a learning output. Learners were required to make a presentation twice: one for a proposal and the other for a term project. The first task dealt with written activities including learning goals of each passage of a term project. Data were recorded and transcribed verbatim for each subject. In collecting qualitative data, they were asked to keep records of a screen capture and send them back to the researcher. At this stage, three experts were invited to help scrutinize the transcriptions. Significant statements were identified and meanings were formulated from them. The meanings were arrived at by reading, rereading, and reflecting upon the significant statements in the original transcriptions to gain understanding of the meanings of the participants' statements during undertaking the tasks in the original contexts. The following table (Table 4.5) provides significant statements of the written task.

Table 4.5 Significant Statements of the written task (n = 10)

Significant statements
1: "Database and writing tools such as Grammar checking applications."(*#302055*)
2: "I usually use Google translation." (*#302026*)
3: "I often follow my teacher to search online."(*#302037*)
4: "I search online and read the texts. If I cannot understand it I often use Google translation to help me".(*#302027*)
5: "I work on the cloud Drive and wait for my teacher to give feedback".(*#302061*)
6: "Google translation is a must have tool on my computer."(*#333009*)
7: "Longdo online dictionary and Google translation is a useful tool when I read English texts."(*#333066*)
8: "I love Google and when I do not understand the meanings of the words I use Google translation to help me."(*#333047*)
9: "I read comments taken from my teacher. If I cannot get it, I will send a message to ask her."(*#333051*)
10: "I often visited Google translation in order to translate Thai into English language."(*#333049*)

The above significant statements (Table 4.5) show that a majority of respondents experienced satisfaction with using application software such as Grammar checking, Google translation. Three examples of significant statements were taken from the participants (#302026, #333009, and #333049).

(a)

> *When I started writing, I often read the information I have got from the Internet. I often stopped reading when I did not know the meaning of words or phrases. I usually visited Google Translation. Although I did not know the direct link of Google Translation, I typed "Trans …" and I got it. I saved Google Translation as my favourite search. It is on my search icon [action… the participant pointed to his computer screen]. (#302026).*

(b)

> *My teacher suggested I work on the cloud drive. At the beginning I did not like working on the cloud. I realized that working on the cloud was useful when I forgot my laptop. Subsequently, I worked on the cloud. I also added add-ons from Google products (free downloads) such as Google translation. I normally accessed Google Translation when I needed to know the meanings of the words. <u>It was the must have application tool of my add-on icons</u>. (#333009)*

(c)

> *I first visited Google and then I used the key word—satisfaction towards first aids unit--in order to widen my view about student's satisfaction towards the First Aid Unit on the campus. Luckily, I hit my search and could get what I needed. I spent several minutes to read and gain understanding about that point. I further searched for more understanding by using Google translation. <u>I often visited Google translation in order to translate Thai to English language. I copy some Thai sentences from the source and pasted them onto a space in Google translation and click the icon English.</u> (#333049)*

According to the above examples, the participants tried to make use of application software to help them complete learning tasks. Google translation was frequently mentioned and was one of favourite tools amongst the participants because it was easy to use and met the participation needs.

Besides, some respondents seem like obedient students. They waited for comments and suggestions from the teacher. Consequently, they could continue working. Many of them thought that teacher's suggestions were useful for them. They could add more information and make corrections in their work. The following three examples given by the participants (#302061, #302037, and #333051) are supporting evidence.

(d)

> *My mission was to keep working on Literature Review. I adjusted my keywords for searching for further information. At the same time, I visited the citation link at cite-this-for-me. <u>This link was introduced by my project advisor.</u> I tried to revisit it. (#302037)*

(e)

> *I visited Google, available at the link <u>www.google.co.th,</u> and used the search words "Levels of students' satisfaction towards food sellers' service in the canteen. This phrase was taken from my project adviser ... Also,<u> I read her comments. If I could not get it,, I would l send a message to ask her</u>.* (#302051)

The above examples from the participants show that suggestions from experts (teachers) are considered useful and essential to promote learner (respondents) achievement. Suggestions from the experts could lead to ways to motivate learners to complete learning tasks. Some suggestions might be able to provide what learners (respondents) need such as content knowledge or skill-knowledge. In using Google add-ons, the learners realized the value of working with add-ons for Google documents. In the analysis, the formulated meanings from the significant statements were integrated into the description of an essential structure of using Google add-ons. The list of clusters of common themes below provides corroboration.

(A) usefulness

- Language tools for translation

(B) availability

- It is free-downloadable.

- Google add-ons are easy to install.

Additionally, many learners benefits from teacher's suggestions. They continued completing their learning tasks by deploying some advice from experts (a teacher and/ or more knowledgeable person), For example, the learner (#302061) agreed to employ an idea from her teacher.

> *I usually visit Gmail first because <u>I have got some comments from my teacher. I read and reread all the comments. Then, I correct my errors and mistakes that were shown by my teacher</u>. If I do not understand I will come to ask her directly. All of my data for making a presentation was recorded in my cloud Drive at Google Drive. I love using the cloud drive because it is very useful. I get rid of my concern about losing data when I work on the cloud. <u>My teacher suggested the cloud and demonstrated how to work with it</u>. It is really good. (#302061)*

Clusters of themes were organised from the aggregate formulations of meanings and were referred back to the original descriptions in order to validate them. If any of themes appears unrelated to the original, it was not accounted for in the clusters of themes. A final validating step was done by returning to the participants and asking if the description validated the original experience of respondents.

Therefore, the above table (Table 4.5) and the aforementioned examples reveal some evidence of latent statements in written tasks. Accordingly, there are two emerging themes, (1) Google translation is useful for learners, and (2) suggestions from experts foster learner (respondents) achievement.

In addition, an exhaustive description of the phenomenon was produced by the integration of the results of the analysis. The meanings of the themes were also collected from the participants' written diaries. In order to arrange qualitative data, making use of software application for qualitative data analysis is necessary and useful for organizing coding, annotating and analysing collections of documents. The

software used in this current study is QDA Miner Lite (free download version). The frequency of words and phrases was coded and reported in the following table (Table 4.6).

Table 4.6 Coding Frequency from student's written diary***** (n = 10)

Category	Code	Description	Count	(%) of codes	Cases (%)
Search engine	-Google -Image	- an image option	5 1	6.6 1.3	100 100
Person (an expert)	-project advisor	-Teacher advised/ suggested learners.	12	15.8	100
Google++	-translation -pathway -application tools	-Google translation -First visit -add-on	8 6 7	10.4 7.9 9.2	100 100 100
Prior knowledge	-language experience -past experience	-The participants' knowledge	5 8	6.6 10.4	100 100
Learner's preference	-easy	-Google is friendly-accessed.	5	6.5	100
Strategy	-shorten -keyword -citation -revisit -negotiation - sharing	- make sentences short -the keywords are similar to my project -my rapid reading though texts - making references - revisit - talking and consulting - sharing documents	2 9 5 3 1 4 2	2.6 11.8 6.5 3.9 1.3 5.3 2.6	100 100 100 100 100 100 100 100

Table 4.6 Coding Frequency from student's written diary* (n = 10) (Cont.)

Category	Code	Description	Count	(%) of codes	Cases (%)
Networking	- Facebook - Live chat	-Facebook - Live chat	1 1	1.3 1.3	100 100

*QDA Miner Lite-- the qualitative data collection tool (a free download application available at download.cnet.com/**QDA**-**Miner**/3000-10743_4-75321791.html).

As can be seen (Table 4.6), seven categories were found. The category consisted of search engine, person (an expert), Google++, prior knowledge, learner's preference, strategy, and networking. Each category contains many labels. The first category covers two labels--*google*, and *image*. The label *'Google'* has the highest percentage point (11%) between two labels within the category of search engine, while another label *'image'* shows a smaller percentage (2.2%). The second category is about a person (an expert) containing only one label--*project advisor*. The percentage point is the highest (15.8%) compared to other labels amongst six strategies. Next, the third category is *Google++*. It consists of three labels--*translation, gateway,* and *application tools*. The label *'translation'* refers to a software application providing translation services. The percentage point reveals 10.5%. The label *'pathway'* deals with a track built for making a connection. The percentage point is approximately 7.9% that is the lowest point amongst others in the category of *Google++*. The label *'application tool'* relates to some add-on software. In this current study, it also refers to grammar checker, online dictionary and translation provided by Google browser. The percentage point of this label is 9.2%. The fourth category is about *'prior knowledge'* embracing two labels--*language experience*, and *past experience*. The label *'language experience'* refers to language skills embedded in a person and the label *'past experience'* deals with previous

knowledge of an individual. The percentage point of each label reveals 6.6% for the label '*language experience*' as well as 3.9% for the label '*past experience*'. The fifth category is about learner's preference. It contains only one label--*easy*. The label '*easy*' refers to a feeling of comfort and ease of accessing links. The f percentage shows 6.5% for frequent use. Then, the sixth category is '*strategy*'. It consists of six labels namely, '*keyword*', '*negotiation*', '*citation*',' *shorten*', '*sharing*', and '*revisit*'. Comparing the frequent use of strategies amongst these labels, the label '*keyword*' is more often used than others because the percentage is approximately 11.8%. Then, the next most often used label is '*negotiation*' (5.3%). Other labels were not as often mentioned as the previous ones. The percentages of each label are relatively close to each other, for example, '*citation*' (3.9%), '*shorten*' (2.6%), '*sharing*' (2.6%), and '*revisit*' (1.3%). The last category is '*networking*' containing two labels--'*Facebook*', and '*live chat*'. Both labels refer to a channel of making connection. They also share some similarities in terms of the percentage point of frequent use (1.3%).

In order to clarify a picture of how the original description was coded, the below example (Figure 4.5) provides a depiction of coding processes. Each sentence was read and reread in order to obtain an insight into meanings of the descriptions. Sentences with marks were created and considered them as codes. At this stage, the credibility of the data in qualitative research was under consideration. A peer debriefing process was employed. Throughout the stage of generating codes, the researcher and two impartial peers conducted extensive discussion about preliminary inquiry, corroborations as well as code building. Then, labels were categorized by making use of the QDA software. The labels appeared on the right hand side of a screen.
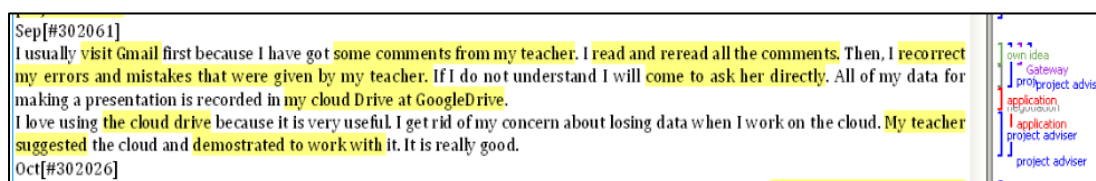
Figure 4.5: An example of an original description by using QDA Miner Lite

From the above figure (Figure 4.5), this is an example from written diaries.

Table 4.7 Significant Statements of making a presentation task (n = 10)

Significant statements
1: "I spent much time to select themes for giving a presentation from Google Slide". It wasted my time but I loved options of the themes. (#302055)
2: "I shared my files with my project partner via Facebook and invited him to work on Google Slide" (#302026)
3: "I decided to work on the cloud drive because it was very convenient. I read information on the slide. If I could not remember it, I used a note message from the slide" (#302037).
4: "Google was my main source of searching for information. Images from Google were also often selected and copied" (#302027).
5: "I did not often meet my teacher because I picked some major points from my work on the cloud drive and pasted them on my slide. I used my knowledge to speak out" (#302061).
6: " I accessed Facebook first and worked on the cloud drive. It was really useful. I got this idea when I was in class". (#333009)
7: "I love Facebook and Google. These two provided me lots of information". (#333066)
8: "I decided to use every software on the cloud drive because there were many choices for me to complete my assignment. Especially, the Google slide was very useful. It provided me many beautiful themes and backgrounds". (#333047).
9: "When I made this presentation I accessed Facebook at the beginning of my working time. Then, I visited Youtube in order to watch some clips related to my work. I sometimes applied some techniques to my presentation". (#333051)
10: "I work on the cloud drive so that I could download many files and pasted some on my (cloud) slide. It was really useful. My teacher introduced me to work on the cloud drive". (#333049)

An exhaustive description of the significant statements was taken from the participant (#302026). He extended his perception of making a decision while making a presentation.

(a)

"I knew how to work on the cloud when I was in third year, as suggested by a teacher. I enrolled in a selective course namely CALL . My teacher introduced the cloud drive to me. At that time, I used OneDrive and Google Drive. At last, I preferred working on the cloud of Google because it was easy to use and it provided many add-ons. It was easy to instore. When I turn on my computer, I firstly accessed Facebook and read what was going on there. Then, I chatted with my project partner via a live chat on Facebook. My work was shared with my project partner on the cloud drive. I shared my work with my teacher and friends because it saved me time to revise my work. Specifically, I saved my time to revise because when my teacher gave me comments I could change them immediately. When I did not understand her comments I often chat with her on the live chat box on the Google Slide. My speaking skill tended to be accepted because I loved speaking. I read and speak it out immediately(#302026) [translated into English].

4.3.2 Visual Data Analysis

The following shots of clips could be clear evidence for supporting what the participant (#302026) did. All clips were recorded and uploaded on the researcher's channel of YouTube. The saved clips on the channel were kept privately in order to pay respect to participants' privacy and keep their information confidential. The clips were recorded while the participant joined the class on 23rd June 2017 at the computer lab, SKRU. The participant (#302026) not only signed in on Google Document but also prepared information for writing chapter 1 (see also 4.5). The figures (Figure 4.6 and Figure 4.7) showed a frame of two windows, one for Google Document and another for their online journal. Then, the participant (#302026) searched for add-ons. This evidence could confirm that the participant (#302026) often worked on the cloud drive (Google Document), as presented in the above transcript (lines 3-4)--"*At last, I preferred working on the cloud of Google because it was easy to use and it provided*

many add-ons". The whole session of the clips on that day (23rd June, 2017) was about writing an introduction part.

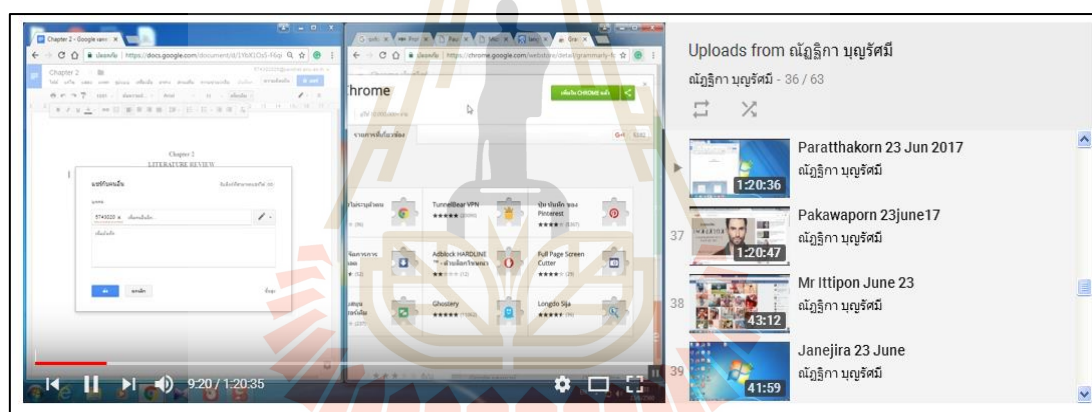**Figure 4.6** A frame of the participant's (#302026) working in writing task 1

Figure 4.7 A frame of the participant's (#302026) working in writing task 2

The aggregate of formulated meanings was organized into initial codes (Braun & Clark, 2006) of themes. The initial codes represent themes that have emerged from and are common to all the participants' descriptions as seen previously (Table 4.6, and Table 4.7). These codes were referred back to the original description in order to validate them. Each description was examined to see if there was anything in the original that was not accounted for in the codes of themes, and whether the code proposed something that was a distortion.

A final validation was undertaken by returning to all informants and asking them if the description formulated validated their original thoughts. All of them stated that the description they read of the reflection contained the essence of their opinions. Moreover, they further stated that the words and phrases they used in the original diary conveyed the same meaning as the terminology used by the researcher.

The following table (Table 4.8) shows the cluster themes that emerged from the student's written diary. These clusters were referred back to the original descriptions in order to validate them. Also, each cluster theme and its corroboration are also presented in the following table (Table 4.8).

Table 4.8 Emerging themes about making a decision

Cluster themes	Corroboration
Theme 1: Sources on the cloud storage and social networking are a primary visit for a decision-making.	"I work on the cloud drive so that I could download many files and pasted some on my (cloud) slide. It was really useful. My teacher introduced me to work on the cloud drive". (#333049) "When I made this presentation I accessed Facebook at the beginning of my working time. Then, I visited YouTube in order to watch some clips related to my work. I sometimes applied some techniques to my presentation". (#333051) "I love Facebook and Google. These two provided me lots of information". (#333066) "When I made this presentation I accessed Facebook at the beginning of my working time. Then

Table 4.8 Emerging themes about making a decision (Cont.)

Cluster themes	Corroboration
Theme 2: Suggestions from knowledgeable persons provide an effective choice.	"...My teacher introduced me to work on the cloud drive". (#333049) "I read comments taken from my teacher. If I cannot get it, I will send message to ask her."(*#333051*) "I usually get comments from my teacher and I request a meeting with her in order to ask her."(*#333049*) "I work on the cloud Drive and wait for my teacher to give feedback".(*#302061*)
Theme 3: Past experience helps the learner to select information.	"It was not often for me to meet my teacher because I picked some major points from my work on the cloud drive and pasted them on my slide. I used my knowledge to speak out" (#302061).

In order to make a clear picture of qualitative data analysis, the following data analysis model shows how analytical methods were employed in order to generate the themes.
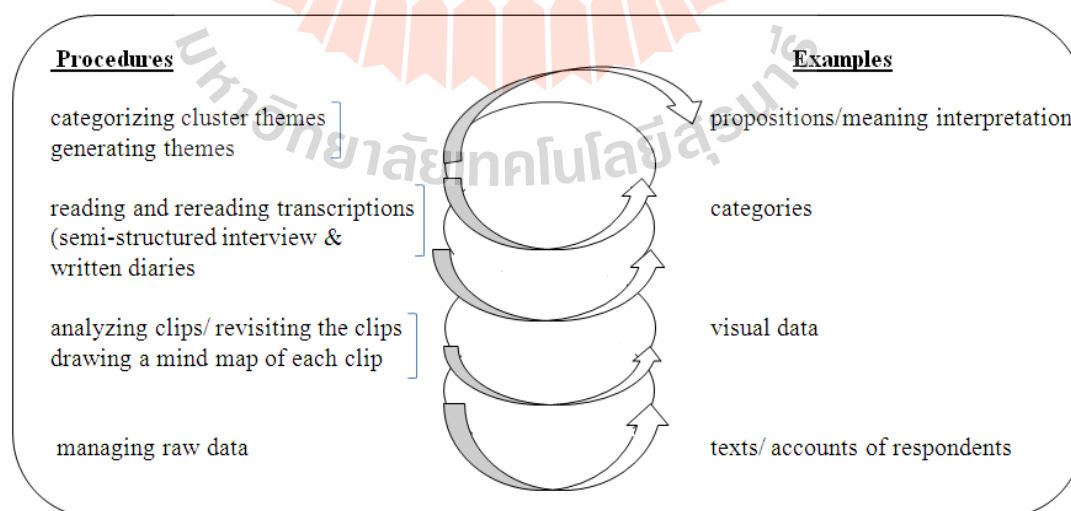
Figure 4.8 A model of qualitative data analysis of this current study

The above figure (Figure 4.8) provides a summary of how the themes were generated. First, all transcripts were read and reread in order to gain an insight into qualitative data such as written diaries, semi-structured interview transcripts, clips, and tag clouds. The researcher engaged in the process of moving in analytic circles rather than using a (fixed) linear approach.

To sum up, the conclusion was developed from previous data. The core findings are from three emerging themes (see also Table 4.8). Extracting these themes, a few critical aspects could be presented as follows: technological strategies, negotiation (e.g., an expert), self-regulation, self-efficacy, and self-managed resources. Details of these five elements are:

1) Technological strategies: the participants were equipped with technological strategies and had got experience of digital technology for years. These strategies have been accumulated from direct experience such as trial and error, and from indirect ways (from studying or suggestions).

2) Negotiation: when the participants (students) do not know any direct ways of problem solving, they need to ask more knowledgeable persons (from this current study, a project advisor and a project partner were considered as experts) or gain more understanding about solving problems by sharing knowledge. Typically, the participants employed comments from an expert to make a decision. Experts' comments were considered as a possible choice for them. Asking the experts or obtaining some comments are actually an indirect way to solve problems.

3) Self-regulation: keeping tracks of [an expert's] suggestions tends to be helpful for the participants to make progress. Many of them try to continue their work. Obviously, a majority of the participants worked on the cloud drive as they could receive real time comments and can search for useful information in synchronous and asynchronous modes.

4) Self-efficacy: a majority of the participants are likely to have a growing belief that they could find a possible way of solving a [language] problem from past experience as well as an effective ability for searching online information. For example, when they faced vocabulary difficulties they need to recall their memory about those words or phrases. If they cannot remember them, they navigate the Internet and visit the sites for solving the language problems. From this case, Google translation was a favourite site for solving the vocabulary problem.

5) Self-managed resources: the participants tended to have power to manage information from various sources that were included in past experience. The learners gained insight into specific information from human and non-human sources. They also generated feelings of a hunger for information (power of knowing) by visiting Google (or other) search engine(s) and saving a pile of information with a huge memory space on the cloud storage.

The five above elements can be divided into two main categories--(1) practical strategies, and (2) intrinsic interests. With respect to practical strategies, first two

cores are brought into focus. The last three cores are grouped in intrinsic interests. These categories will be elaborated on and discussed later (see also 4.4).

4.4 PLEs of the participants

Prior to conducting this current study with the participants, twelve volunteer students (EFL learners) were invited to an interview. The interview was conducted in Thai and was translated into English. The following assemblage of responses from the interviewees was initially noted to exemplify understanding of personal learning environments (PLEs) or mind maps of learning.

> *Researcher: Have you ever heard about a learning mind map? Have you*
> *ever created a mind map about your learning?*
> *#302006 : Never.*
> *#333006: Yes, once I made it when I was in a high school. I used it when I*
> *read short stories that was in my compulsory course last term.*
> *#333051, #333066, #333017: [reaction … smiled and said nothing]*
> *#333015: No, but I knew how to draw it. I never used it because I was not*
> *good at drawing.*
> *#302061, #302066: So did I. I thought that drawing a mind map wasted our*
> *time. We put marks by using colour ink. [reaction*
> *they also showed several colourful-ink pens and a big*
> *pack of magic pens.]*
> *#302021, #302027: [reaction … said nothing but accessed a page on*
> *Facebook]*

According to the above assemblage, many of the EFL learners did not have any experience of mind maps or did not use any tools as learning aids. Later (from April to June, 2017), these learners enrolled in the course namely "Individual English Studies" that is research-based approach in its nature. Three queries questions were asked all of them in order to introduce what a mind map of learning is, as well as to

trigger a response from the participants. The three questions are 1) how do you search a topic for your individual project?, 2) How do you access information through a database?, and 3) Who introduce you to use the database? The decision to use these three questions was to introduce the participants to know how to make a plan for completing the term project. From the perspective of the participants, a voice record of the twelve participants were transcribed. After that the significant statements were extracted from the original transcriptions. It became apparent that it would be of value to make a list of navigating the Internet. In the final step of qualitative data analysis, the extraction of all significant statements from all twelve transcriptions was complete and the duplicate statements were eliminated. The remaining significant statements are revealed in the following tables (Table 4.9).

Table 4.9 Significant Statements: three queries (n=12)

Queries	Significant statements
1) How do you search a topic for your individual project?	1. I discussed the topic and made a plan. 2. I brainstormed ideas from surfing on the Internet. 3. I used Google. 4. I used Google Scholar. 5. I went to the library. 6. I had a meeting with my project supervisor. 7. I read directly from our senior students
2) How do you access information through a database?	1. I did it in class (a lecture) 2. My project advisor introduced a database to me.
3) Who introduce you to use the database?	1. A teacher (a project advisor)

An example of significant statements (1-4) of first query is from the following transcription:

"At first, I had got some ideas but needed to discuss them with my friends. Then, we decided to use Google to search the topic. We typed keywords "student's satisfaction" on the space provided on Google. It provided lots of information about student's satisfaction. We could not choose any of them. We saw one topic from the list and typed the same phrases on Google Scholar. Similarly, there were many studies about student's satisfaction. We stopped searching the topic on that day. We needed to have a meeting with our project advisor on other days of this week" (#333051 & #333017, August 2017) (translated into English).

The following statements from this transcription were duplications of significant statements from previous transcriptions: Google and Google Scholar were the duplication of number 3 and number 4.

Another example from the significant transcriptions of the of last two queries is shown as follows:

"I gained more understandings about software applications and tools when we met in class. Personally, I always access Google first because it offered me anything that I required" (#302006 & 302027) *"I loved activities in class because the teacher usually provided me new software applications such as Mendeley storage [online library]. Also, she gave me some techniques for working on the cloud [Google Drive and OneDrive]. I preferred working on the cloud because I could work anyplace and did not have to carry my old laptop"* (#302027, #302017, & #333051) (translated into English).

A discussion addressed here is a real situation of pedagogical aspect at the research site (SKRU). According the above transcriptions, the participants were required to submit a project topic within a week (week 3rd, the academic year 1/2016). The quick method of completing the assignment was to meet a project advisor who was considered as an expert, and navigating the Internet was the second decision by

most participants. The Google search engine was often mentioned by the participants because of its popularity. The participants tried to reach their learning goal in both direct and indirect ways. Teacher initiation seemed to be necessary and important to this course since the teacher evaluated the project and gave her students feedback in the form of a grade as well as real time comments (see also Figure 4.9). At the same time, the participants also initiated the study by navigating the Internet in accordance with the study plan or the project advisor's suggestions.
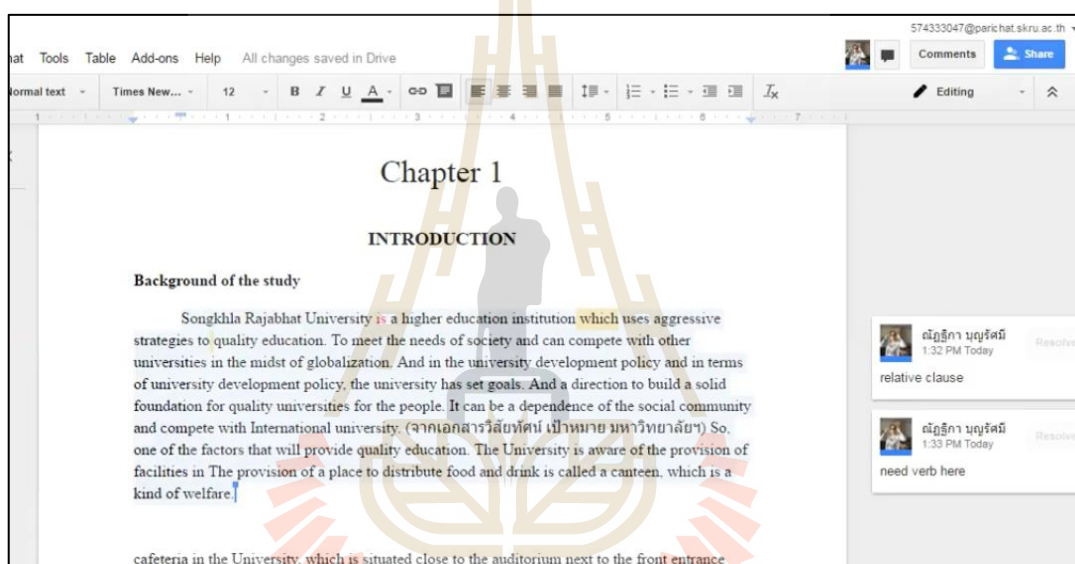
Figure 4.9 Real time comments
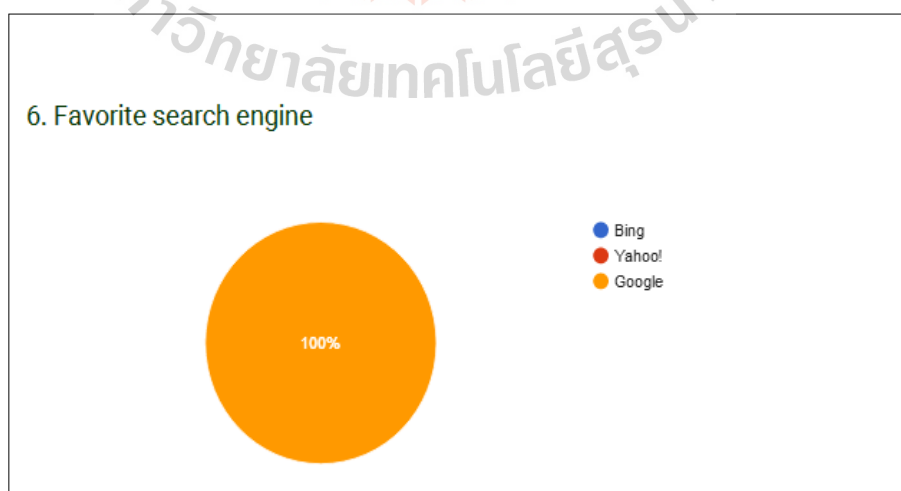
Figure 4.10 The survey of favourite search engine amongst the participants (n = 69)

According to the above figure (Figure 4.9), the participants sent an invitation via email and waited for a response from a teacher (an expert). A consensus between the students and the expert was to make a discussion on the Google Drive where "we" [the students and the project advisor] could share ideas and give comments. Sometimes, they could examine what they discussed by checking from the cloud drive (see also Figure 4.11).
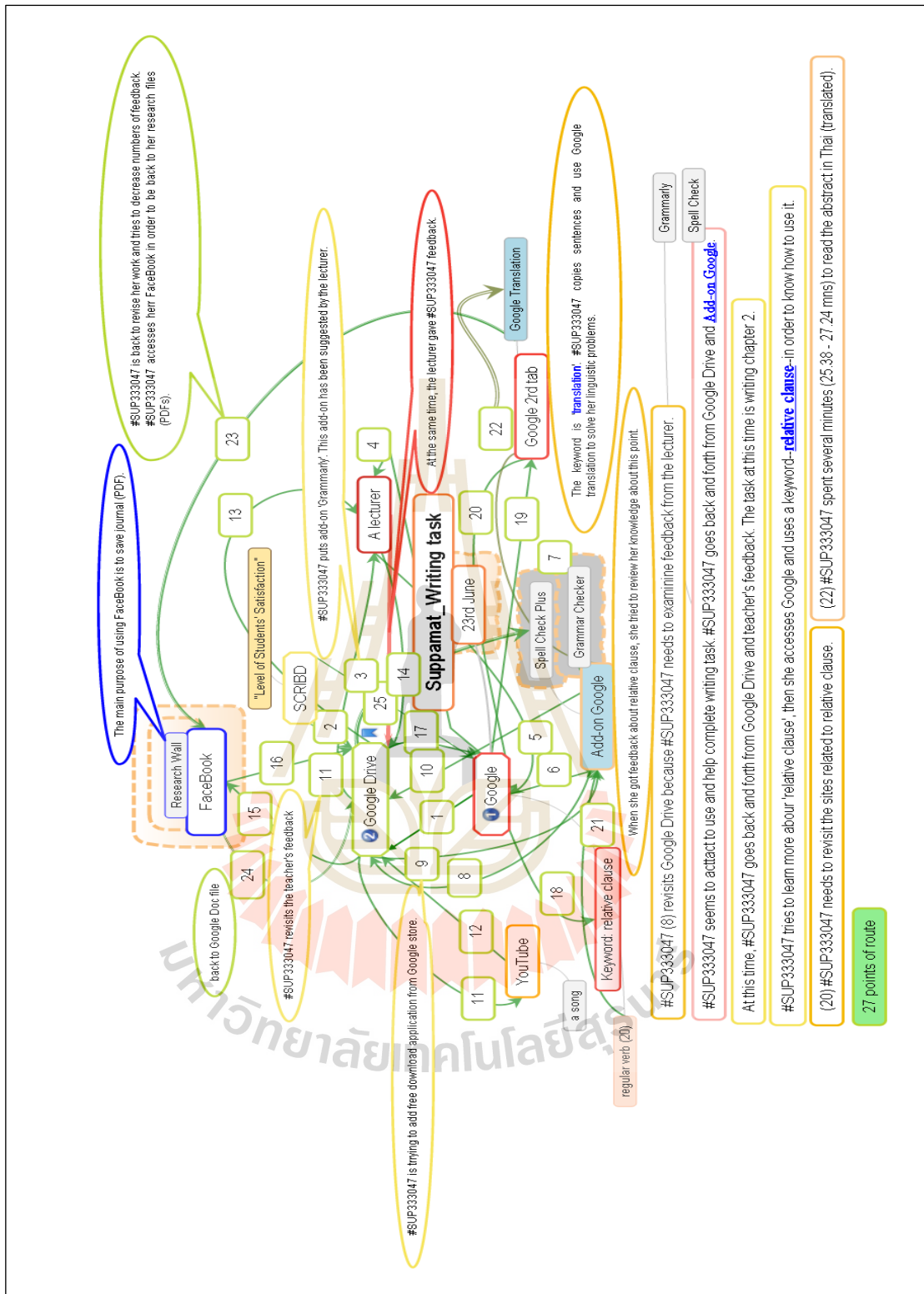
Figure 4.11 An example of the PLE (#333047)

The depiction of the pedagogical aspect reveals that the participants often relied on suggestions from an expert in order to accomplish their task. At this step, the teacher's role tends to be necessary and important since she gave helpful suggestions.

The students spent approximately 16 weeks (From June to October, 2017) to complete research tasks. An example of the personal learning environments (PLEs) through the tasks done by one of the participants was shown below (Figure 4.11).

As can be seen in this figure (Figure 4.11), twenty-seven pathways of a learning environment were initiated by the participant [#333047]. She spent almost two hours to search for information about her project topic. She was working with her project partner at the computer lab. She commonly accessed the Google Drive first and then visited other links. Her work was done on the cloud drive that was introduced by her project advisor at the beginning of the term. It is not surprising that Google was the first visit of all the participants. While she tried to complete her research task, she also visited her favorite URLs (uniform resource locators) such as Grammar Check and Spelling Check. She tended to rely on these two URLs. The links provided her ready availability of software applications. At the same time, she also needed (real time) feedback from her project advisor.

4.5 Summary

This chapter presents results of the study. The findings consist of quantitative and qualitative answers for the mixed-method approaches. The study shows that the learners utilised basic knowledge of Internet navigation as well as online search strategies in order to develop making decision ability. In the qualitative approach, three emerging themes are (1) sources on the cloud storage and social networking are a primary sources for decision-making; (2) suggestions from knowledgeable persons

provide an effective choice; and (3) past experience helps the learner to select information. In addition, this study discusses critical factors that relate to decision making procedures, such as previous studies, and established theories. The next chapter will have in-depth discussion in relation to three emerging themes.

CHAPTER 5

DISCUSSION

5.1 Introduction

This section aims at discussing the findings dealing with the decision-making processes identified previously. First, learners' PLEs will be elaborated in relation to self-organized learning systems. Second, the rhizomatic aspect of decision-making will be discussed. Third, brief reflections on PLEs are presented. The chapter, then, ends with a summary.

5.2 Discussion of Learners' PLEs

This part discusses the findings reported in Chapter 4 about learners' overall performance in online retrieval, characteristics of learners' PLEs (in the form of mind maps), and oral interviews in terms of learners' perceptions of PLEs. Findings from written diaries are also discussed.

5.2.1 Learners' Overall Performance

In terms of overall performance of online retrieval, there was not much difference between the pretest and the posttest scores of the participants. This indicates that the performances of the participants seemed consistent. In other words, a majority of the participants were able to perform the Internet navigation in a stable way, indicating that the participants were familiar with navigating the Internet and experienced in online retrieval. It could be claimed that they were able to improve their online retrieval skills (in some degree).

5.2.2 Characteristics of Learners' PLEs Represented by Mind Maps

From the written data presented in Chapter 4, a majority of the participants often visited Google Translation, and Grammarly applications. This means that the learners had limited knowledge of vocabulary and sentence structures. Also, their action to copy original texts and paste them to a space provided by Google Translation indicates that the learners did not want to spend much time to read the original texts in their entirety. In other words, they required to achieve their job to be done within a specific time allocation.

Again, this can only be an example as procedures that are contingent on many unpredicted and unpredictable factors though some may be predictable at a statistical level, for example we might know that 'as a group' certain students are statistically 'likely' to have a problem but no individual student within that group is 'guaranteed' to have a specific problem. In other words, learners are engaged permanently in a fluid, dynamic, shuttling, a kind of toing and froing, between needs, activities and resources, ultimately driven by personal understandings of what is required to achieve the job to be done. This is where research in learner education (including learner empowerment) and scientific research into the learning processes of learner populations needs to be initiated. This should be done in an open, non-restrictive, manner that invites understanding of both self and tasks, rather than imposing compliance to fixed models of behaviour that are essentially self-serving and temporary in nature even though they may appear to achieve the "job to be done" in the short term. This is the essential outcome of this research. It argues that no hard and fast, pre-determined, decision support advice may be given to learners beyond encouraging the ability to develop a dynamic understanding of one's personal relationship to the connections between self, task and resources

(whatever their nature). It would be the primary task of education to nurture such an understanding and allow it to burgeon and bloom. Perhaps, unsurprisingly, one may think of it as a variation of the Delphic maxim found in Apollo's Temple and adopted by Socrates and Plato: γνῶθι σεαυτόν (Know thyself – actually, develop an understanding of yourself) (Best, 2018).

5.2.3 Interviewees' Perceptions on PLEs

None of the participants knew of the concept of PLEs at the beginning of the study. They later understood PLEs by looking at an example of PLE in the form of a mind map drawn by the researcher. A majority of them had no experience in making use of visual data such as a mind map to represent PLEs. All interviewees first accessed the Google search engine whenever needing to know new information. From the oral interview results, many of them liked to visit the Google search engine because they could search for what they required at that time that they need it. Moreover, Google functioned as a jumping-off point for the search for information as it provided relevant information and gave additional broad hints for participants to choose from.

Additionally, the results from the oral interview also showed that all learners employed three sources to support them during the completion of their learning tasks. These sources were a search engine, an online database, and negotiation with experts. It could be argued that the group of learners was accustomed to a trial-and-error mode of decision-making involving switching back and forth between two pre-existing points: the search engine and the online database. Hence, it was not surprising to notice that many pre-exiting points could act as the starting point for the PLEs.

In sum, in completing learning tasks, learners were able to demonstrate their academic ability to use technology to retrieve online information.

5.3 The Rhizomatic Aspect

This section discusses the rhizomatic perspective adopted here in relation to self-organizing learning systems, and thinking approaches as well as value of learning arrangements.

5.3.1 The Rhizomatic Concept in Self-Organizing Learning Systems

As noted by Deleuze and Guatari (1987), "*any point of a rhizome can be connected to any other things, and must be*", rhizomatic learning deals with multiplicity of arranging learning tasks in which learners initiated actions by exploring sources, and negotiating with different communities. In essence, rhizomatic learning supports the idea of that learners construct PLEs, and self-organization of learning because it responds to meet learners' requirements.
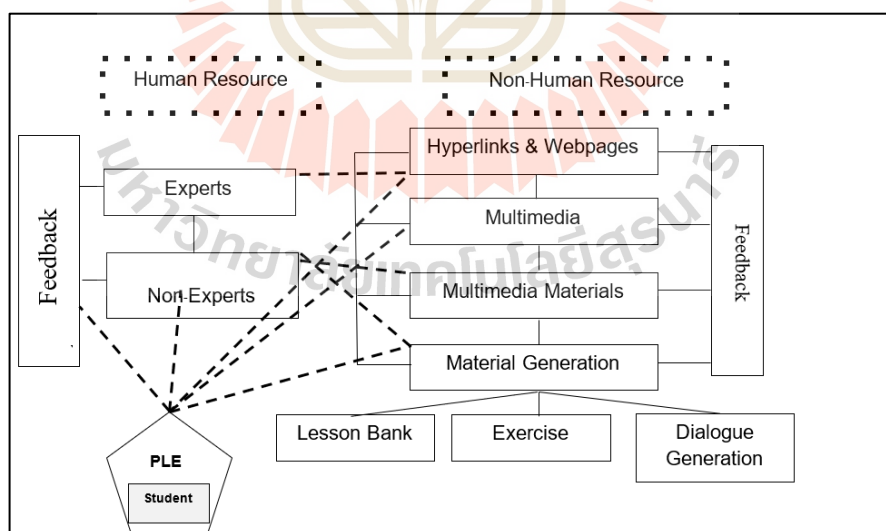
Figure 5.1 A hypothetical rhizomatic PLE (adapted from Lian & Pineda, 2014)

In respect of learners' PLEs, a PLE construction seems positive one learner feel free to build connections between preexisting gaps in order to fill in the gaps and/or

find possible solutions to solve academic problems. The figure below (Figure 5.3) shows a hypothetical rhizomatic PLE. It presents a positive relationship between human and non-human resources in terms of the PLE construction of one particular learner.

From the bottom-up, a learner's PLE establishes connections ceaselessly. The learner collects an assemblage of information from feedback of both human (experts) and non-human (technology) resources. Regarding the non-human resources, active support from an institution (e.g., databases, e-library) can provide academic resources, essential application tools and an existing infrastructure for the learner. Arguably, various directions and connections followed belong to only one learner because every learner has different needs. Hence, the existence of an individual PLE completely rejects a 'one size fits all' belief in education.

As a result, a (language) learner is able to develop a dedicated language learning environment in order to fix her/his language difficulties as well as improve her/his specific language skills. The following figure (Figure 5.2) displays an example of the dedicated language learning environment of one such learner.
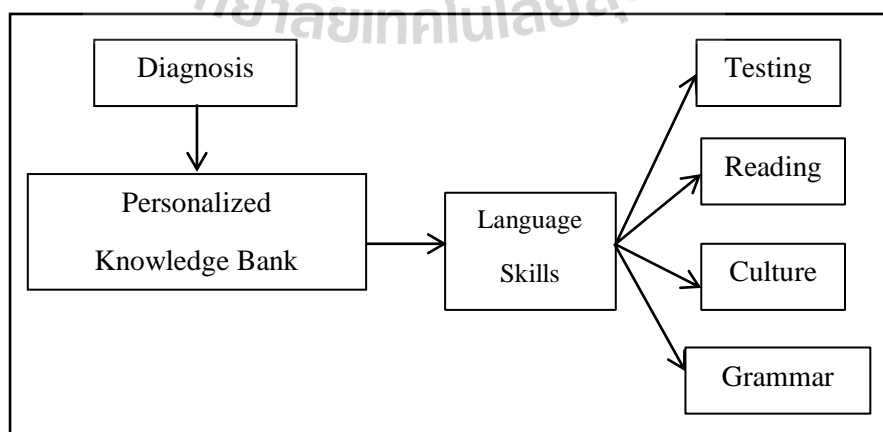
Figure 5.2: A dedicated language learning environment

From the above figure, a learner is able to examine what language aspect s/he needs to develop. S/He then collects assemblages of information in order to arrange a personal bank responding to her/his requirements. Subsequently, s/he holds a personal knowledge bank for developing specific language skills. Within each knowledge bank, the learner is able to categorize contents of language skills.

In sum, a PLE construction looks chaotic first because a learner needs to connect preexisting gaps and collect responses in ways that fit her/his academic needs. Hence, the learner needs to be creative and flexible enough. At the end, the learner could rearrange her/her needs in sequences that best suit her/him.

5.3.2 Thinking approaches to Self-Organized Learning Systems

Notably, a rhizomatic approach represents a thinking concept because it is an entirely interconnected entity of heterogeneity. It contains several layers of information collected by negotiation and connectedness. That is, anything can be precisely connected to any other points of situations. Regarding the term "multiplicity" (Deleuze & Guattari, 1987), it shows any increase in numbers of determinations and self-discovery of an individual.

The rhizomatic concept is likely to be a foundation for the thinking of human beings because subjectivities almost always emerge by way of ruptures and discontinuity (Freitas, 2012). That is, a feature of an individual's thought is not necessary linked through others' counterparts. In particular, one's thought could be repetitive, different, and proliferous in terms of a network of thinking. Paving the way for thinking establishment of a rhizome approach, graphic organizers are considered as visual representation of everyone's thoughts. The graphic organizers such as diagrams and main maps are useful. Such tools benefit people in developing critical

and creative thinking, organizing ideas, improving understanding, and arranging plans for problem-solving, for instance.

One way of dealing with problem-solving that may be relevant in the context of this thesis as well as providing open-ended guidelines for decision-making is called *computational thinking*. Computational thinking is like thinking in ways similar to how computers solve problems. That is, a computer works by making use of analytic and algorithmic approaches to analyze and solve the problem. Likewise, the computational thinking allows people to solve problems by making use a possible step-by-step solution. As a result, others are able to understand how people solve problems.

Computational thinking includes four main keys namely, decomposition (breaking a complex task into a series of small tasks), pattern recognition (making a relationship between relevant aspects of the tasks and irrelevant counterparts), abstraction (focusing on the relevant aspects of the tasks and rejecting the irrelevant ones), and algorithms (developing a hierarchical structure to complete the tasks) (Wing, 2006). As a result, these keys work comparatively. In essence, these four elements of computational thinking enable learners to turn a complex task into a more manageable one.

Regarding the written tasks of this study, learners were assigned to initiate a topic for their term project. They then searched online information by using keywords in order to examine other relevant studies. Next, the learners engaged in discussions with each other and developed the topic of their project. From these two stages, the learners undertook an analytical skill in order to identify the topic (decomposition and pattern recognition). After that, the learners searched for information which fitted

their learning requirements (to some degree). Finally, the learners gained an insight into the learning task based on research activities and produced a research report. A mind map was used to keep track of online retrieval strategies. Hence, the mind map is considered as an algorithmic procedure of one's study. Simply stated, computational thinking encourages learners to confront a complex task, compare similarities of learners' requirements and information from retrieval, and contest with learning aims.

Additionally, benefits of computational thinking underpinning this current study provide further reflections. Computational thinking enables any learner to achieve quality in decision-making because it helps the learners categorize complex tasks, and transform them to simple solutions. For example, you can see a list of your preferences. Then, you can choose each item in the list that suits yourself the most. Another example is that, a collection of mind maps provides a pattern of learners' preferences. Educators and other educational stakeholders can make use of the PLE collection to design the bulk of learning exercises that match those of learners.

5.4 Freedom in class

As previously mentioned, learners undertook to manage their learning system based on shared learning goals at the beginning of the semester. Each learner or project member needed to organize a possible plan to achieve success. Metaphorically, teachers in traditional teaching approaches are like the 'sage on the stage' who seem to be cleverer than learners. On the other hands, in this century, teachers should play a role as 'a guide on the side' who provides productive comments and feedback to learners (Wright, 2011). Also, the learning environment

was designed and controlled by learners. They could select what contents they wanted to work on rather than obeying what the teacher required.

Freedom in class could be now considered from many aspects: learner empowerment, learner responsibility, and course objectives (Wright, 2011). Citing Wright (2011), such aspects were usually involved in student-centered learning characteristics in which the learners could exhibit their own interesting behaviour in organizational learning activities. To clarify this idea, working with assumptions of student-centeredness is essentially close to student empowerment. Starting with this assumption, *individuals must assume a greater responsibility for their own learning* (Land & Hannafin, 1996). This assumption is relevant to learner responsibility (Wright, 2011) posited previously. At first, an important consideration is that neither teacher nor students' need to make a shift. The onus is on everyone including teacher, students and policy makers (Weimer, 2002) to redesign and make adjustment to encourage any student to attain the learning goal. Then, external motivation and assessment are also critical to support the individual construction of knowledge. Since students at present need to recognise the structure of the course and possible ways to gain a good academic grade, then alignment of course contents, teaching approaches, assessment and learner's requirement is vital (*ibid*, 2002; Chung & Chow, 2004).

Another assumption is that *learners perform best when varied/multiple representations are supported* (Land & Hannafin, 1996). It could be argued that connections amongst ideas (e.g., brainstorming, providing feedback, group discussion) through negotiation between groups of people could encourage learners to handle rote memory. According to this current study, as can be seen in the mind maps (Chapter 4), several visits showed that each learner obtained different understandings

in terms of degrees of difficulty and complexity of (digital) information as their abilities and English proficiency were not equivalent. Consequently, information and texts seemed to be discursive. It depends upon learner's needs and preferences. The way they gained an insightful understanding needed time to do so: "understanding required time" (*ibid,* 1996). This process of undertaking the learning tasks in the research-based course of the current study was ongoing until the end of term. However, this situation could reflect that they could achieve success and a better understanding about the aim of the course with help from peers and other knowledgeable experts (teachers, lecturers, and peers).

Why time is significantly important for making an insight into a particular content, this question seems fascinating for learning. It could be argued that 'time allocation' in completing a learning task is likely to be an important factor for decision-making since it could represent one of the important conditions for task-completion in any learning course. Locating Bourdieu's (1992) proposition about '*Structure, Habitus, and Practice*', whereby "*the conditionings associated with a particular class of conditions of existence produce habitus (collective experiences), system of durable, transposable dispositions ... an express mastery of the operations necessary to attain them*" (p.53).

Considering the quality of learning outputs (a project report and making a presentation), as mentioned earlier--gaining information from negotiation amongst peers seemed to be discursive, the input would be made comprehensible when an act of negotiation was performed (Pica, 1994 cited in Swain, 2000). For example one group (the research subject) addressed a problem about food-sellers in a canteen of the campus. Two learners (pair work) did a preliminary observation on food-sellers'

activities for a couple of days and then reported possible ways of being good food-sellers (i.e., the students made a list of good behaviour of good-sellers, ambiance of the canteen and so on). Then, they created a questionnaire containing 5 lists developed from their preliminary observations. Consequently, they established a working topic for the term project namely: *Student's Satisfaction towards Food-Sellers at the Canteen, SKRU*. With respect to the outcome, two of them collected information and handled basic research strategies without teacher intervention. Because of being free in learning systems and technology-supported learning, learners could produce satisfactory learning outcomes. In other words, learners interpreted the meanings of the real world (a research setting) based on various understandings about a specific situation existing in their internal mechanism.

Another example was an at will learning of the participants in a session on making a presentation. Although this course was originally intended for pair-work, one of the participants did nothing. He was very passive in learning: working as a labourer (e.g., helped type documents, provided food and refreshments). By contrast, he did very well in making a presentation. He could organize the session very well. He felt at ease when he performed in front of the class. Noticeably, proficiency levels between two participants seemed to be a key to success as the female participants were likely better than one another in terms of cognitive levels, whereby relevance and dignity in class could encourage a passive learner to be involved with academic activity (Glenn, 2013).

As mentioned earlier (somewhere else in Chapter 4), learners had obtained some different degrees of self-reliance in a timely manner. It is argued that the learners could manage time and re-organize information dealing with a specific

interest when they could increase the ability to gain an insightful understanding about the content. Hence, learning organization is done individually as people perceive the world differently and not in solidarity with each other. Perceptions of an individual seem to be a critical key to understanding reality. Locating Derrida (in Turner's translation, 2016), *a meaning arises from the constant process of negotiation between competing concepts*--a learner could try to find a possible way to develop and improve one's understanding (Lian, 2011).
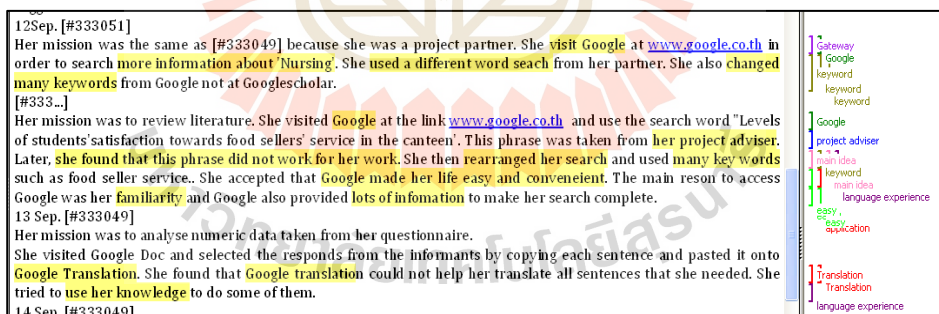
In short, learner empowerment could be thought of as part of an area of student-centred perspective. Each learner could construct his/her own learning environment in order to fulfil leaning requirements (at different levels) that an individual could handle difficult situations at a stage not beyond one's level of comprehension (Lian, 2011). Also, freedom could provide a sense of control that learners felt could overwhelm academic difficulties (Lian 2002).

5.5 Self-Regulated Learning (SRL)

According to the emerging themes of this study, the theme "past *experience* helps the learner to select information" (theme 3), indicates that the learners attempted to solve a (language) problem. In doing so, a majority of learners at the research site came of their own volition. They recognised the learning processes by setting a shared-learning goal, employing specific strategies as well as encouraging project partners to accomplish the goal with them. These processes appear to reflect self-regulated learning (Zimmerman & Campillo, 2002; English & Kitsantas, 2013). It could be argued that navigating the Internet was an action of the learners to negotiate the goal of learning, and manage information aggregation. Obviously, the most popular search engine amongst the learners was Google (available at

www.google.com/). This search engine tends to be an important (academic) learning tool in allowing learners (at the research site) to discover a new meaning.

A notable question to examine: why does the learner's online search behavior depend on visiting Google? One reason is Google was selected as a homepage by the university. Also, a number of add-ons of Google products seem more popular than other homepages. Google Translation and Grammarly were almost always visited, for instance. Regarding learners' past experience, many of the learners visited Google (www.google.com) first and their accessed other links provided by Google. The search behaviour tends to indicate that the learners considered Google as a gateway to search for more specific information or it is an ingrained habit for those learners. One of the participants expressed their opinion that 'Google made her life easy and convenient' (#333…). The following note is the original transcription of the participant.

Figure 5.3 Evidence from the participants

Specifically, the Google effect is spread over the world in that people [learners] are using the Internet as a personal memory bank (Sparrow, 2011; LeMind, 2017). To clarify this point, the learners pay much attention to finding sources of information rather than to gaining insights into that information (e.g., Sparrow, 2011; Lian & Sangarun, 2017) as Google search engine offers (or just hints) a list of

websites and allows people to choose information as they desire. In the same line as Wimber's (2015, as cited in Roberts, 2015) assertion in his blog, the Google Effect "*makes us good at remembering where to find a given bit of information, but not necessarily what the information was. It is likely to be true that we don't attempt to store information in our own memory to the same degree that we used to, because we know that the internet knows everything.*" Whether the participants visited the Google search engine with that intention or not, this search engine was led them to manage their own interests and might cast new light on making meanings of a real world someway.

In short, the learning processes of the participants at this research site share some similarities to many previous studies (e.g., Dabbagh & Kitsantas, 2012; Kitsantas, 2013; Zimmerman, 2000; Dabbagh & Kitsantas, 2011; English & Kitsantas, 2013). These aforementioned studies were conducted along the same line and claimed that learning environments and features of teaching fostered learners to constantly develop responsibility and motivation to keep learning. However, not all the participants were capable of self-regulated learning. Some of them followed their project partner's idea because they could not maintain concentration on the project. Many of them explored websites and visited social networkings in order to release a negative feeling in learning.

5.6 Self- Efficacy in Education

Self-efficacy of this study refers to a learner's high motivation and strong belief in their ability to accomplish learning goals. In respect of the qualitative findings, a majority of the participants was likely to spend an attempt to conduct the project with their strong positive belief in their ability to complete a given task. Regarding

Bandura's (1994) concept of self-efficacy, a learner's belief in his/her own abilities to succeed in undertaking a specific (learning) task. Hence, self-efficacy is considered as one crucial factors in leading the learner in [an online/ blended learning] class to achieve success. Several studies (e.g., Liang & Tsai, 2008; Chu & Tsai, 2009; Wu, et al, 2006; Thompson et al, 2002) have shown that learners make their effort to complete the tasks. Due to nature of the course at the research site, the learners performed to navigate information through the Internet. With regard to learners' self-efficacy of this current study, it might be relevant to academic self-efficacy and Internet-based learning (Tsai, Chung, Liang, & Tsai, 2011) as the learners performed the interplay between the Internet navigation and learning in online settings. Consequently, the learners could attain a mastery of the Internet knowledge as well as a content of specific interests.

Likewise, a majority of the learners had a strong growing belief in project completion. For example, the learners interacted well with various academic sources as well as were engaged in social networks such as Facebook live chat. Examples of academic self-efficacy (Tsai, Chung, Liang, & Tsai, 2011) of the learners could be shown through search behaviour.

Oct[#302026]
I knew how to work on the cloud when I was in third year. I enrolled a selective course namely CALL . My teacher introduced the cloud drive to me. At that time, I used OneDrive and Google Drive. At last, I prefered working on the cloud of Google because I was easy to use and it provided many add-ons. It was easy to instore. When I turn on my computer, I firstly accessed Facebook and read what was going on there. Then, I chatted with my project partner via a live chat on Facebook. My work was shared with my project partner on the cloud drive. I shared my work with my teacher and my friend because it saved my time to revise my work. Specifically, I saved my time to revise because when my project adviser gave me comments I could change them immediately. When I did not understand her comments I often chat with her on the live chat box on the Google Slide. My speaking skill tended to be accepted because I loved speaking. I read and speak it out immediately.
Oct [#302009]
My teacher suggested me to work on the cloud drive. At the beginning I did not like working on the cloud. I realized that doing on the cloud was useful when I forgot my laptop. Subsequently, I worked on the cloud. I also added add-on from Google products (free download) such as Google translation. I normally accessed Google Translation when I needed to know meanings of the words. It was the must have application tool of my add-on icon.

Figure 5.4 Examples of academic self-efficacy (ibid, 2011)

As can be seen from the above figure (Figure 5.6), two learners' online search actions provided compelling evidences supporting how they developed their academic self-efficacy (ibid, 2011). Both of them performed an ability to collaborate online by means of a synchronous chat on assignments for their term project and managed online information. Pink ellipses from the participants #302026 and #302009 were obviously shown, for instance. Furthermore, the evidence also revealed a remarkable ability of learners to conduct several online navigation tasks as presented with blue ellipses in the previous figure (Figure 5.4). This evidence would support that the learner's self-efficacy could work well when they employed their self-regulated learning strategies: prepare own learning and execute a plan to study.

5.7 Summary

Learners' PLEs play an important role in learning organization. The PLEs provides connections between human resources and non-human resources. That is, one PLE contains an assemblage of information that fit her/his requirements. Also, this study confirms that learning exists when the learner needs as well as make use of technology to work collaboratively. Furthermore, a critical concept of a learner's thinking is computational thinking. It enables the learners to solve academic problems by making use step-by-step solution.

CHAPTER 6

CONCLUSION AND IMPLICATIONS

6.1 Introduction

This chapter presents values of the study. It includes four main sections. First, it begins with the value of the study. It is then followed by implications of the study. Third, strengths and limitations of the study are described. It ends with suggestions for further research.

This study demonstrates the potential ability of learners in pursuit of learning objectives to self-organized learning. In other words, self-organization is possible, and arguably, desirable, as we have seen in this current study. All participants of this study achieved the learning objectives. They finished their project which was generated in their own way with minimal guidance from their teacher. This situation proved that self-organized learning existed and was useful for learning development.

In detail, participants tended to know how to undertake research tasks as well as deal with language difficulty. Discoveries tended to happen in a way of negotiation or incidental search. The participants might ask for some help from friends and some [ideally more knowledgeable persons] might demonstrate how to complete the tasks. They finally reached an outcome of learning tasks. In short, learners can manage and organize themselves.

Moreover, this study supports the idea of directional-instruction. Minimal intervention might be better to allow learners to discover new knowledge. At present, knowledge is available and accessible. Consequently, the learners could move themselves to a "just-in-time education", in which they could search for information from the Internet or access online communities to find solutions, as can be seen from the qualitative findings (cloud tags and PLEs).

Likewise, a do-it-yourself (DIY) education is vividly outstanding. PLEs of each learner provide an insight into how people create a pathway of learning to suit their (learning) requirements. Each of them becomes a content creator. In other words, the findings of the study encourage learners to initiate new developments in the learning system.

Besides, a focus of this study firmly rejects 'one-size-fits-all' belief. Each learner perceives the world differently. Then, it is impossible for all learners to have the same degree of being known.

Hence, this current study would reform thinking about pedagogical aspects, and the learning system development at all levels.

6.2 Summary of the Study

Four factors influencing EFl learners' decision-making processes as they navigate the Internet or approach other resources for learning are: 1) online information search strategies, 2) a research-based course, 3) freedom to learn, and 4) academic mindsets.

6.3 Implications of the Study

The research findings indicate some critically important aspects that are particularly relevant to decision‑making amongst EFL learners. In particular, they reveal that learners have various ways to meet their learning needs. One learner, for example, prefers working with peers while another favours taking practice worksheets into a quiet corner. The following list shows theoretical and pedagogical possibilities.

6.3.1 Theoretical implications

This study was underpinned by constructivist philosophy which deals with the cognitive growth of learning. Learning systems are necessarily organized by learners because the learners themselves know and understand what they need. A good example of adjusting learning activities is the Hole-in-the-Wall experiments (Mitra, 2010), and the Kalikuppam experiment (Mitra & Dangwal, 2010). How are these aforementioned experiments applicable to this current study? As can be seen in the Hole-in-the-wall experiments, learners created their preferred environments while completing a learning task. Each learner owned a personal learning environment that was adapted to their academic needs and learning preferences hence Sugata Mitra's (2010) famous direct quotation-- "*There's a space between order and chaos where something strange happens, the kind of environment where dust devils form. If you create a chaotic learning environment for children with just the right amount of chaos, spontaneous order occurs*." To interpret this idea, self-organized learning environments not only trigger a feeling of curiosity but also enable a voyage of self-discovery to happen. The learners worked together to search for more insightful information and present their understandings [or findings]. The creation of chaotic learning environments is similar to drawing a mind map (PLE) as we have seen a

number of points that disrupt each other. In other words, multiple connections of different illustrations (e.g. numbers, photos, and marks) and thoughts (e.g. concepts, attitudes, and dispositions) are interconnected, whereby the principles of the rhizome-
-connection, heterogeneity, multiplicity, signifying rupture, cartography and decalcomania ("Deleuze & Guattari on the rhizome", 2018).

Learners generally arrange [flexible] concepts and ideas in their head. The PLEs are generated dynamically through a process of reasoning. For this to happen, it is necessary for all learners to control a considerable number of variables that influence learning such as self-efficacy, volition, and cognitive strategies (Panadero, 2017).

Arguably, learners' flexible concepts are similar to a chaotic state within the network of human thinking systems. In other words, the term 'rhizome' is best described as the state of learner's thinking systems because it consists of innumerable numbers of connections of thought (e.g. presuppositions). In personal learning environments, a rhizome forms assemblages--including groups of people, various sources, and network services and so on. In this view, the rhizomatic perspective exclusively reveals how knowledge can be constructed within an individual. Learners can create and construct their knowledge by negotiation with different social communities. They are also engaged in a collaborative working context where learning exists in a wide range of knowledgeable people. The growth of an individual's knowledge might depend upon the learner's background that has accumulated by acquiring and learning as well as existing in their particular interests upon learning contents. That is, each learner requires a large number of resources,

feedback, and concepts. The manifold factors could facilitate the learner to search for possible solutions. Every stage of volition is chaotic.

The Hole-in-the-Wall analogy might throw new light on a chaotic learning system. Actually, learning in a traditional educational system needs to follow what education policymakers and teachers have arranged (e.g. syllabi, class activities, as well as assessment and evaluation). Sequences of learning activities are organized through a whole academic semester. Likewise, "*the order*" in Mitra's (2010) direct quotation, set up learning stations in a wall. However, his learning system was different from others in the general education system. He allowed his students [underprivileged kids in South Delhi, India] to discover new knowledge without supervision. He found that they could cultivate [basic] computer literacy, skills, and good relationships, thus ensuring that the children constructed an educational experience. In a traditional context, order is expected to prevail in the form of course syllabi and lesson plans. It is further assumed that all teaching and learning requires such ordered planning. In our case, the principle of discovery was unlike a traditionally planned course. The starting point consisted of a chaotic environment with little or no planning which, nevertheless, led to success. By the time, the objectives of the course were reached; chaos had given a way to a form of personalized order which enabled success to occur. This seems to be a confirmation at the university level of primary search on self-organized learning environments, and hints at the possibility that self-organization could be universally valuable. If this is the case, then it also reinforces the view that learning is a highly personal activity that requires precise (i.e., personalized) intervention for best results. It is unlikely under the circumstances that a statistically-modelled, one-size-fits-all approach would be

optimally effective. Instead, entirely personalized systems will meet more effectively the needs of learners provided that learners are familiar with how to make good pedagogical choices (i.e., choices that are especially good for them). As we have seen, such choices derive from the availability of a large number of options from which to choose that maximise their freedom to make correct choices. What does this mean in terms of how people learn? It is clearly connected with teaching and learning.

6.3.2 Pedagogical Implications

Regarding mobility in ubiquitous information environments, education stakeholders such as teachers, education policymakers, and learners, take advantage of using technologies to explore the world around them and develop their own solutions to hardships while working in collaboration with others (peers, colleague). It is really c hallenging for the education stakeholders to provide opportunities and to seek out possible ways to encourage learners to think critically, and sustain lifelong learning for the learners [to some degree]. The findings of this current study demonstrated the importance of self-managed learning, and self-organised learning in that they provided the necessary elements for critical thinking, a lifelong learning.

Notably, it became clear that a personal learning environment (PLE) could foster a learner's sense of responsibility for undertaking learning activities. Making use of a PLE in learning also encourages the learner to develop a learning plan and implement learning strategies to meet task requirements (Johnson & Davies, 2014; Juarros, Ibanez, & Crosetti, 2014). To interpret the above idea, the PLE encourages learners to customise a personalised learning environment to learn and work autonomously and collaboratively. It is really essential for all learners to become accustomed to the [learning] environment. Observing the current study, almost all

learners felt confused and bewildered in the [learning] environment at the beginning. It would be particularly helpful, if at the beginning there were some training or guidance in constructing environments. For example, in the initial stage one might practice using a discussion board, or learners could be guided on how to work on collaborative documents (e.g., Google documents, and the Google calendar tool).

6.3.3 Methodological Implications

The learners in this study often used Facebook to present themselves, interact with people, and establish or maintain connections with others. In order to encourage them to organize and manage content for personal productivity, online bookmarks (e.g., delicious.com), media resources, and calendars could be introduced. These social networking services and applications can be used as communication and productivity tools.

These web tools might help the learners to adjust online information as well as to be engaged in self-organized learning systems. Besides, a collaborative workspace, a wiki for instance, may be essentially important for the learners. Such wikis allow learners to connect to more knowledgeable people as well as get involved in basic sharing and collaborative activities because a discussion board (e.g., a wiki) is a comfort zone where the learners can develop plans and strategies to achieve personal goals. In short, the web tools are particularly suitable for promoting an active learner in the processes of learning.

6.4   Strengths and Limitations of the Study

Data in the current study were collected from various sources including questionnaires (in both the-pretest-period and the-posttest-period), a semi-structured

interview, students' written diaries, clips, and mind maps. The triangulation of these multiple sources of data helps to understand the phenomenon under examination. The questionnaire was used to gain an insight into the learner's online search strategies while the semi-structured interview was employed in order to gain a more comprehensive understanding of how the learners controlled their learning systems as well as discovered new knowledge. Besides, the student's written diaries also provided deep information on how the learners organized time, evaluated online information, and arranged learning procedures. As for clips and mind maps, these two artifacts enabled the researcher to examine learners' self-organized learning systems. Arguably, triangulation of data collection processes made the study more rigorous and the findings more reliable.

Three main limitations of this study seem to exist:

1 Limitations of the participants

The sample of the study was selected from fourth-year English majors in only one university. That is, the sample population seemed small and all learners were from the Faculty of Humanities and Social Sciences in one specific university. Consequently, it is difficult to generalize the results. Nevertheless, this enabled the identification of in-depth is true.

2 Limitations of data collection instruments

There were two main kinds of data collection instruments. Regarding the quantitative data collection, only one questionnaire was used. As for the qualitative counterparts, there were clips, learner's mind maps (PLEs), students' written diaries, and the semi-structured interview. Some items in the questionnaire

seemed unsuitable for the context of the research site. The findings, then, might not be applicable to all undergraduate learners in a Thai university.

3 Limitations of ethical considerations

The obtained data was a good example of how learners arranged their self-organized learning systems. It was impossible to know the content and preferences of learners' PLEs at all times. Such information would have been useful for the current study and in the meantime ethics of conducting research were carefully considered.

6.5 Recommendations for Further Study

On the basis of the findings from this study, the following might be applicable to further studies. First, this study was a first attempt to trace EFL learners' trajectories through web tools and social networking services across personal learning environments in one course at a tertiary level. A large-scale replication is essentially needed.

Second, the participants in this study were fourth-year English majors. As for further study, research should focus on the learning systems of students in other fields and at different levels in their courses of study.

The questionnaire used in this study dealt with online information search strategies. In further studies, other aspects should be investigated such as motivational beliefs.

Lastly, many studies about personal learning environments and/or interactive learning environments posit that the PLE is a platform for both integrating formal and informal learning as well as fostering self-regulated learning (i.e. Dabbagh &

Kitsantas, 2011; Juarros, Ibabez, & Crosetti, 2014). Any further study might focus on creating a database of PLEs to provide other learners with possible ideas about how to achieve their goals.

This study might be a starting point for improving learning environments and encouraging educational stakeholders to rethink and reform the education system at all levels. Hopefully, the aforementioned may contribute to the body of research regarding self-organized learning as well as technology-supported learning.

APPENDIX A

Online Information Search Strategy Inventory (OISSI)

This inventory is deployed in this current study in order to keep records of EFL learners᾽ profiles in terms of cognitive and metacognitive strategies used while searching online information.

Directions: Please read each specific question carefully and mark (/) the response which represents your considerations in the space provided. The value of each point means:

+1 = the item **is congruent** with the objective.

 0 = the item **is not** congruent with the objective.

 1 = uncertain about this item

Category[1]	Statement	Result of Analysis			Comments
		-1	**0**	**1**	
CON	1. I know how to use a web browser, like IE (Internet Explorer), Firefox or Chrome				
	2. I look through the titles or hyperlinks in order to catch the main ideas in a webpage.				
	3. I know how to utilize advances-search functions provided by search engines.				
	4. I know how to login a specific website with its URL.				
SMI	5. I usually think about what keywords I can use in advance.				
	6. I select main ideas provided in each webpage as possible as I can.				
	7. I look through titles or hyperlinks in a web in order to catch major information.				

---

[1] CON = Control; SMI = Selecting the main idea; EVA = Evaluation; PUT = Purposeful Thinking; DIS = Disorientation; T&E = Trial and Error; POS = Problem Solving

Category	Statement	Result of Analysis			Comments
		-1	**0**	**1**	
EVA	8. I think of how to present and organize the data that I have obtained from the website.				
	9. I keep on evaluating the relationships amongst the information searched from the website.				
	10. I compare information that has been gathered and collected from different websites.				
	11. I decide if the information provided in a website is notable for reference.				
PUT	12. I usually understand the goals of information retrieval before starting my online searching				
	13. I keep on reminding myself of the purpose for searching online.				
	14. I think of how to utilize the searched information				
	15. Sometimes, I pause to think about what information is still lack.				
DIS	16. I always feel nervous when I search information of the Internet.				
	17. I do not know how to start my online searching.				
	18. I always feel lost while searching information on the Internet.				
	19. I do not know what to do when I search information on the Internet.				
T&E	20. I try some possible entrance websites when I cannot find enough information.				
	21. I try other databases when I cannot get any information in one database.				
	22. I try some other search engines when my search is not successful.				
POS	23. I usually give up searching when I come up with unsolved problems.				
	24. I think of some solutions when I am frustrated with searching problems.				
	25. I do my best to resolve any problem occurred during a searching.				

(Adapted from Tsai, 2009)

Semi-Structure Interview

This semi-structure interview is used in order to examine the search strategies for online information EFL learners used in reaching a decision about identifying trajectories in the PLE creation.

Directions: Please read each specific question carefully and mark (/) the response which represents your considerations in the space provided. The value of each point means

+1 = the item **is congruent** with the objective.

Interview Questions	Result of Analysis			Comments
	-1	**0**	**1**	
1. How long have you been using the Internet?				
2. Did you have any plan before undertaking online searching activity?				
3. Did you have any experience in creating a personal learning environment? If yes, in what ways? If no, why not?				
4. Do you believe that the PLE will enhance your learning processes? Why?				
5. Do you like your PLE? Why?				
6. How do you feel about your PLE?				
7. If you face some problems during your online searching, what will you solve the problems?				

Interview Questions	Result of Analysis			Comments
	-1	0	1	
9. What website have you visited firstly?				
10. Have you obtained better understandings about what your retrieved? If yes, in what ways? If no, why not?				
11. Do you think the PLE help you increase awareness of information correctness?				
12. Do you think the PLE allow you to study individually?				
13. What else would you like to say about the PLE?				

APPENDIX B

IOC Analysis for online information searching strategy inventory (OISSI)

Items	Experts					ΣR	IOC $=\Sigma R/N$	Result of IOC Analysis
	1	2	3	4	5			
Q1	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q2	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q3	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q4	+1	-1	+1	+1	+1	3	$\frac{3}{5} = 0.6$	/
Q5	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q6	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q7	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q8	0	+1	+1	+1	+1	4	$\frac{4}{5} = 0.8$	/
Q9	+1	-1	+1	+1	+1	3	$\frac{3}{5} = 0.6$	/
Q10	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q11	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q12	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q13	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q14	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q15	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q16	+1	+1	0	+1	+1	4	$\frac{4}{5} = 0.8$	/
Q17	+1	+1	0	+1	+1	4	$\frac{4}{5} = 0.8$	/
Q18	+1	+1	0	+1	+1	4	$\frac{4}{5} = 0.8$	/
Q19	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q20	+1	-1	+1	+1	+1	3	$\frac{3}{5} = 0.6$	/
Q21	+1	-1	+1	+1	+1	3	$\frac{3}{5} = 0.6$	/
Q22	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q23	0	+1	+1	+1	+1	4	$\frac{4}{5} = 0.8$	/
Q24	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/
Q25	+1	+1	+1	+1	+1	5	$\frac{5}{5} = 1$	/

APPENDIX C

Semi-Structured Interview

1. How long have you been using the Internet?

   คุณใช้อินเตอร์เน็ตมานานเท่าใด

2. Did you have any plan before undertaking online searching activity? (PUT)[1]

   คุณวางแผนก่อนที่จะทำกิจกรรมการสืบค้นหรือไม่

3. Did you have any experience in creating a personal learning environment? If yes, in what ways? If no, why not?

   คุณมีประสบการณ์ในการสร้างสิ่งแวดล้อมการเรียนส่วนบุคคลหรือไม่ หากใช่เป็นใน แนวทางใด และหากไม่ใช่เป็นแนวทางใด

4. Do you believe that the PLE will enhance your learning processes? Why?

   คุณเชื่อว่าสิ่งแวดล้อมการเรียนส่วนบุคคลช่วยกระบวนการเรียนของคุณหรือไม่ เพราะเหตุ ใด

5. Do you like your PLE? Why?

   คุณชอบสิ่งแวดล้อมการเรียนส่วนบุคคลของคุณหรือไม่ เพราะเหตุใด

6. How do you feel about your PLE?

   คุณมีความรู้สึกอย่างไรเกี่ยวกับสิ่งแวดล้อมการเรียนส่วนบุคคลของคุณ

7. If you face some problems during your online searching, what will you solve the problems? (T&E)[2]

   หากคุณประสบปัญหาระหว่างการสืบค้นออนไลน์ คุณจะแก้ไขปัญหาอย่างไร

8. What is your most favourite URL? Why? (CON)[3]

   ที่อยู่เว็บไซต์ใดที่คุณโปรดปรานที่สุด เพราะเหตุใด

---

[1] purposeful thinking
[2] trial and error
[3] control

9. Have you obtained better understandings about what your retrieved? If yes, in what ways? If no, why not? (EVA)[4]

คุณได้รับข้อมูลที่ดีขึ้นเกี่ยวข้อมูลที่คุณได้สืบค้น หากใช่ เป็นในแนวทางใด หากไม่ใช่ เพราะเหตุใด

10. Do you think the PLE helps you increase awareness of information correctness?

คุณคิดว่าสิ่งแวดล้อมเฉพาะบุคคลช่วยเพิ่มความตระหนักของความถูกต้องของข้อมูล หรือไม่

11. Do you think the PLE allow you to study individually?

คุณคิดว่าสิ่งแวดล้อมการเรียนเฉพาะบุคคลช่วยให้คุณเรียนรู้ได้เพียงเฉพาะบุคคลหรือไม่

12. What else would you like to say about the PLE?

คุณมีความเห็นเพิ่มเติมอื่นใดเกี่ยวกับสิ่งแวดล้อมการเรียนเฉพาะบุคคลของคุณ

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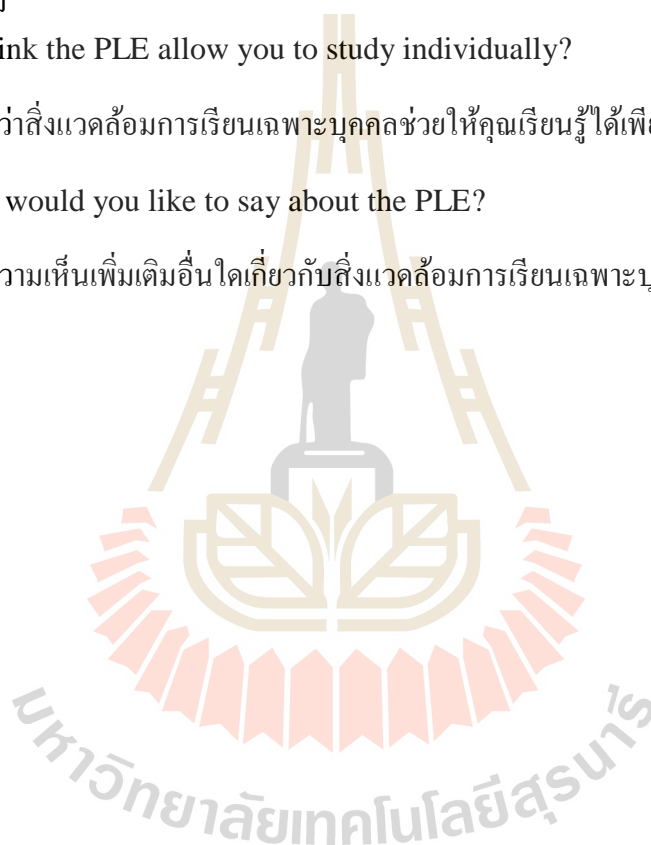
[4] evaluation

APPENDIX D

Bar Charts and Histograms

First category SMI Three bar charts (from items number 1 to 3) will be presented, respectively.

(1) I usually think about what keywords I can use in advance.

(2) I select the main ideas provided on each webpage as well as I can.

(3) I look through titles or hyperlinks in order to catch each major information.
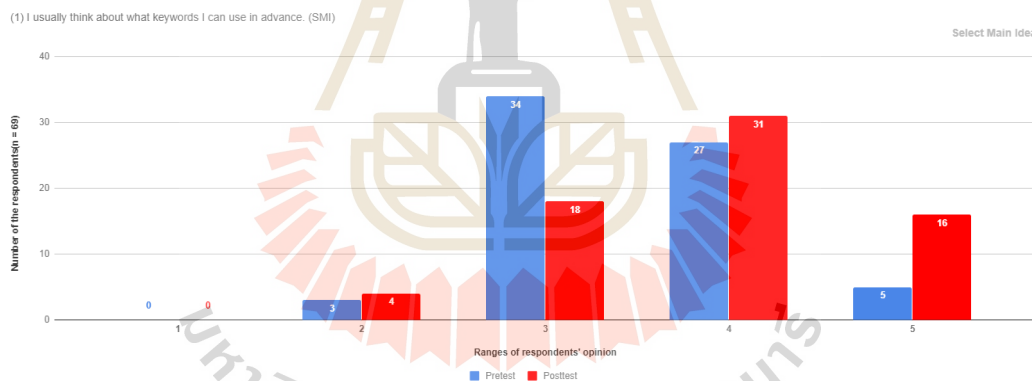
Bar Chart 1: Select main idea of the item 1

The bar chart gives information about the scores of the pretest and the posttest about search online strategies of the first item of 'select main idea' category (SMI).

With respect to the pretest of the above bar chart (Bar chart 1), there is an upward trend at the neutral range of the chart. Followed by the fourth range of the

opinion, twenty-seven of the respondents expressed that they could plan to search online information by thinking about using keywords to search more information. On the other hand, at the highest range, a sharp drop can be seen (n = 5). At a lower range, a few of respondents can be found. None of them is at the lowest range.

As for the posttest, an upward trend is noticeable at fourth range (n = 31). Two bars of third and fourth ranges seem very much close in terms of a number of respondents--eighteen of them were in the third range followed by seventeen respondents were at the highest range.

Comparing the trend between the pretest and the posttest, the trend of the posttest looks more growing than that of the pretest. A number of respondents at higher ranges (fourth and fifth ranges) shows that the respondents at the posttest could make a plan when navigating the Internet, (n = 31, 16, respectively). A peak raising at the highest range and a downward trend at the third range of the posttest might represent notable information about an ability of the respondents to think and plan. Overall, it could be claimed that more than half of the respondents (n = 48) use keywords effectively.
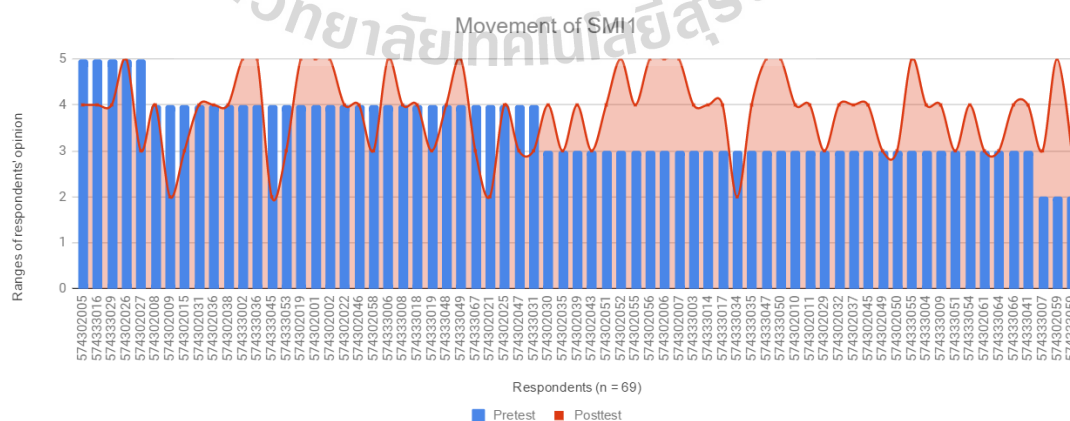
Histogram 1: Movement of SMI1

In order to clarify a picture of the movements of respondents, the above histogram (Histogram 1) reveals that a growing trend of responses is noticeable. The red area shows an upward trend of the posttest. Twenty-six of the respondents stayed in higher ranges of opinions while thirty-five of them were at the same range and the rest chose lower range. It could be claimed that some respondents could perform a task in using keywords efficiently.
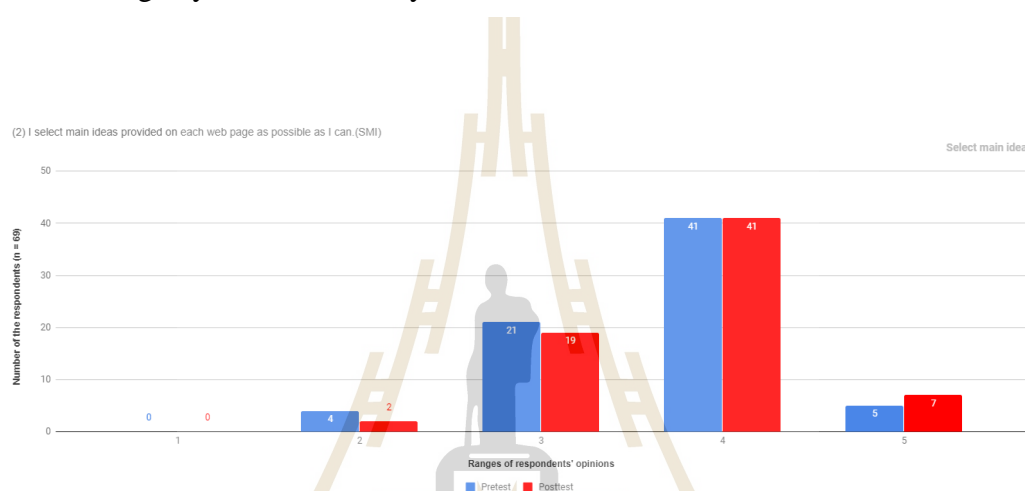
Bar Chart 2: Select main idea of the item 2

According to the chart (Bar chart 2), both pretest and posttest data relate to the category of selecting main ideas. As for the pretest, exponential growth can be seen in the fourth range (n = 41) and followed by neutral level (third range). Less than half of the respondents (n = 21) stay in the neutral range and four of them can be found at a lower range of the opinion. Five of them were found at the highest range of the opinion. It could be claimed that a majority of respondents might have enough ability to choose links by reading a main idea of the webs.

As for the posttest, the trend in the fourth range shows the same stable (n = 41). At a neutral range, the respondents, in terms of number, are less than those of the pretest. Two of them moved to lower ranges of opinions (see also Histogram 2). It

also indicated that the majority of respondents (more than half of the respondents) could demonstrate a remarkable ability to read and find the main ideas of the webs.
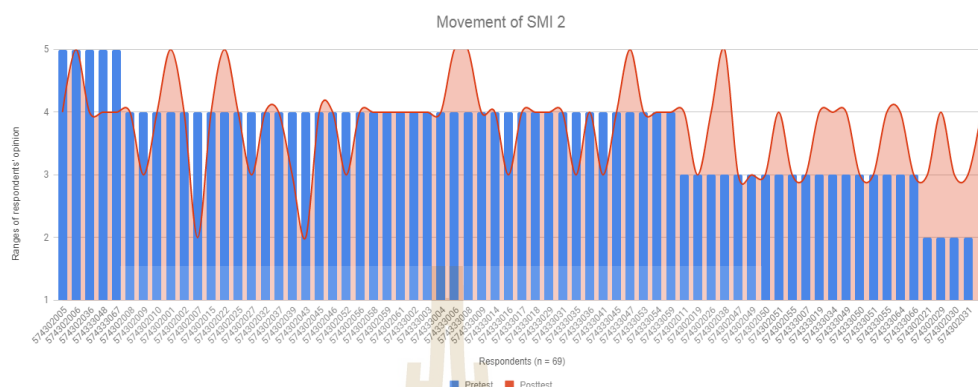
Histogram 2: Movement of SMI2

The above histogram (Histogram 2) shows movement of responses dealing with the category of selecting the main idea. As can be seen, a red area frequently appears in the fourth range. This means that a great number of respondents (n = 41) employed a strategy to find main ideas while retrieving online information. Remarkably, those who stayed in the highest range of the pretest moved downwards. There was only one kept staying in the same range. There were six respondents moved upwards from the fourth range to the fifth one (n = 5) and third range (n = 1). In the fourth range, thirty-three respondents remained at the same range while eight of them moved downwards. Overall, a great number of respondents were in higher ranges of opinions. A majority of them, therefore, might have enough experience in employing a strategy of selecting main ideas.

(3) I look through titles or hyperlinks in a web in order to find each major information. (SMI)   Select Main Idea
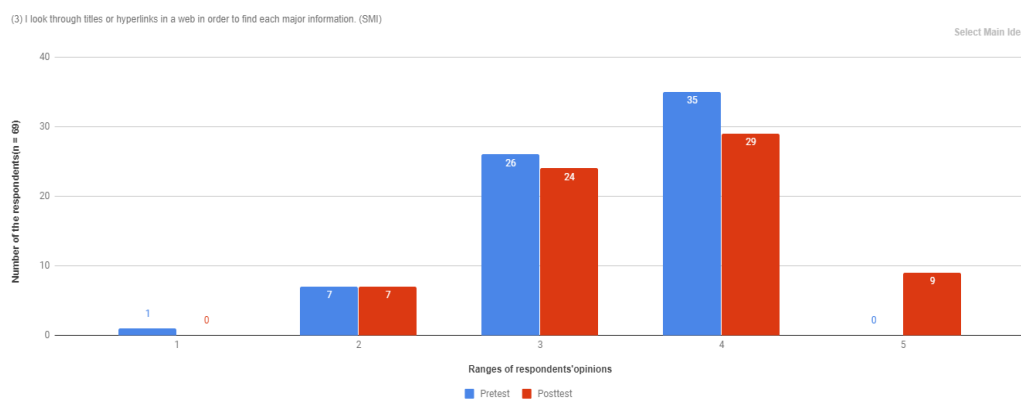
Bar Chart 3: Select main idea of the item 3

According to the chart (Bar chart 3), it provides information about making a meaning examining the main idea of the webs. As for the pretest, a steady increase is remarkably seen in the fourth range of the pretest (n = 35) and followed by twenty-nine respondents in the neutral range. There is not much different in terms of numbers of the respondents in the lowest ranges and the highest range. In the highest range, none of them is seen.

With respect to the posttest, many respondents (n = 29) are in the higher range (the fourth bar). Though the trend of both bars (third and fourth) seems lower than that of the pretest, numbers of respondents in the highest range increases remarkably. It should be noted that a majority of the respondents could perform well in intensive reading skills--finding main ideas.

In short, an outstanding increase can be seen at higher levels fourth and fifth ranges) in both the pretest and the posttest. A rising trend in the posttest is noticeable (see also the following histogram, Histogram 3). As can be seen, responses from the fourth range to the lowest one in the pretest were changed. The range also indicates an

upward trend. This supports the above claim--a majority of respondents read through titles, and hyperlinks in order to search for more information.
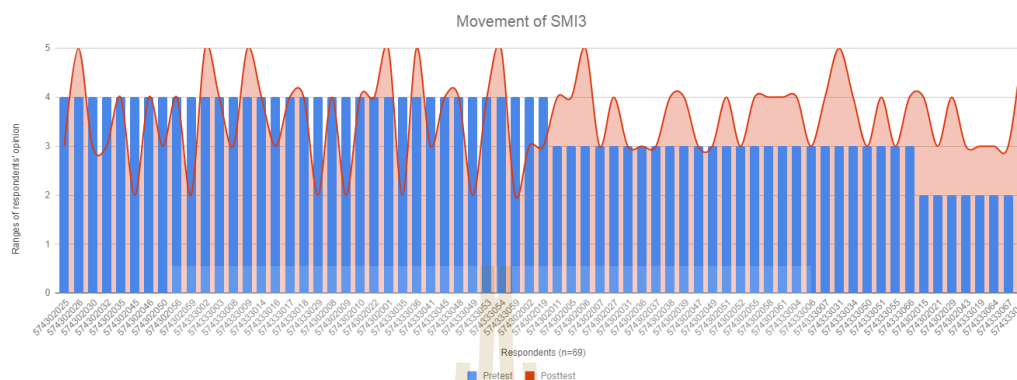
Histogram 3: Movement of SMI 3

According to the above histogram (Histogram 3), the histogram reveals that a growing trend can be obviously seen from the neutral range to the lowest one. That is, a majority of respondents (n = 24) moved upwards while seven of them kept stable. By contrast, a fluctuation of the trend is found in the fourth range. Six respondents reached the peak of the trend while twenty-nine were shown in a downward trend. Overall, a majority of respondents might not use titles or hyperlinks to catch major information. In other words, titles and hyperlinks might not be useful for many of them to online retrieval.

The first category, in sum, provides that reading for finding main ideas is an essential skill for respondents. Keywords in web pages are important for getting major information while titles of hyperlinks might not useful for respondents.

Second category EVA: Four barcharts (from items number 4 to 7) will be presented, respectively.

(4) I think of how to present and organise the data that I have obtained from the website.

(5) I keep on evaluating the relationship amongst the information searched from the website.

(6) I compare information that has been gathered and collected from different websites.

(7) I decide if the information provided in a website is noteworthy.
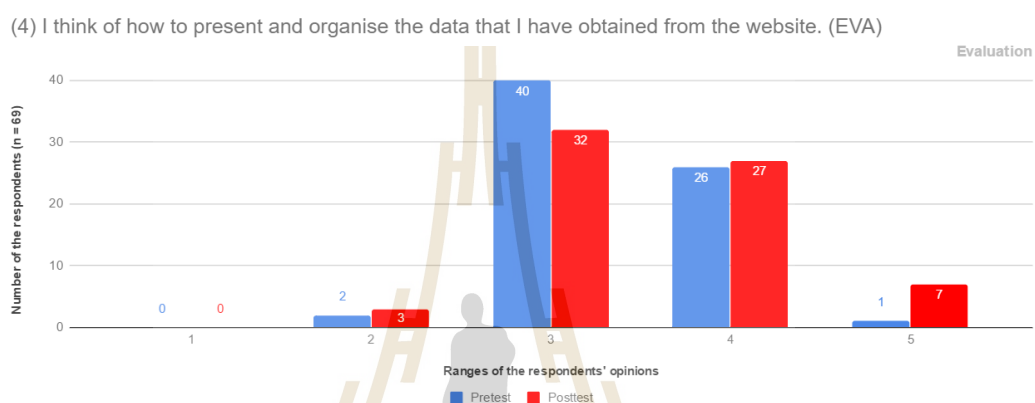
Bar Chart 4: Evaluation of the item 4

As it can be seen from the chart (Bar chart 4), it provides comparative data between the pretest and the posttest about a know-how strategy of information interpretation.

With respect to the pretest, a neutral range shows a remarkable increase (n = 40). Followed by the high range, there are twenty-six of them that expressed they might know how to arrange and interpret information. Only one of respondents can be seen in the highest range and none is found in the lowest one.

As for the posttest, almost a half of respondents (n = 32) stayed in the neutral range of opinions. Likewise, a small change in the number of respondents can be seen in higher levels (n = 27). In the highest range, a modest growth (n = 7) is shown. As can be seen in the following histogram (Histogram 4), six respondents in the highest

range were from the fourth range (n = 4) and the third range (n = 2). Only one kept

stable in the same range.

Overall, a majority of the respondents (approximately 34) might have an

ability to arrange online information. Data in both pretest and posttest might indicate

that almost all respondents have performed this strategy very well when navigating

the Internet because there are a few of them found at the lower and the lowest range.

None is found in the lowest in both of the tests.
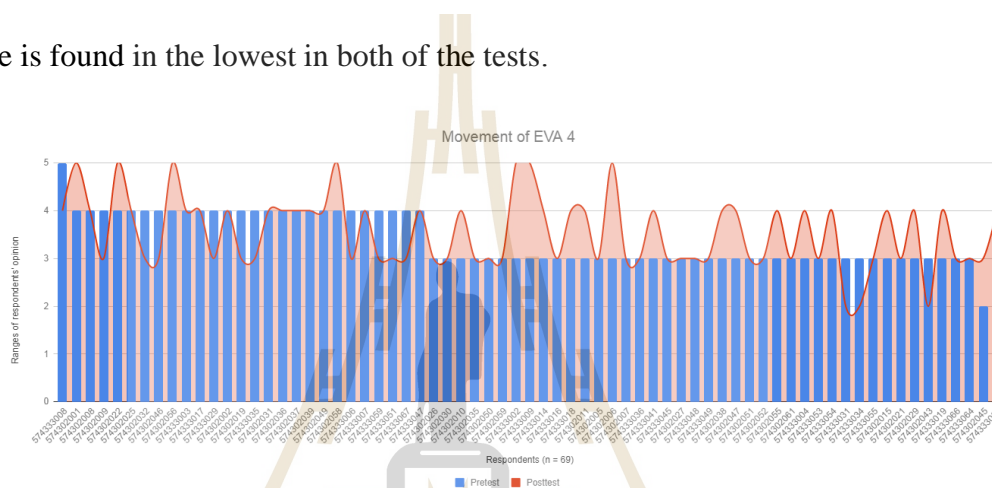
Histogram 4: Movement of EVA 4

The above histogram (Histogram 4) shows how much respondents developed

evaluation strategies. As can be seen, the ratio of growing is much more than moving

downwards. It could be argued that many respondents (approximately n = 52)

considered a way to use the obtained information from the websites because a red area

moderately covers higher range.

(5) I keep on evaluating he relationship amongst the information searched from the website (EVA)
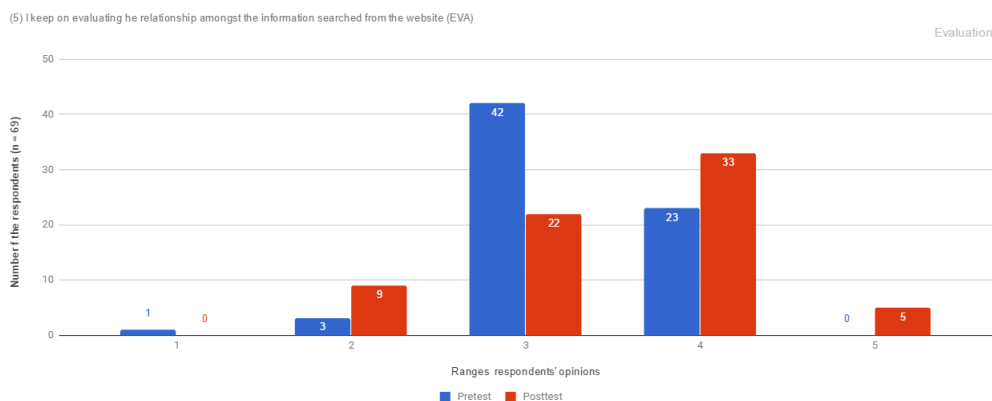
Evaluation

Bar Chart 5: Evaluation of the item 5

As can be seen from the above chart (Bar chart 5), it provides comparative data about evaluating online information from various sources.

With respect to the pretest, only one is found in the lowest range and a small increase appears in second level (n = 3). By contrast, an outstanding upward trend is seen in neutral level of opinions (n = 42). Then, a sharp drop falls in the fourth range (n = 23). None is found in the highest range.

As for the posttest, none is found at the lowest range of respondents' opinions. In the second range, a number of respondents becomes bigger than that of the pretest (n = 9). Comparing to the pretest, a sharp drop is obviously seen. Twenty of them moved to other ranges (see also the following histogram, Histogram 5). Focusing on the fourth range, the bar of the posttest shows an increase in numbers of respondents. At the highest range, a growing number of respondents is revealed (n = 5).
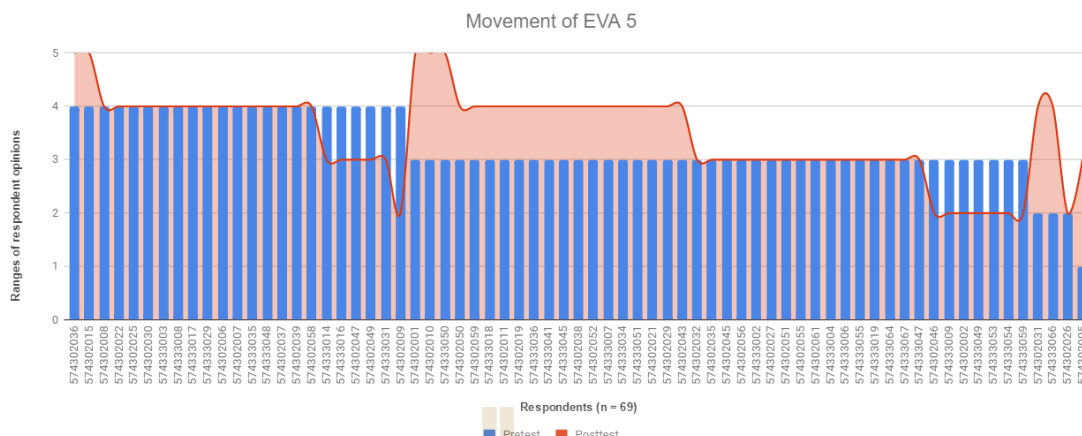
Histogram 5 : Movement of EVA 5

The above histogram (Histogram 5) reveals the movement of responses of evaluation strategies. An obvious change of responses can be seen between the fourth and the third ranges. At the fourth range, fourteen of respondents remained stable while six of them moved downwards, two went up to the second range and three of them moved to the third range, respectively. Focusing on the third range, five respondents moved upwards to the highest range. Thirteen of them went up to the fourth range. By contrast, three respondents went downwards. The overall movement shows exponential growth of the responses. It means that a majority of respondents could employ the evaluation strategy for comparing online information from the website.

Bar Chart 6: Evaluation of the item 6

According to the above chart (Bar chart 6), it provides information about evaluation strategy for searching information from various sources. The overall data of the pretest shows that many respondents (n = 39) might not be certain about how to compare information from several sources of online information. Some of them (n = 18) expressed that they could do so. Then, a group of them is in neutral level. In the highest range of the respondents' opinion, a small number of the respondents (n = 5) could perform this strategy of evaluation skill pretty well.

With respect to the posttest, a majority of the respondents (n = 31) was found in higher levels. Notably, a number of respondents the highest bar becomes bigger than the pretest (n = 10). A small drop of responses is found in lower ranges. None is found in the lowest range.
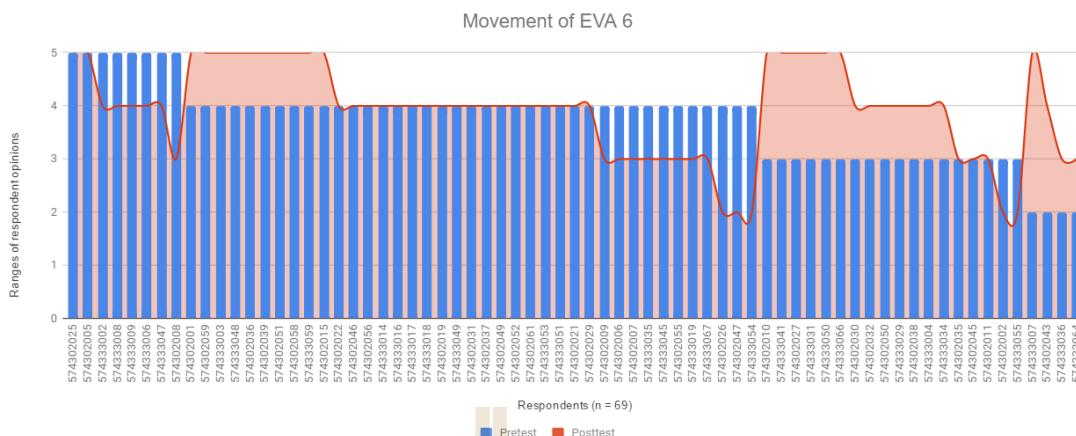
Histogram 6 : Movement of EVA 6

According to the above histogram (Histogram 6), a red area covers almost a whole range of a high level (the fourth range). Noticeably, responses in the neutral range of the pretest changed a position to higher ranges and some to the highest one. Seventeen of them remained stable while eleven of respondents moved downwards. All in a low range of the pretest moved upwards. The overall trend is moderately growing.
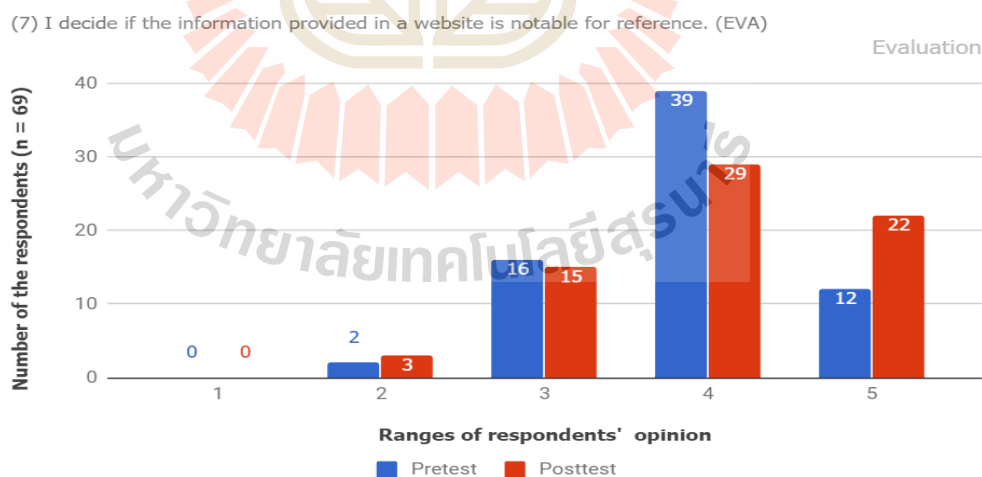
Bar Chart 7: Evaluation of the item 7

As can be seen from the above chart (Bar chart 7), it provides information about evaluation strategy in using online searched information for citation and references. The overall data of the pretest shows that many respondents (n = 39) could

have enough experience in making a decision to select online information. Some of them (n = 29) might not be sure that they could do. At the highest range of the respondents' opinion, a small number of the respondents (n = 12) had got this strategy of making references.

With respect to the posttest, a majority of the respondents (n = 29) is found at higher level of the range (fourth range). Ten of them from the pretest moved to other ranges of the opinions. Notably, a number of respondents in a blue bar becomes bigger than that of the pretest (n = 22). The other two bars (second and third ranges, respectively) are not much different than those of the pretest.

In short, the respondents of this category might have prior experience in evaluating information from various sources in the webs. Comparing the trend of both tests, a vast majority of them are found at higher levels (fourth and fifth ranges). That is, after they gain more understanding about navigating webs (by themselves), they could develop ability in evaluation strategies, for example, making a comparison, making references, and so on.
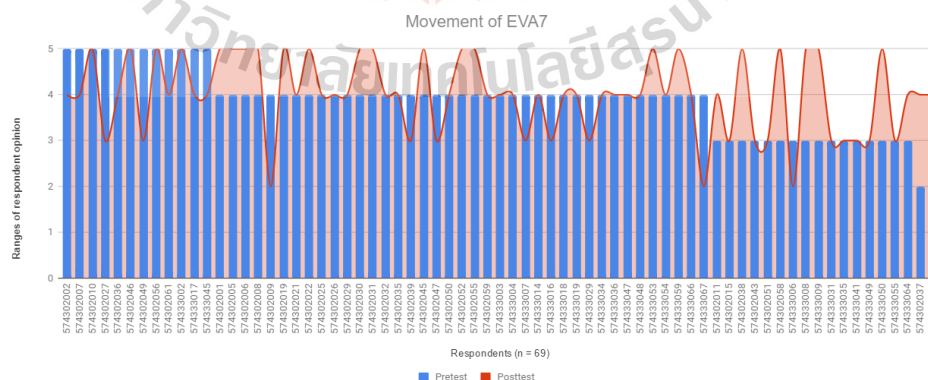
Histogram 7: Movement of EVA7

According to the above histogram (Histogram 7), a majority of responses is obviously seen in the fourth range of the pretest (blue bars) and many of them moved

upwards in the posttest. A noticeable downward trend is also found in the highest range. Seven respondents moved downwards to the third range of the posttest. By contrast, almost half of respondents expressed that they could use obtained information for making references and many of them moved upwards.

In summary, the overall movements of trends in the second category reveal that respondents could perform evaluation strategies efficiently. Many of them could make a comparison, arrange, and make use of obtained information from different sources.

Third category PUT: Four bar charts (from items number 8 to 11) will be presented, respectively.

(8) I usually understand the goals of information retrieval before starting my online searching.

(9) I keep on reminding myself of the purposes for searching online.

(10) I think of how to utilise the searched information.

(11) Sometimes, I pause to think about what information is still lacking.
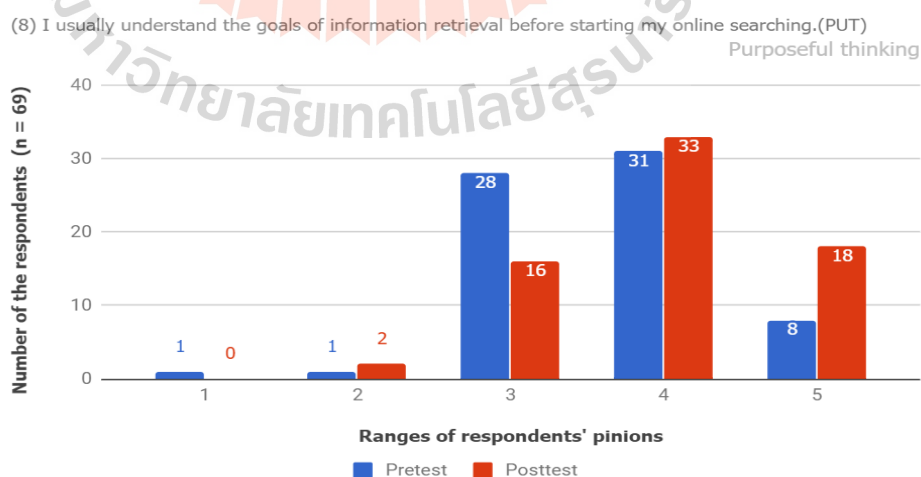
Bar Chart 8: Purposeful thinking of the item 8

According to the previous chart (Bar chart 8), it provides information about a strategy of understanding of details of the contents. With respect to the pretest, each bar of lower ranges show only one of respondents. By contrast, a peak trend can be found at neutral as well as higher ranges (n = 28, 31, respectively). At the highest range, there are eight respondents. Overall, a vast majority of respondents can be found at high range.

With respect to the posttest, a few respondents can be found in a lower range (n = 2), and none is seen in the lowest range. The growing increase is outstanding in both neutral and higher ranges (n = 16, 33, respectively). It could be estimated that a majority of the respondents could understand the goal of information retrieval. That is, they could arrange a plan prior to navigate online information. A double increase is shown at the highest range (n = 18).

To sum up, a vast majority of respondents seems to be equipped with learning skill strategy. They learn to understand learning goals and they have a plan to retrieve online information before navigating the Internet.

Histogram 8: Movement of PUT 8

According to the above histogram (Histogram 8), an upward trend can be seen in three ranges: the lowest, the second range and the third range. A vast number of
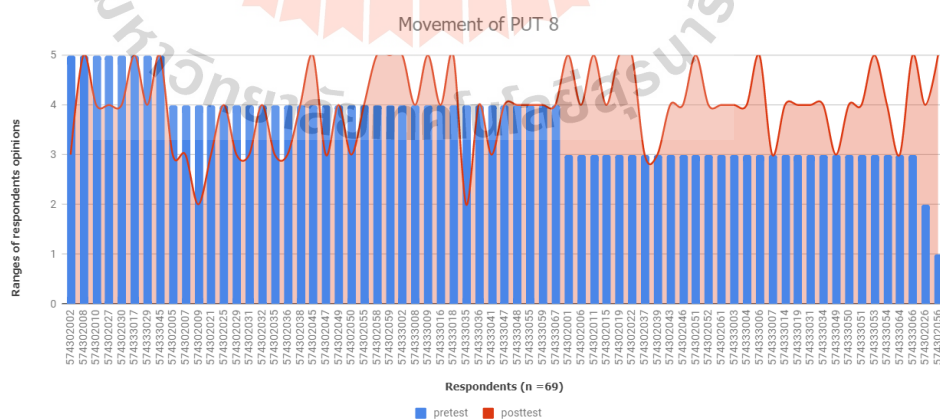
respondents of these three ranges moved upwards in the posttest. Fifteen of respondents rated their opinion very high in the posttest. In addition, almost all of them in the third range of the pretest moved upward in the posttest. That is, they found that they understand the goals of online information retrieval. By contrast, some of respondents who stayed in high ranges were found in lower ranges of the posttest. An overall movement of this histogram shows a significant increase.
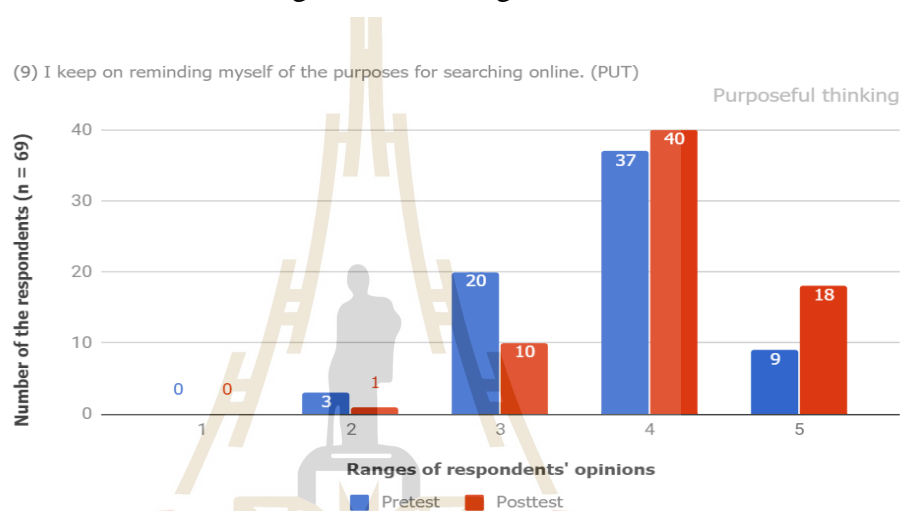

Bar Chart 9: Purposeful thinking of the item 9

According to the above chart (Bar chart 9), it provides information about comparative data in both of the pretest and the posttest of thinking strategy. That is, the respondents can use their own experience to think about and gain an insight into goals of navigation. An overall data of the pretest shows that nine respondents could recall memory of what they have experienced. Likewise, thirty-seven of them also employ past experience to navigate the Internet. In the neutral range of the respondents' opinion, twenty of them are found.

With respect to the posttest, a double increase can be seen vividly in the highest range. An upward trend is also notable in the fourth range (n = 40). According to data, two bars in higher ranges could indicate that a majority of respondents

employ thinking strategy in navigating the Internet. A downward trend can be found in the lower range of respondents' opinions--ten in the third range, and only one in the second range, respectively.

In short, the respondents could understand a focus of online search. They might be tenacious in order to reach the goal of online search.
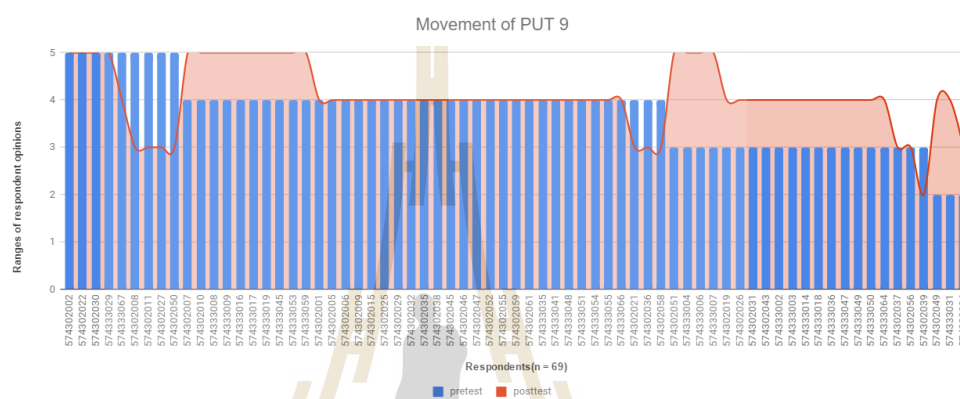
Histogram 9: Movement of PUT 9

In order to clarify the movement of purposeful thinking, the above histogram (Histogram 9) shows that a red area of responses in higher ranges of respondents' opinions seems larger than that of the blue one. As can be seen, nine respondents rated their opinion in the highest range of the posttest. Similarly, other nine respondents in the third range did as those of the fourth range. Fourteen of them in the third range also rated their opinion higher than they did in the pretest. The overall movement of responses indicates that many of respondents are in a high range of opinions. It means that most of them could recall purposes of online retrieval effectively.

(10) I think of how to utilise the searched information. (PUT)

Purposeful thinking
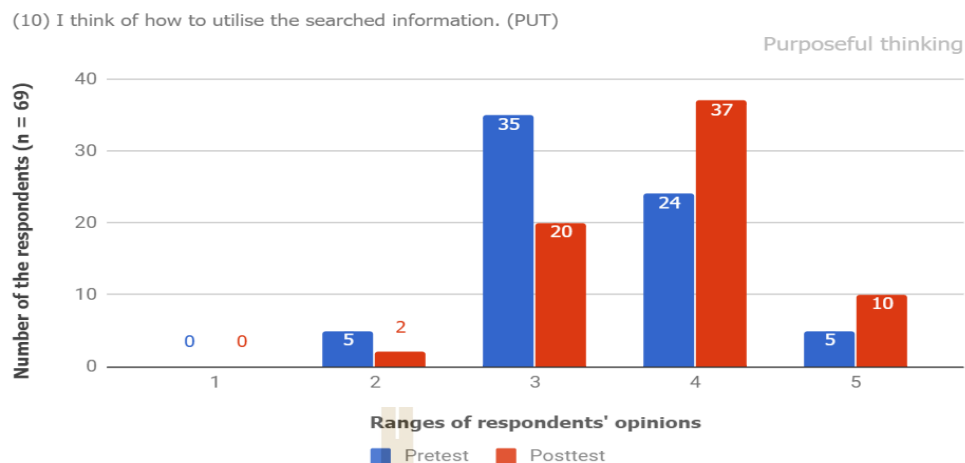

Bar chart 10: Purposeful think of the item 10

According to the above chart (Bar chart 10), it provides data about thinking strategy of both the pretest and the posttest. It could be likely a know-how strategy of online search. An overall data of the pretest presents an upward trend. It can be seen at neutral range. Thirty-five of them might know possible methods for online searching. Less than half of them are found in high ranges of the respondent's opinion--five in the highest range followed by twenty-four in high ranges. None of them is found in the lowest range.

With respect to the posttest, a doubled increase can be seen in the highest range of the respondents' opinions (n = 10). The trend in the fourth range becomes bigger than that of the posttest. Not many respondents are in both the neutral and the low ranges. It could be said that there are approximately fifty respondents could recognize a know-how strategy in online search.

The trend of the posttest becomes more growing than that of the pretest. It could be claimed that a great number of respondents could have enough past experience in online search as well as gain an insight into what they have searched.
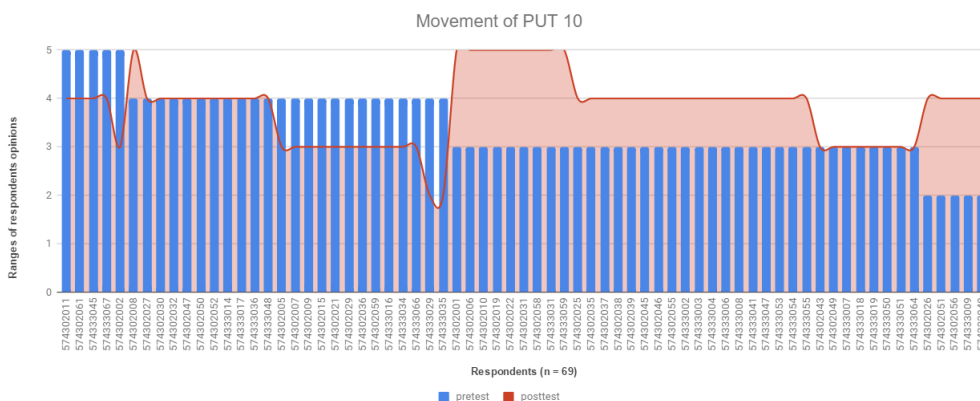
Histogram 10 : Movement of PUT 10

According to the above histogram (Histogram 10), a great number of respondents in the third range surges from the neutral level to the higher ones--nine of respondents rated themselves in the highest range and seventeen of them were in the fourth range. Therefore, an increase in numbers of respondents in the highest range is from those in the neutral level of the pretest. Half of the respondents in the fourth range remain stable while many of them goes downwards. By contrast, a noticeable upward trend is also found in the second range (the pretest). All of respondents in a low range moved upwards in the posttest. An overall movement of responses (see also Histogram 10) shows that a majority of respondents have a plan to analyse obtained (online) information.
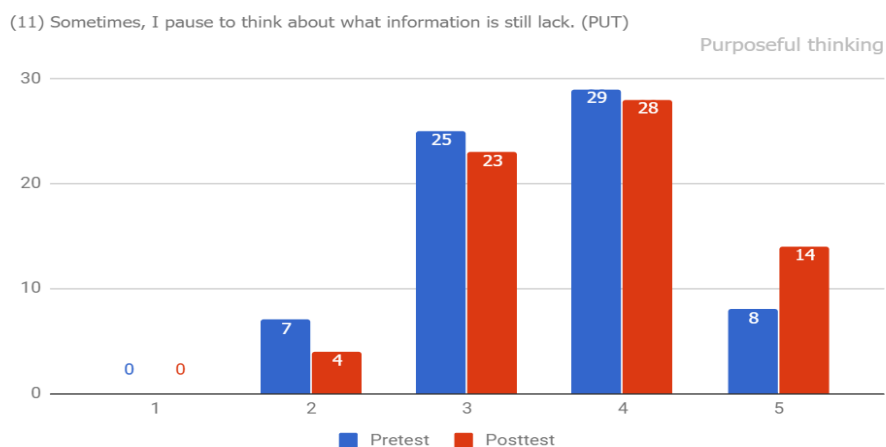
Bar Chart 11: Purposeful thinking of the item 11

According to the above chart (Bar chart 11), it provides information about undertaking a review of online searched information between the pretest and the posttest. In the pretest, some respondents (n = 8) were in the highest range of the respondents' opinions. A substantial number of the respondents reach a peak (n = 29) in the fourth range of the respondents' opinions. Followed by a neutral range of opinions, twenty-five of respondents employ the thinking strategy to reexamining online information. It is not very often for seven of them to pause to review of online information.

With respect to the posttest, the trend of the bar chart is likely similar to that of the pretest. Almost a double growth (n = 14) can be seen at the highest range of opinions. In the low range, a number of respondents (n = 4) seems less than that of the pretest. It could be said that some of them might have critical thinking skills and self-organisation in learning task completion.

According to the chart, a huge number of respondents expressed that they have experienced and understood of what they retrieved. It can be seen from the trend of the posttest. A significant growing is generally found in high levels of respondents' opinions. The following movement (Histogram 11) shows directions of responses in accordance with the purposeful thinking category.
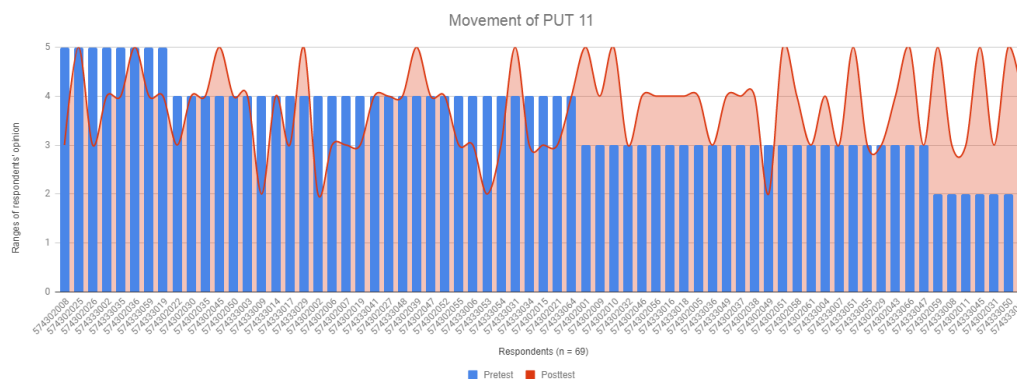
Histogram 11: Movement of PUT11

According to the above histogram (Histogram 11), a big change can be seen in the fourth range. Many of respondents in the fourth range moved downwards while four of them rated themselves in the highest range. By contrast, almost all of respondents in lower ranges moved upwards. Although there is fluctuation in ranges of respondents' opinions in lower ranges (the second and the third ranges), the overall area covers high ranges.

With respect to four items in the third category, a majority of respondents could use of purposeful thinking skills in task completion effectively. Understanding the goals of information retrieval, recall purposes of (online) search, making use of a know-how strategy, critical thinking as well as self-organization are important strategies for online retrieval and learning.

Fourth category T&E: three bar charts (from items number 12 to 14) will be presented, respectively.

(12) I try some new accessible websites when I cannot find enough information.

(13) I try often databases when I cannot find enough information in one database.

(14) I try some other search engines when my search is not successful.
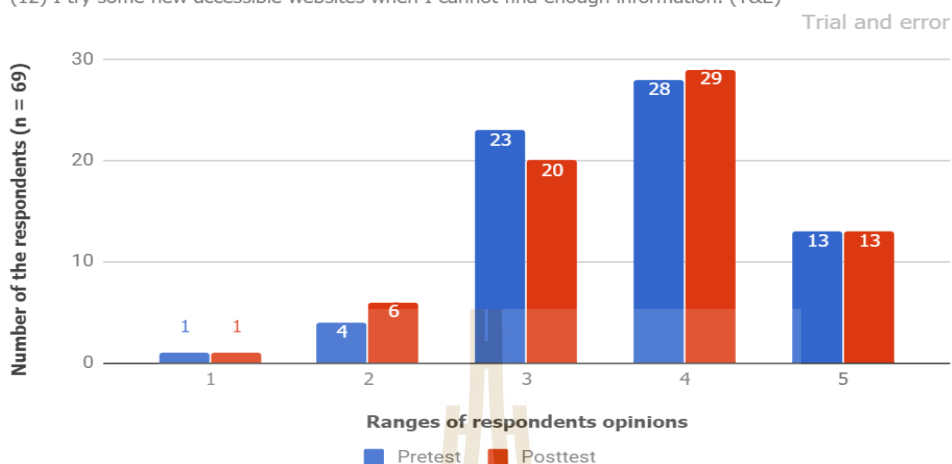
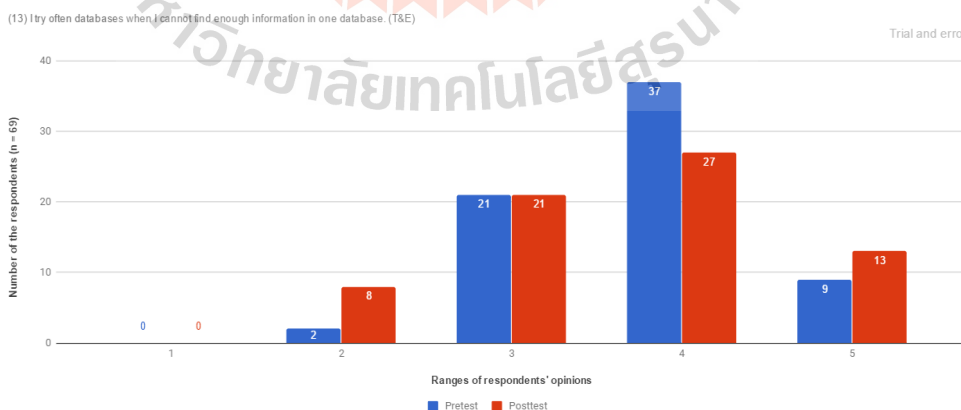Bar Chart 12: Trial and error of the item 12

As can be seen from the above bar chart (Bar chart 12), it provides information about an attempt of the respondents to try new searches. With respect to the pretest, thirteen respondents well perform an ability of navigating online information. High growth of the respondents (n = 28) can be seen in the fourth range (high level). A marginal fall of the respondents (n = 23) is shown in the neutral range. In lower ranges, four of them are found. Only one is in the lowest range.

As for the posttest, an overall data seems alike in terms of a number of respondents in the highest range (n = 13). There is a slight rise in numbers of the respondents in high ranges (n = 29) but a small drop (n = 20) can be found in neutral range. At lower range, a small growth a can be seen. It could be claimed that the respondents perform an ability to search new websites or sources when they need more information.
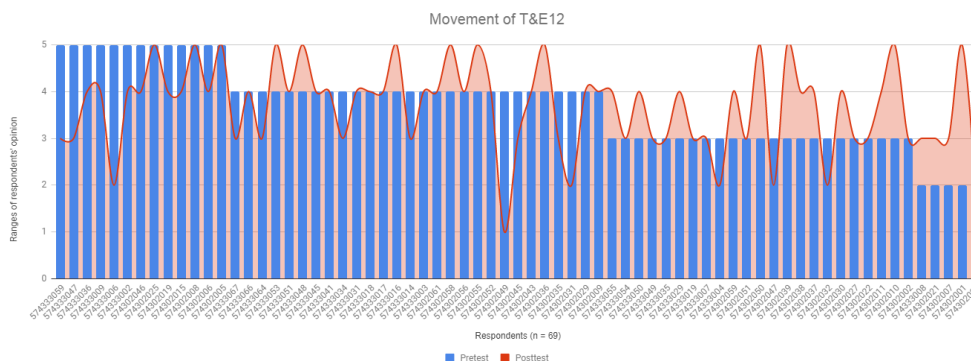
Histogram 12: Movement of T&E 12

According to the above histogram (Histogram 12), changes in the highest range seem outstanding whereby three respondents remained stable while the others moved downwards. In the fourth range, six out of twenty-eight rated themselves in the highest range while a majority of respondents went downwards. By contrast, an exponential trend can be seen in lower ranges. All respondents in both the low range and in the lowest one moved upwards in the posttest. The distribution of changes in the neutral level varied in terms of numbers--nine moved upwards, six stayed constant, and eight moved downwards. The overall trend of the data moderately increases.

Bar Chart 13: Trial and error of the item 13

As can be seen from the previous chart (Bar chart 13), it provides information about using databases to add details in online search. With respect to the pretest, nine

respondents well perform an ability of accessing databases. A high growth of the respondents (n = 37) can be seen. A sharp decline of the respondents (n = 21) appears in the neutral level. In lower ranges, two of them are found. Only one is in the lowest range.

With respect to the posttest, none of the respondent is found in the lowest range. Eight respondents are in the lower range while many of them (n = 21) are seen in neutral range. In higher ranges, twenty-seven are in the fourth range and thirteen of them are in the highest range.

Comparing the pretest with the posttest, in terms of numbers, there is a small drop of respondents in the fourth range whereas a small growth is seen in the highest one. A constant number of respondents is also shown in the third range. It could be noted that a majority of respondents tried to access databases in order to obtain enough information. Furthermore, the movement of respondents will be elaborated in the following histogram (Histogram 13).
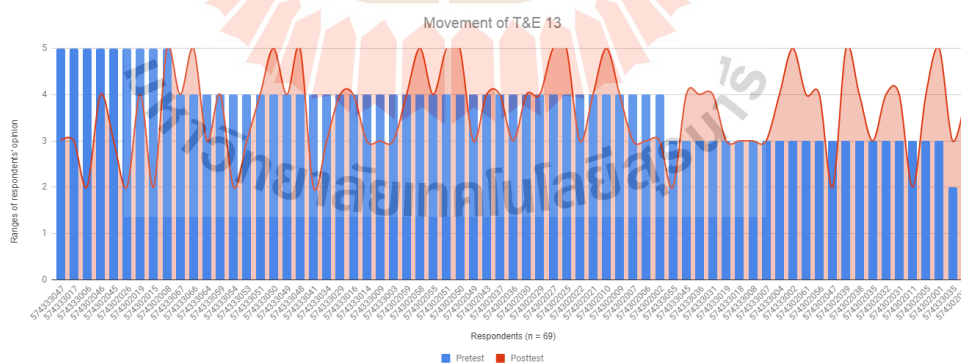
Histogram 13 : Movement of T&E 13

The above histogram (Histogram 13) shows movement of respondents in trial and errors in the item 13. It deals with an attempt to access other databases during navigating the Internet. In the highest range, the movement of responses fluctuates

widely. The trend plummets to lower ranges. Likewise, a majority of respondents in the fourth range moved downwards in the posttest while nine of them reach the highest range. From the neutral to lower ranges, some respondents (n = 8) move upwards whereas the others remain stable. Hence, the overall trend of this histogram (Histogram 13) increases steadily. Consequently, a vast number of respondents could attempt to access databases in order to search for more information.
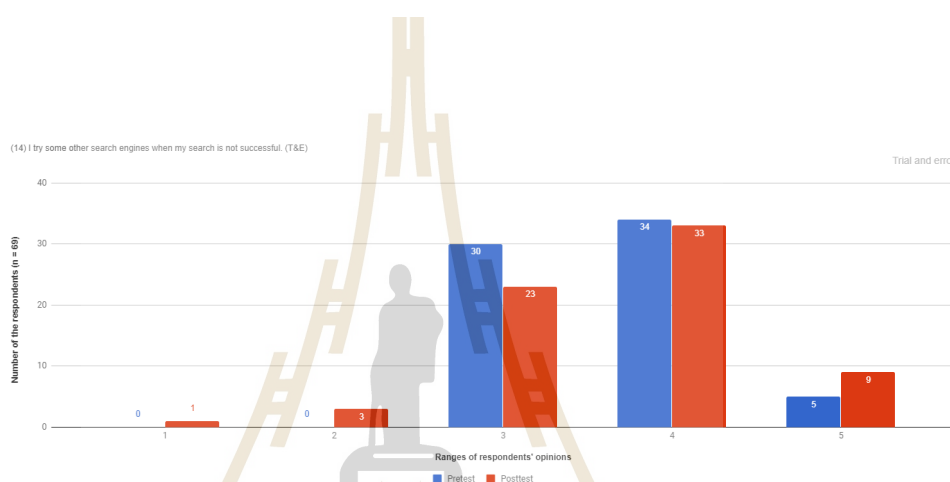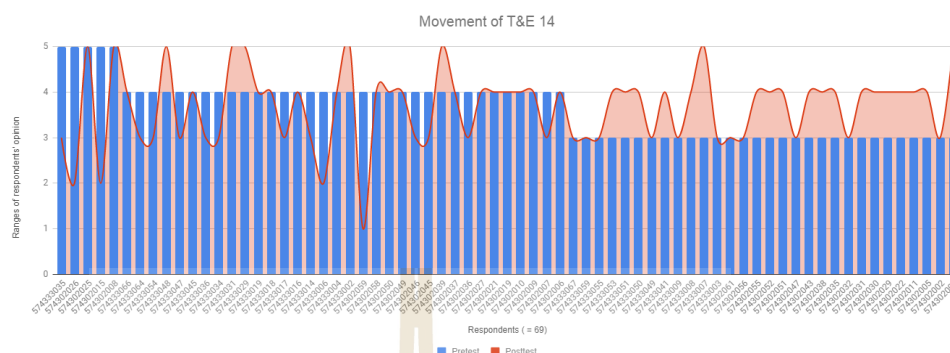

Bar Chart 14: Trial and error of the item 14

According to the above chart (Bar chart 14), it provides information about an attempt to use search engines to find more information. With respect to the pretest, a peak growth can be found in the fourth range (n = 34) of respondents' opinions and followed by the third range (n = 30), respectively. There are five of respondents try to access online information with new search engines. None can be found in the lower ranges.

As for the posttest, a minimal number of the respondents (n = 33) dips in the fourth range. Likewise, a slight decrease shows in the neutral level (n = 23)--seven of them from the pretest move to other levels of range. Notably, in the highest range, there is a growing in number of the respondents (n = 9). It could be noted that the

respondents might have accessed online information with other search engines because there are not much different in terms of the trend.

Histogram 14: Movement of T&E 14

The above histogram (Histogram 14) provides information of the movements of respondents in trial and errors in the item 14. It deals with an attempt to access other search engines during navigating the Internet. From the highest to the lowest ranges, a majority of respondents remained stable. At the highest point, nine respondents are from various levels of the ranges--two stay stable from the pretest, five are from the fourth range, and the others move up from the neutral range. Noticeably, a vast number of respondents in the neutral range rated themselves higher than they did in the pretest. The overall trend of this histogram (Histogram 14) shows a slight improvement of respondents' effort to use new search engines.

In sum, with respect to three items in the fourth category, it could be claimed that a majority of respondents often employed trial and error strategy in online retrieval and organise obtained information from different sources. Also, many of them could use different search engines to add more information as well as spend an effort to access new databases very well.

Fifth category PS: three bar charts (from items number 15 to 17) will be presented, respectively.

(15) I usually give up searching when I come up with unsolved problem.

(16) I think of some solutions when I am frustrated with searching problem.

(17) I do my best to resolve any problems occurring during a searching.
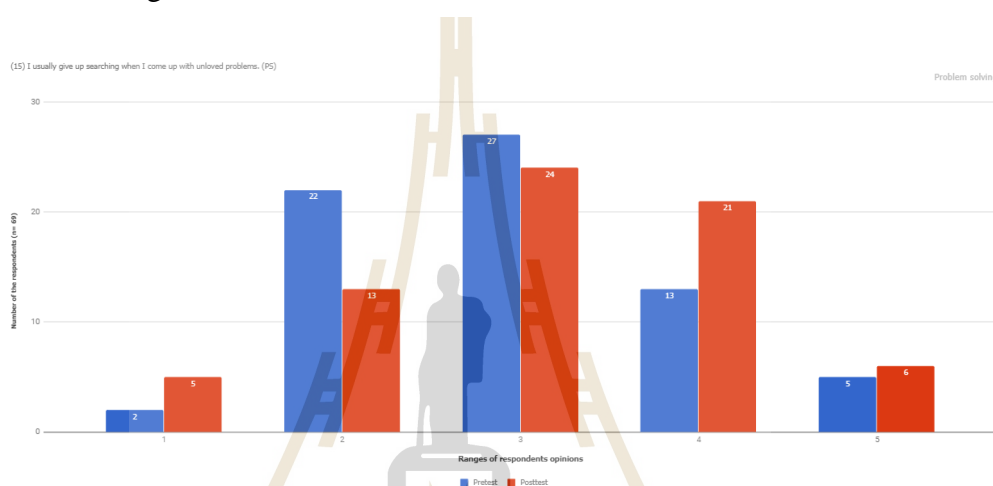
Bar Chart 15: Problem solving of the item 15

As can be seen from the previous chart (Bar chart 15), it provides information how respondents solve a problem during navigating the Internet. The overall illustration seems much alike in terms of a trend of the chart. With respect to the pretest, a sharp increase is very outstanding at third range (n = 27) and followed by twenty-two of them in the second range of respondents opinions. In the highest range, five respondents expressed that they usually gave up searching information because of barriers.

As for the posttest, the overall trend shows that not many respondents try to keep searching when they face hardships--five at the lowest point (first range), and thirteen in the second range. The peak trend can be seen in the third range (n = 24).

Notably, twenty-five of them (n = 21) in the high range seems raise significantly. It could be noted that a majority of them could not stand for difficulties during navigating the Internet and could not have enough potential to solve some problems.
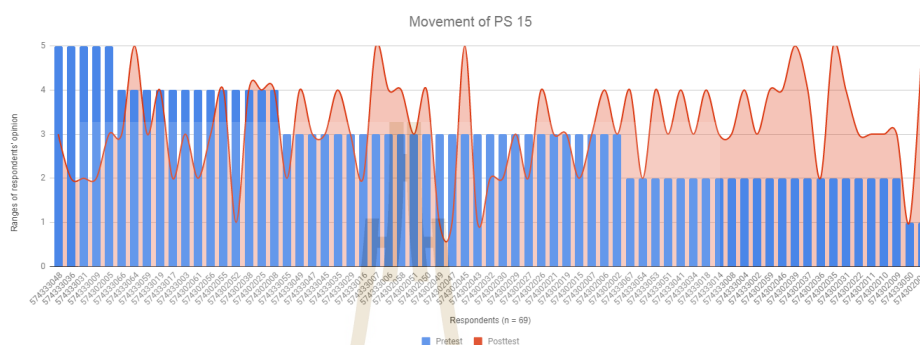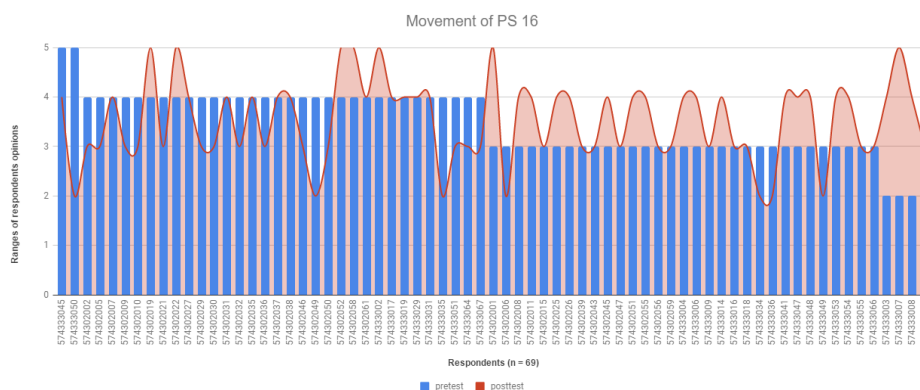

Histogram 15: Movement of PS15

The above histogram (Histogram 15) shows a movement of respondents in the category of problem solving. At the highest range, all respondents in the posttest move downwards. Consequently, the trend of the movement in the highest range suddenly declines. Likewise, the trend of drop still remains in the fourth range. That is, almost all respondents moved downwards whereas only one went up. By contrast, from the neutral to the lowest range, a vast number of respondents moved upwards. A big group of a rocket growth is obviously seen in the lower range. The overall trend of the movement shows exponential growth. It also shows that a majority of respondents often stops searching when they encounter difficulties.

(16) I think of some solutions when I am frustrated with searching problem. (PS)
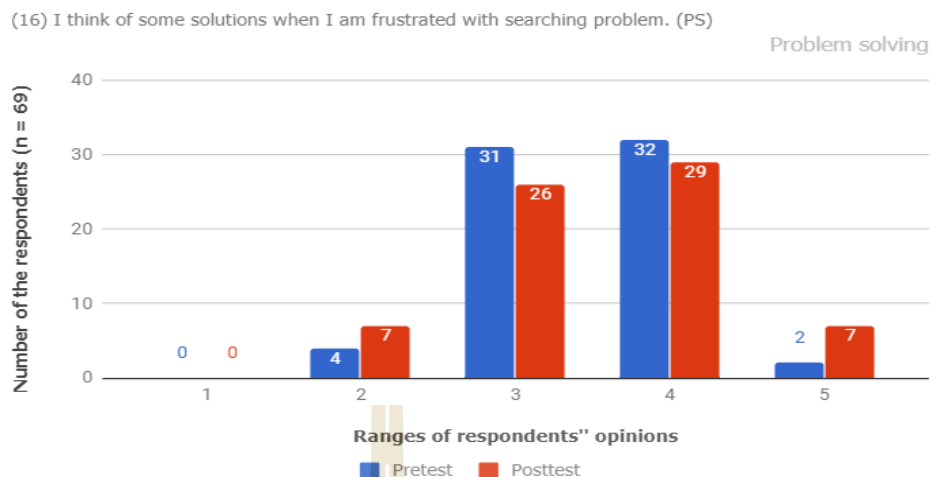
Problem solving

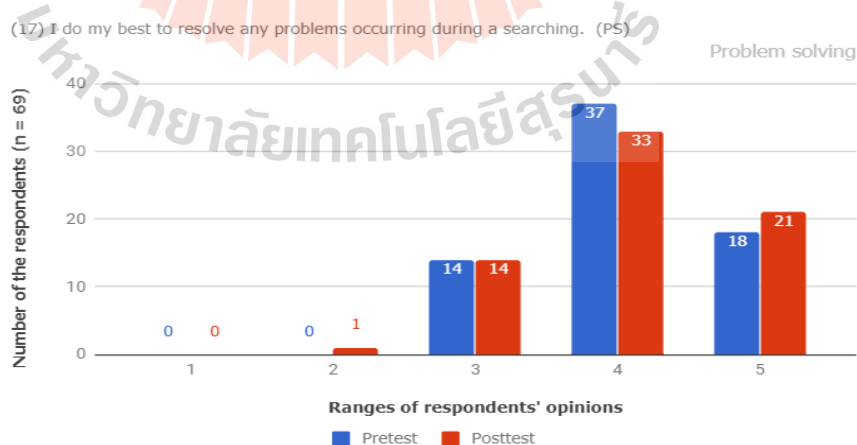Bar Chart 16: Problem solving of the item 16

As can be seen from the above chart (Bar chart 16), it provides information about an attempt to find solutions during navigating the Internet. According to the pretest, the trend of third and fourth ranges shows a remarkable increase (n = 31, 32, respectively). A few of them (n = 2) are in the highest range. None of them is found in the lowest range. It could be said that a majority of them attempt to find ways to solve problems.

With respect to the posttest, the trend of growth can be seen in the second range (n = 7). Three of respondents might not want to find a way to solve problems while other seven of them are found at the highest range. A downward trend is seen in the third range (n = 26) and the fourth range (n = 29). A notable number of respondents probably need to find solutions during navigating the Internet.
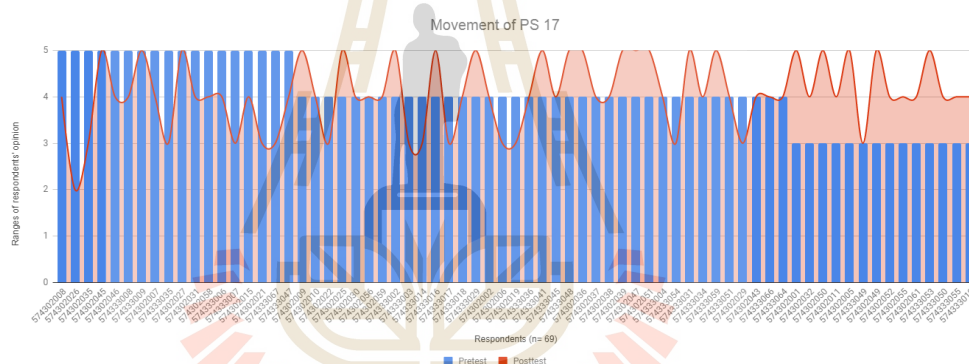
Histogram 16 : Movement of PS 16

The above histogram (Histogram 16) provides the trend of movements of respondents opinions on problem solving. As can be seen, two respondents in the highest range of the pretest moved downwards of the posttest. Similarly, the trend of movement in the fourth range seems much alike in terms of a steady decline. That is, many respondents are in higher range of the pretest but go down in the posttest. In contrast, from the neutral range to the lower ones, the trend of movements shows an improvement. The overall movement of this histogram (Histogram 16) displays a gradual increase.

Bar Chart 17: Problem solving of the item 17

The previous chart (Bar chart 17) provides information about problem-solving in completing a task. With respect to the pretest, none is found at the lowest range. Fourteen of respondents are not be sure to find any solution. This evidence can be seen in the neutral range. A majority of respondents (n = 37) is in the fourth range. Some respondents (n = 18) in the fifth range believe that they can solve problems.

Comparing to the pretest, a number of respondents at the highest range (n =21) increases slightly. Equal number of the respondents (n = 14) in the third range in both the pretest and the posttest is seen. It could be said that a majority of the respondents might try to find possible solutions to solve problems during navigating the Internet.

Histogram 17: Movement of PS 17

The above histogram (Histogram 17) shows fluctuation in numbers of respondents. A great flutter of changes in numbers of respondents can be seen in the highest range. In the pretest, eighteen of them rated themselves very high but in the posttest thirteen of them moved downwards. Consequently, this histogram shows a downward trend in the highest range. By contrast, from the fourth range to the third range, the trend is likely growing as a majority of respondents (n = 18) could try to solve problems. A noticeable upward trend is also shown in the third range. Almost of

all respondents in the neutral range rated themselves higher than they did in the pretest. It is evident that the overall trend is consistently upward.

In short, the overall movements of three items of the fifth category reveal that many respondents could not endure difficult situations of online search. In contrast, some of them still try to solve basic problems of online retrieval.

CURRICULUM VITAE

Natthika Boonrasamee was born in Songkhla, Thailand. She obtained a Bachelor of Arts degree in English Language at Srinakharinwirot University, Southern campus in 1996. She pursued her Master of Arts degree in English Language at Prince of Songkla University, Pattani campus in five years later.

Upon her graduation from Prince of Songkla University, Natthika started her teaching career at Songkhla Rajabhat University. She is currently a lecturer at Department of Foreign Languages, Faculty of Humanities and Social Sciences. She teaches a wide range of courses such as foundation of English courses, children's literature, and English literature.

Since 2012, Natthika has been enrolled in the Ph.D. programme of English Language Studies at the School of Foreign Languages, Institute of Social Technology, Suranaree University of Technology, Thailand. Her research interests include Computer Assisted Language Learning (CALL), and technology in teaching and learning.