A protocol-based study of L2 problem-solving processes in Korean university students' L2 English writing

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ABSTRACT

Writing has increasingly been emphasised in EFL classrooms in recent years, and Korea is no exception to this trend. The literature indicates that L2 writers experience language problems and attempt to solve them while converting their thoughts into another language. At the moment when learners struggle with a linguistic feature, they become aware of their lack of linguistic knowledge, and try to resolve the problem either by employing their own previously acquired knowledge sources, or by trying to access external knowledge sources. This problem-solving process may occur repeatedly during the L2 writing process.

The aims of the current research are threefold: first, it investigates what Korean university learners of English notice while they are writing in L2; second, it attempts to examine what variables are related to and affect learners' noticing during the L2 problem-solving process and; third, the knowledge sources employed by learners when they face language problems are analysed. In order to achieve these aims, 108 English major students were recruited from three high ranked universities in Korea; think-aloud protocols and stimulated-recall interviews comprised the primary means of data collection. All participants were asked to do a writing task in L2 and to verbalise their thoughts while producing written text. Building on the data gathered from the writing task, stimulated recall interviews were carried out in order to identify the sources of knowledge employed to resolve language problems.

The results of quantitative data analysis showed that the 108 participants in this study noticed approximately five language problems while writing an L2 text for 20 minutes, and verbally expressed many more lexical episodes than grammatical episodes. Regarding the relations between learner-related variables and noticing during the L2 writing process, previous study abroad experience and L2 proficiency affected learners' noticing. It was also found that L2-based verbal working memory had an effect when learners notice language problems in L2 text production, while L1-based verbal working memory had no effect. Moreover, qualitative data analysis indicated that the participants employed various types of knowledge sources in order to solve lexical or grammatical problems. It was found that both explicit linguistic knowledge sources, such as previously acquired L1-L2 translation word pairs, aspects of word knowledge (i.e., form, meaning, or use), episodic memory or analogy, and implicit knowledge sources, such as intuition, were used during the L2 problem-solving process.

Based on these findings, possible implications for L2 writing teaching are discussed, stressing the importance of providing many writing opportunities for students, and suggestions for future research are presented.

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1. INTRODUCTION

1.1 Background of the research

With the prevalence of the Communicative Language Teaching (CLT) approach, there has been a focus on communicative competence; productive language skills, that is, writing and speaking, have been stressed more than before in EFL classrooms. Korea is no exception to this trend, and in fact, Nam (2005) remarks that English education in Korea has experienced a paradigm shift from a focus on receptive to productive skills and knowledge. Indeed, a new English test for adult learners in university or in the workplace and for high school students was designed by the Korea Institute for Curriculum and Evaluation (2008), and administered to around one thousand high school students and a group of five hundred Korean English teachers in 2012 for the first time. This National English Ability Test (NEAT) is significantly different from the current national English exam for university entry, in that the NEAT includes speaking and writing sections in addition to reading and listening sections, while the current exam has only reading and listening sections. There has been a lot of recent discussion concerning the use of the NEAT as an alternative for the current national English exam (National Assembly Research Service, 2012), so many researchers and English teachers are more interested than before in how to improve speaking and writing skills.

However, although CLT is accepted as an important teaching approach in Korea (Vasilopoulos, 2008; Yu, 2013), learners still have difficulties in using appropriate grammar, spelling, and vocabulary in L2 English production (Lim, 2010). In particular, learners may find it more difficult to use appropriate language when they produce an L2 written text than when they have a conversation, since written language is often more formal than spoken language. Learners are allowed to backtrack, repeat, or even make minor grammatical errors in speech, because there is an interlocutor during the conversational interaction; on the other hand, they need to consider more carefully using proper words and correct grammar to communicate an intended message in writing, since there are no immediate interactions with readers. That is to say, L2 learners may be required to be more concerned about appropriate language use in writing than in speaking.

Korean leaners' difficulties with English composition may be linked to the situation in Korean English language classrooms. Bae (2011) contends that teaching writing has been neglected in these classrooms, since English writing ability is rarely required inside or outside of the classroom, even on the national English exam. That is, learners have few chances to write in English, and in particular, they receive little writing instruction beyond the sentence level in English classes (Kim, 2008; Riley, 2011). In addition, Korean classrooms present a typical EFL context where exposure to English is limited to a few hours per week, and there is a lack of opportunity to practise writing in English. Korean learners have been found to struggle with many difficulties including developing ideas about specific topics, choosing appropriate

words in a particular context, or using correct grammatical structures (Kim & Kim, 2005).

Furthermore, the traditional teaching method in class may prevent Korean students from learning the process of writing and from developing L2 writing abilities. Teacher-led form-focused and product-oriented instruction is still the dominant method for teaching writing in English. Many English teachers consider grammar as the most important component in English education, and the sentence-by-sentence translation from Korean to English is still the prevalent method of L2 writing instruction (Bae, 2011; Nam, Benedetti & Kim, 2008). Moreover, since grammatical features are generally taught separate from any context, learners' knowledge of grammar may not carry over to their ability to write. In addition, Korean students are generally accustomed to being provided with authoritative feedback from teachers rather than critically reflecting (Kim & Kim, 2005). This conventional way of teaching has deprived learners of opportunities to write English texts by interacting with peers or an instructor during the completion of writing tasks; in sum, traditional writing instruction makes it challenging for learners to achieve a high level of L2 writing proficiency (Shin, 2008).

1.2 Rationale for the research

Regarding research on writing, Hyland (2009) refers to three approaches: examining written texts, focusing on writers and the writing processes, and investigating the

role of readers in writing. Traditionally, research on L2 writing focused on learners' final textual product; however, this standpoint caused some problems, such as a failure to take into account the actual procedures which occur in writing. Consequently, there has been a shift of emphasis from textual features to the process of writing in L2 composition studies (Matsuda, 2003). In addition, as Hyland (2003:10) points out, focusing on the writing process is meaningful in that this field of research can tell teachers what they can do to help improve learners' writing performance.

Myles (2002) argues that L2 writing research has been closely dependent on L1 writing research, and L1 writing models have had a significant influence on L2 writing pedagogy. However, Krapels (1990) warns that even though L1 writing process research has provided L2 researchers with guidance, L2 writing processes should be carefully investigated, because the research contexts are different from those of L1 studies. In particular, among the three writing processes - planning, formulating, and reviewing - proposed by Flower and Hayes (1981), *formulating* may be the process that differs the most between L1 and L2 writing models, because L2 learners can struggle to produce sentences in another language during this process. Weijen, Berch, Rijlaarsdam, and Sanders (2008:81) acknowledge that in both L1 and L2 compositions, *formulating* is 'the central component of the writing process, during which the ideas which are generated are put into words and the text is produced'. However, in contrast with L1 writing, L2 writing formulation has its own specificity in that L2 writers may find many more language problems than their L1 counterparts

while translating the ideas into the words in L2 (Roca de Larios, Marín, & Murphy, 2001).

During the formulation process, L2 writers often engage in decision-making and problem-solving while trying to convert their thoughts into language (Roca de Larios, Manchón, & Murphy, 2006). Due to a lack of L2 linguistic knowledge, they sometimes struggle to find the appropriate expressions or grammatical structures to express the intended meaning. In other words, L2 learners experience language problems and attempt to solve them while generating texts. During this problem-solving subprocess of the L2 writing process, learners may realise that they cannot express precisely in the target language what they want to express (Swain, 1995). Once the need for a certain language feature is noticed, learners try to discover how to resolve the problem with information drawn from internal or external knowledge sources. That is, when learners face language problems, they solve these problems either by relying on their own knowledge (e.g., mental lexicon or L2 grammar knowledge) developed through their previous language learning experience, or by trying to find outside resources (e.g., a bilingual dictionary or peer support) if internal knowledge sources are inadequate. This L2 problem-solving process may occur again and again during the formulation process.

Swain and Lapkin (1995) propose that when learners encounter linguistic problems, they notice what they do not know or only partially know in the target language. In other words, learners consciously recognise language problems while speaking or

writing, and they become aware of what they may need to find out about their L2. Qi and Lapkin (2001) add that language-related noticing in the context of L2 composing may promote learners' problem-solving performance during a writing activity. A number of studies of noticing in L2 composing have been conducted (e.g., Abe, 2008; Hanaoka, 2007; Iwanaka & Takatsuka, 2007; Izumi, 2002; Qi & Lapkin, 2001; Soleimani, Ketabi, & Talebinejad, 2008; Swain & Lapkin, 1995); however, it seems that Song and Suh's (2008) study is the only one that has empirically examined noticing in the L2 writing of Korean students. This study with 52 adult Korean students focused on the effect of task differences, a learner-external factor. It was found that a picture-cued writing task led to more noticing of the target form than a reconstruction task, and that both output tasks triggered the participants' noticing significantly more than the non-output task did.

In addition to the learner-external factors that influence noticing in L2 writing (e.g., writing task differences found by Song and Suh (2008) and Abe (2008); the effect of individual and collaborative writing environments found by Martínez Esteban and Roca de Larios (2010)), there may be some learner-internal factors that have an impact on noticing. This is an area which remains under-researched. Although some studies have included L2 proficiency level as an independent variable influencing noticing (e.g., Abe, 2008; Hanaoka, 2007; Iwanaka & Takatsuka, 2007; Qi & Lapkin, 2001), these studies have focused on learners' noticing of linguistic items, while they compare their own texts with written feedback instead of while they compose alone without external resources. In addition, as Weissheimer and Mota (2009) posit,

working memory capacity is limited, and attentional resources are constrained by working memory. Therefore, it may be reasonable to hypothesise that working memory has an impact on noticing. It might also be hypothesised that there would be effects of study abroad experience on noticing, since learners' previous study abroad experience may facilitate automatic language information processes such as retrieving lexical items or determining the correct surface structure of the sentence (Lafford, 2006). Therefore, this study includes learners' L2 proficiency, working memory capacity, and prior study abroad experience as independent variables that influence noticing during the L2 writing process.

Furthermore, while a number of studies have been conducted on how learners might react when facing linguistic difficulties in the process of written production in L2 (e.g., Aliakbari & Karimi Allvar, 2009; Chimbganda 2000, Roca de Larios, Murphy & Manchón, 1999; Sasaki, 2000), scant attention has been paid in empirical research to the knowledge sources L2 learner writers use when they notice language problems (e.g., García Mayo, 2002; Storch, 1998a, 1998b). Studying the type of knowledge sources used in L2 writing may be important, since it can lead to identifying what kinds of knowledge are applied in L2 problem-solving circumstances. García Mayo (2002) says, 'some of the mental processes learners reflect in the change made to their output (reasoning about linguistic choices, comparing cross-linguistic equivalent etc.) seem to be potentially involved in second language learning'. Knowledge L2 learners have in their current interlanguage system may be secure or insecure, and incomplete or inaccurate linguistic knowledge may be revealed in the language

production process. Therefore, if information about knowledge sources employed during the L2 problem-solving process is uncovered, L2 teachers may be able to make L2 writing preparation more effective.

On the basis of the background and rationale briefly described above, the current study aims to fill a gap in the literature by exploring some learner-internal factors related to noticing, and the knowledge sources used for solving L2 linguistic problems in Korean university learners' L2 English writing. With this overarching aim, the specific research questions for the present study will be provided in Section 2.5.

1.3 Outline of the thesis

Following this introduction chapter, Chapter 2 reviews the literature which is both theoretically and empirically related to some critical concepts in the present study, such as *writing process*, *output hypothesis*, *noticing*, *working memory,* and *knowledge sources*. On the basis of literature review, the research aims and questions for the current study are presented.

Chapter 3 provides a detailed overview of the methodological framework of the study, including information on the participants and sampling procedures. In addition, the research instruments and the data collection and analysis methodology for the study are introduced. Ethical issues related to the study are also discussed.

Chapters 4 and 5 present the results from quantitative and qualitative analysis respectively. The quantitative data analysis is mainly concerned with questions about the effects of certain learner-related variables on noticing during the L2 writing process. In the qualitative data analysis chapter, how learners solve L2 language problems is examined, and a taxonomy of knowledge sources for the L2 problem-solving process is developed.

Chapter 6 critically discusses both the quantitative and the qualitative findings of the study, relating it to the previous theoretical and empirical literature and the research questions.

Chapter 7, the final chapter, provides a summary of the findings and the limitations of this study. In addition, some pedagogical implication for L2 teachers, and some recommendations for future research are provided.

2. LITERATURE REVEIW

2.1 The L2 writing process

2.1.1 Research on L2 writing

2.1.1.1 A historical overview of L2 writing research

Research on L2 writing has been acknowledged as an important field of study in applied linguistics and second language acquisition; however, this field has a relatively short history (Fujieda, 2006). In an historical analysis of research in L2 writing, Matsuda (2003) concludes that writing may have been neglected in the early years of L2 studies because oral proficiency was emphasised over written proficiency, since the audiolingual approach was the main teaching method from the 1940s until the early 1960s. Matsuda adds that spoken language was also prioritised because writing was regarded as simply an orthographic representation of speech and also as the most difficult aspect of language to acquire (Matsuda, 2003). Consequently, it is difficult to find studies of L2 writing from the 1950s. In the 1960s, studies of L2 writing began to emerge, examining the rhetoric and discourse of written language, with a view of writing as a textual product (e.g., Kaplan, 1966).

From the 1970s to the early 1980s, the L2 writing research paradigm focused mainly on the writing process rather than on written products. This research paradigm focused on L2 writers' behaviours, discovered by investigating the process of composition (Zamel, 1983). Instead of the products generated by writers, the actual

process of writing became the focus of researchers. Scholars explored how writers generate and refine ideas to produce text. This process-centred research trend was mostly based on research in L1 composition; and in L2 writing studies, various researchers investigated L2 writing processes with the goal of determining how they were similar to and different from L1 processes. For example, Zamel (1983) argues that there are some similarities between the writing processes of L1 and L2 writers, based on her study with six advanced ESL students. Similarly, in Arndt's (1987) study with six Chinese post-graduate EFL students, it was found that the proficient L2 writers had similar composition skills to proficient L1 writers. On the other hand, Raimes (1985) believes that there are distinct differences between L1 and L2 writing processes. In her study, unskilled ESL college-level students were asked to write a narrative essay, and their think-aloud protocols were analysed. The findings evidenced that the unskilled L2 writers did not edit their work as often as unskilled L1 writers. In addition, cognitive aspects of L2 writing were examined with the development of a number of L1 and L2 writing models, and these will be discussed in detail below.

In the early 1990s, studies on L2 writing began to place greater emphasis on the audience for particular pieces of writing rather than on the writer him- or herself. From this stance, researchers emphasised readers' expectations in writing, and writing was viewed as a social activity. After 2000, there was a surge of L2 literature that explored the context of writing and its status. In particular, Atkinson's (2003) work, which introduced the term *post-process*, was concerned with the context of

writing and the final product as well as the writing process. In the post-process research paradigm, certain research areas for writing with a particular purpose were developed (e.g., EAP or ESP), and researchers started to examine various aspects of writing according to specific context of use (e.g., features of academic writing) (Matsuda, 2003).

2.1.1.2 Pedagogical approaches to L2 writing

With regard to teaching L2 writing in classrooms, learners' final written products were the predominant focus of early L2 writing instruction. According to Silva (1990), the approach to writing as a product is the basis of the *controlled composition approach*, where learners practice certain pattern drills through guided writing exercises to achieve a correct composition, and the *current-traditional rhetoric approach*, where learners mainly focus on the logical arrangement of discourse structures. Although the former emphasises lexical and syntactic features at sentence level while the latter emphasises text organisation and structures at discourse level, both approaches attend mainly to the formal aspects of the composed product. Hyland (2003) acknowledges that from this product-oriented view, writing shows learners' ability to construct well-formed sentences using grammatical and lexical knowledge, and learners are encouraged to imitate models and manipulate structures following guidance provided by teachers.

However, the product-oriented approach to writing results in several problems. Clenton (1998) points out that the product-oriented approach fails to be concerned with non-native learners' needs, which include knowing how proficient writers produce a piece of work. In other words, the actual procedures which occur in writing are neglected by the product-oriented approach, and learners may have little chance of knowing what these processes are and how they can develop them. In addition, for teachers, this approach heavily emphasises superficial knowledge about language. That is, the product-oriented approach to writing focuses much more on which mistakes learners need to correct based on the final written work than on how and why they make mistakes. In addition, for researchers, the product approach makes it hard to gain insight into the steps involved in creating the final outcome.

On the basis of the above problems, the *process approach* has been developed, highlighting the view of writing as a process of developing text organisation instead of the view of writing as a reproduction of previously learned syntactic or discourse structures. Onozawa (2010) explains that in the process approach, L2 learners focus on the writing process itself more than on their final written products, and they are guided in how to produce texts through the writing. Kim and Kim (2005:4) point out that 'the process approach to teaching writing emphasises the writer as an independent producer of texts so that teachers allow their students time and opportunity to develop students' abilities to plan, define a rhetorical problem, and propose and evaluate solutions'. A distinctive feature of the process approach is the importance of the interaction between several subprocesses of writing including

planning, *formulating* and *reviewing* (Flower & Hayes, 1981); attention to this interaction is designed to lead students to understand what actual processes are entailed in writing. As a result, while the product approach guides students to duplicate a pre-determined model, the process approach encourages learners to take responsibility for making improvements by themselves (Clenton, 1998).

Despite the advantages of the process approach to teaching L2 writing in class, such as aiding writers' independence, there are some scholars who criticise this approach. For instance, Onozawa (2010) contends that grammar and structure as well as the quality of the final product are neglected in the process approach. Next, this approach overlooks variations in the writing process which arise from differences in writing tasks and situations, and disregards the sociocultural context (Reid, 1984). For example, the usage of vocabulary or grammar items in business letters may be different from that in scientific reports, and students need to understand how these various context-dependent conventions of writing are different. For these reasons, the process approach has been criticised as inappropriate for developing academic writing abilities. As a result, in the post-process approach, teaching is centred on reader expectations and product, on knowledge about language, and on knowledge of the context in which writing happens (He, 2005). The contextual and social aspects of writing have been regarded as crucial components for L2 writing instruction; so, for instance, the nature of academic discourse genres has been more strongly emphasised in ESL classrooms than before (Hyland, 2003, 2009).

Each of the three teaching approaches to L2 writing outlined above has both strengths and weaknesses, and all are still employed in different ESL and EFL classrooms. However, it appears that of the three approaches, the process-oriented approach is dominant in L2 classrooms today (Hyland, 2009). In addition, in order to examine what language problems learners encounter and how they deal with the problems in L2 writing, the processes they experience while producing L2 text need to be examined. Therefore, the focus of the present research is on writing as a process.

2.1.1.3 Summary of studies on L2 writing processes

A number of studies of L2 writing processes have been carried out, with various research goals. In early L2 studies of writing as process, a number of researchers investigated above all what happens in the L2 writing process, discovering both similarities and differences between L1 and L2 writing processes (e.g., Arndt, 1987; Bosher, 1998; Kamimura, 1996; Raimes, 1985; Uzawa, 1996; Zamel, 1983). Following this, various studies have explored L1 use in the L2 composing process, suggesting that L2 writers frequently rely on their L1 while producing an L2 text and that, in particular, the use of L1 can help writers to develop ideas while writing in L2 (e.g., Lally, 2000; Stapa & Majid, 2009; Van Weijen, Van den Bergh, Rijlaarsdam & Sanders, 2009; Wang & Wen, 2002). In addition, many studies have focused on learners' diverse cognitive activities and on the subprocesses of the L2 writing process, such as planning, formulating, and revision (e.g., Hall, 1990; Roca de Larios, Manchón, &

Murphy, 2006; Roca de Larios, Manchón, Murphy & Marín, 2008; Roca de Larios, Marín, & Murphy, 2001; Sasaki, 2000; Shin, 2008).

2.1.2 Writing as a cognitive process

2.1.2.1 Writing as a problem-solving activity

As described above, there are three broad approaches to researching L2 writing, on the basis of three main dimensions of writing: 1) text-oriented, focusing on the final outcome or product of writing, 2) writer-oriented, investigating the processes of learners' writing behaviours, and 3) reader-oriented, paying attention to an interaction between writers and readers with an emphasis on the social dimension of writing in a post-process approach (Hyland, 2009). The first dimension of writing is linked to the product research paradigm, while the second is related to the process-centred approach. The last dimension of writing is connected to the genre-based approach. Concerning the writer-oriented dimension, while some researchers take an *expressivist* focus on writing to the writer's work based on creativity and self-expression, others take a *cognitivist* approach, which emphasises the cognitive aspects of writing. Although both views regard the writer as the centre of attention, there exists a difference of emphasis between the two approaches. That is, the former claims that the writer is the main concern, and an individual's creative expression is the principal goal of writing; the latter focuses on the process of text production.

In the cognitivist view, which is the basis of the process approach, writing is regarded as a problem-solving activity; that is, writing is a process of 'how writers approach a writing task as a problem and bring intellectual resources to solving it' (Hyland, 2009:20). From this viewpoint, learners need to make decisions during the writing process, because different cognitive activities are called for at different moments of that process. For a writing task, generally, the cognitive activities that are involved will be setting a goal and generating ideas, and the production and revision of texts.

Various researchers provide different cognitive models of the L1 writing process, which aim to explain how diverse cognitive activities interact with each other (e.g., Chenoweth & Hayes, 2003; Flower & Hayes, 1981; Kellogg, 1996; Scardamalia & Bereiter, 1987), and these models have had a substantial influence on L2 writing instruction and the development of L2 writing theory. However, as Silva (1993) points out, L2 writing is different in many ways from L1 writing, and it is necessary to develop a theory of L2 writing, making use of L1 research when such research is relevant, but incorporating the unique features of L2 writing. In fact, some L2 researchers have developed a distinct construct of L2 writing, or posited distinctive cognitive subprocesses occurring during the L2 writing process (e.g., Abdel Latif, 2009; Wang & Wen, 2002; Zimmermann, 2000), differentiating this process from that described by L1 writing models. Therefore, it may be worth examining some prominent L1 and L2 writing models to understand how the writing process is seen to operate.

2.1.2.2 Cognitive models of the L1 writing process

Flower and Hayes's (1981) model (Figure 2.1) is perhaps the one most widely used by L2 writing researchers and teachers (Chien, 2008; Hyland, 2003). This framework consists of three writing processes: *Planning*, *Translating*, and *Reviewing*. These three processes are under the control of a *Monitor*, a function which allows the writer to move between processes during writing. There are also two factors that influence the process of writing: the *task environment*, including any writing assignment; and *long-term memory*, including all of the writer's knowledge. In this model, writing consists not of linear but of interactive processes, and this recursive feature is distinguished from a traditional product-centred view of writing, which assumes a linear process of plan-write-edit (Galbraith, 2009).

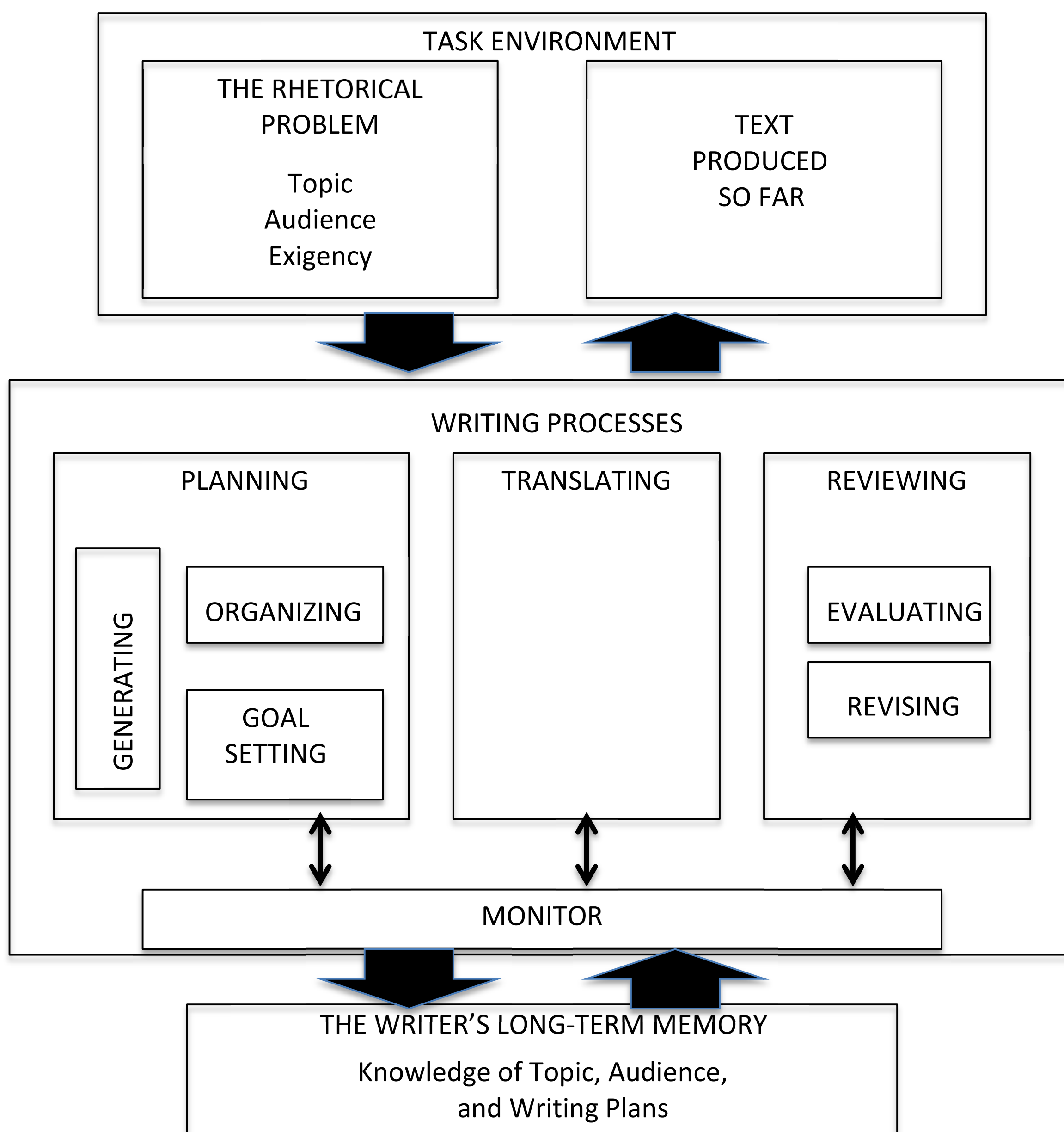


Figure 2.1 Flower and Hayes's writing model (Flower & Hayes, 1981, p. 370)

Based on Flower and Hayes's model, Scardamalia and Bereiter (1987) propose two models, which take into account the differences between novice and skilled writers. One model, called the *knowledge-telling model* (Figure 2.2), represents the writing of unskilled writers, and addresses the fact that these writers have limited goals and mainly concentrate on generating content. Scardamalia and Bereiter also contend

that these novice writers plan and revise less than experts. In this model, the *content knowledge* and the *discourse knowledge* are similar to *knowledge of topic, audience and writing plans* in Flower and Hayes's model, and the *knowledge-telling process* corresponds to *Translating*. More specifically, the subprocesses above *write* in the central box correspond to *Planning* in Flower and Hayes's model, *write* corresponds to *Translating,* and *run tests of appropriateness,* in second and later iterations, correspond in part to *Reviewing.*

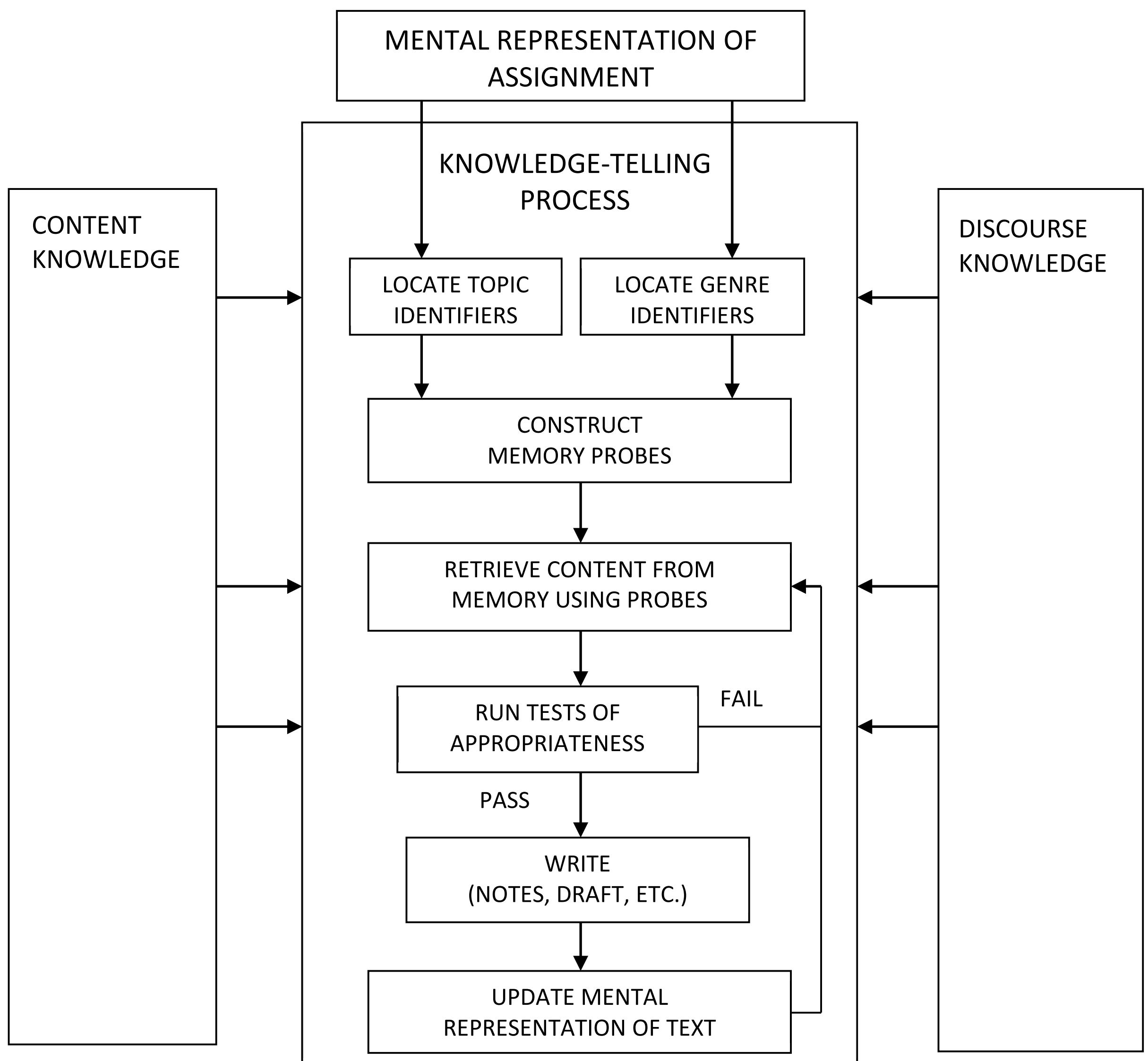


Figure 2.2 The knowledge-telling model (Scardamalia & Bereiter, 1987, p. 144)

On the other hand, Scardamalia and Bereiter's second model, called the *knowledge-transforming model* (Figure 2.3), represents how experienced writers set goals and analyse problems in writing. According to this *knowledge-transforming model*, ideas are represented as a reflection of the writer's knowledge and of the ideas' rhetorical functions within the text. In this model, the *knowledge telling process* once again corresponds to *Translating* in Flower and Hayes's model, and the other processes correspond to *Planning*. In addition, when *problem analysis and goal setting* operate on products from the first iteration of the *knowledge telling process*, the *problem analysis and goal setting* correspond to *Reviewing* in Flower & Hayes's model.

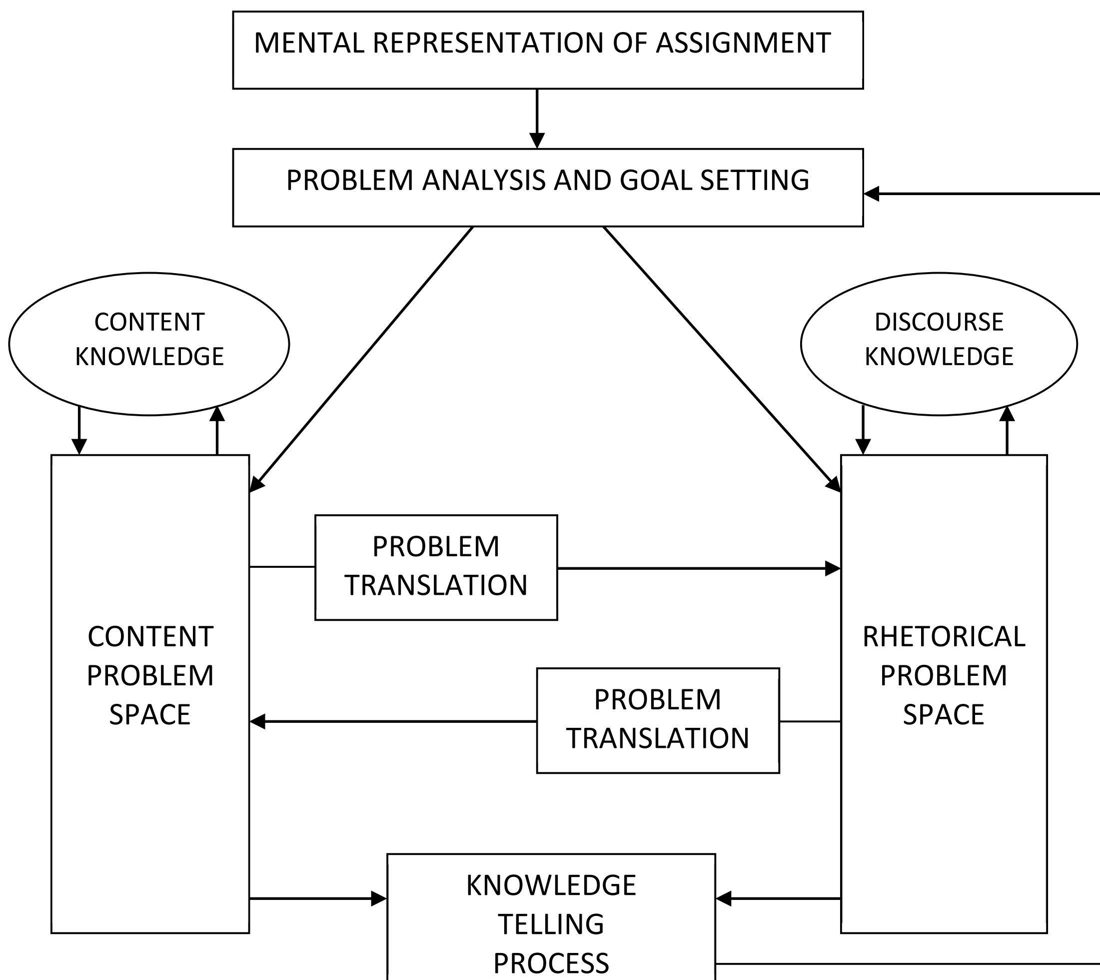


Figure 2.3 The knowledge-transforming model (Scardamalia & Bereiter, 1987, p. 146)

Some scholars have incorporated *working memory* into writing models. For instance, Kellogg (1996) combines the writing processes with functions of working memory (i.e., the visuo-spatial sketchpad, central executive and phonological loop) on the basis of Baddeley's (1986) working memory model. In Kellogg's writing model (Figure 2.4), three basic processes are presented: 1) *formulation,* where rhetorical goals are planned and translated into text; 2) *execution,* where the text is actually produced by typing or hand-writing; and 3) *monitoring,* where the produced text is evaluated and revised through reading and editing. *Formulation* covers *Planning* and *Translating* in Flower and Hayes's model, and *monitoring* covers *Reviewing*. In his model, interestingly, Kellogg is focusing on the processes involved in the actual production of the written artefact (*programming* and *executing*), which may not have been sufficiently considered before. Kellogg observes that these processes activate simultaneously, but use different components of working memory differently, depending on the tasks. Similarly, Hayes (1996) also integrates working memory with the different components of the writing process, claiming that working memory plays a vital role during the writing process. However, there is a difference between these two models; that is, Hayes believes that working memory resources are relevant in all stages of writing, whereas Kellogg argues that execution processes are not usually related to working memory.

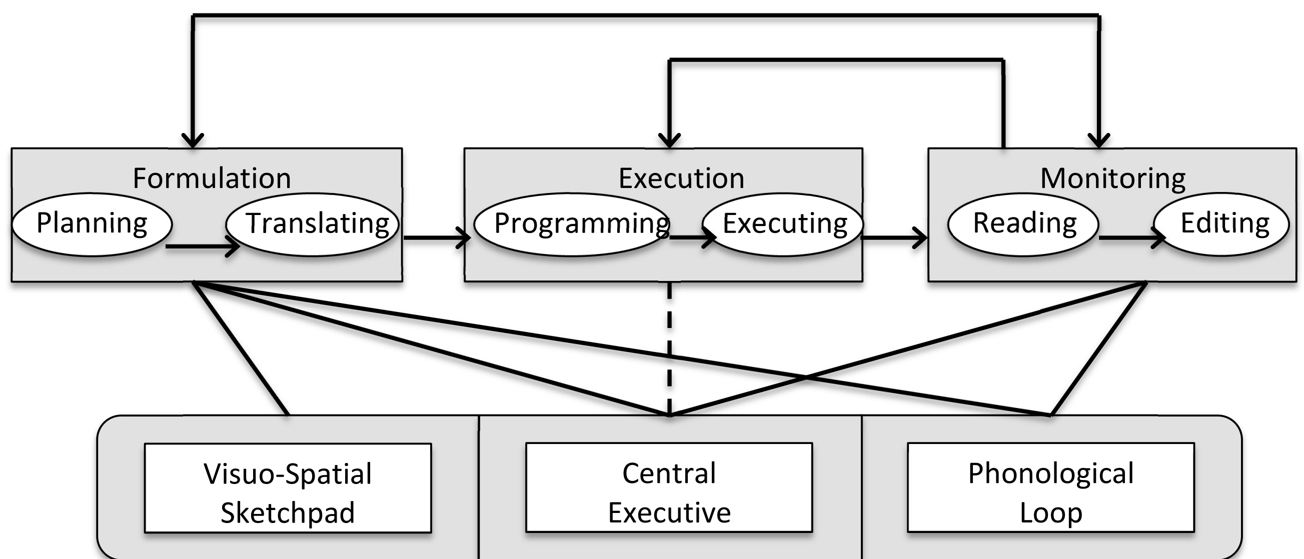


Figure 2.4 The resources of working memory used by the formulation, execution, and monitoring system (Kellogg, 1996, P. 59)

Chenoweth and Hayes (2003) develop a more elaborate model of the processes of text production (Figure 2.5), paying more attention to the processes involved in translation compared to the previous models. There are four components in this model. First, the *proposer* creates content, an idea package, through reflection on the plan and information related to the plan. Relevant information, in either a linguistic or nonlinguistic form, may come from the writer's memory or from external sources. Next, the idea package is sent to the *translator*, and it converts the ideas into a language string. Here, lexical items are chosen and also arranged in a certain order. The translated package is then evaluated by the *evaluator/reviser*. If the language string is acceptable, the *transcriber* writes the texts; however, if the string is not acceptable, the *reviser* may request the other processes to change either ideas or language. The *reviser* can interrupt all other processes at any point (Galbraith, 2009). As in previously discussed models, these processes are typically recursive. While the

proposer corresponds to *Planning* in Flower and Hayes's model, the *translator* and the *transcriber* correspond to *Translating*. The *transcriber* seems to correspond to *Execution* in Kellogg's model. The *evaluator/reviser* is a similar component to *Reviewing* in Flower and Hayes's model.

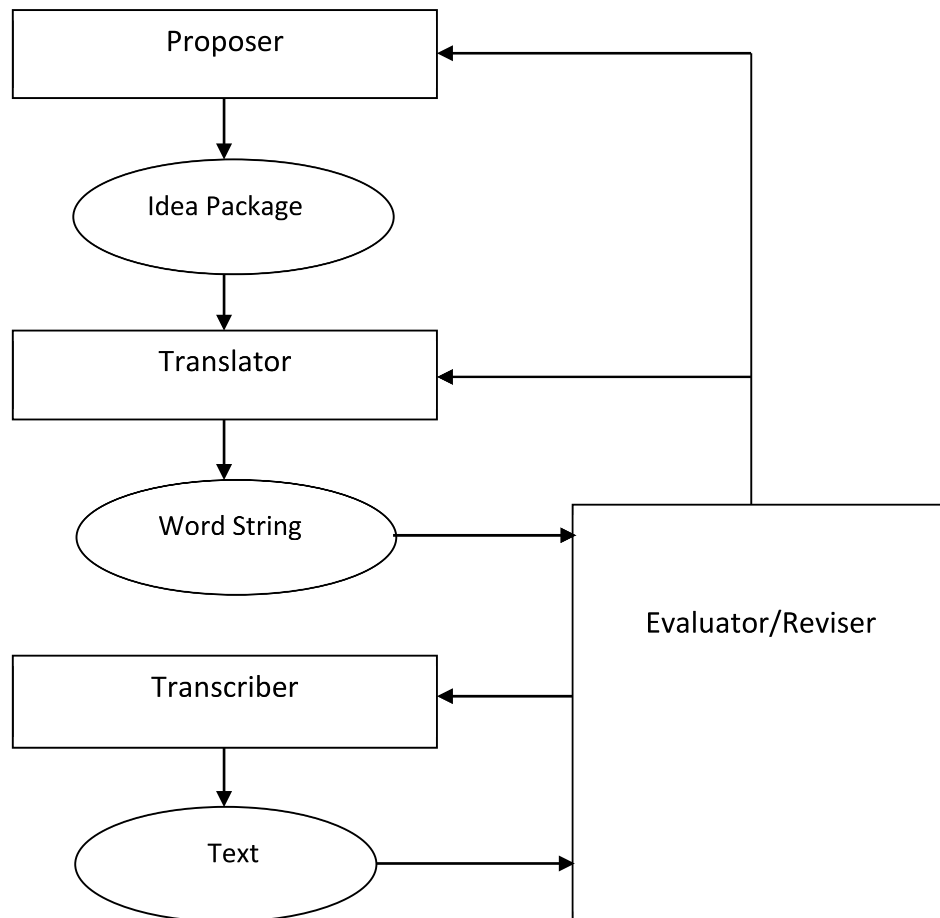


Figure 2.5 A model of text production (Chenoweth & Hayes, 2003, p. 113)

Table 2.1 below shows a summary of the cognitive models of the L1 writing process discussed above, presenting the equivalences between subprocesses proposed by each model.

Table 2.1 Summary of subprocesses of L2 writing

Flower and Hayes (1981)	Scardamalia and Bereiter (1987)		Kellogg (1996)	Chenoweth and Hayes (2003)
	knowledge-telling model	knowledge-transforming model		
Planning	Mental representation of assignment, Locate topic and genre identifiers, Construct memory probes, Retrieve content from memory using probes & Run tests of appropriateness	Mental representation of assignment, Problem analysis and goal setting & Problem translation	Formulation (planning)	Proposer
Translating	Write	Knowledge-telling process	Formulation (translating) & Execution (programming & executing)	Translator & Transcriber
Reviewing	Run tests of appropriateness (in later iterations)	Problem analysis and goal setting (in later iterations)	Monitoring (reading & editing)	Evaluator/ Reviser

Although different terms are used, most cognitive models share two common characteristics. First, during the writing process, there is continuous interaction between knowledge development and text production, and for this, writers use both their long-term and their working memories. A variety of information from the writers' long-term memory and from external resources is employed to generate ideas and text, and the ideas the writers want to express are maintained in working memory until the text is produced. Next, composing processes do not occur in a linear sequence but operate recursively and simultaneously. Ideas and written text can be reviewed, evaluated, and revised at any time during the writing process.

2.1.2.3 Research on L2 writing process models

Several L2 researchers posit different subprocesses or cognitive behaviours in L2 writing, elaborating on L1 writing models. For instance, on the basis of Flower and Hayes's model of L1 writing, Wang and Wen (2002) propose a model of the L2 writing process (Figure 2.6) focusing on which language (L1 or L2) is dominant in each of the subprocesses during the L2 writing process. In their model, Wang and Wen have adopted some components, such as *Task Environment* and *Writer's Long-term Memory*, from Flower and Hayes's model. Where Wang and Wen's model is most different from Flower and Hayes's model is in the component of *The Composing Processor*, which describes L2 writers' mental activities during the process of actual text production. Instead of using traditional terms for writing processes (i.e., planning, translating, and reviewing), Wang and Wen identify five categories of L2 writing activities: *task-examining, idea-generating, idea-organising, text-generating*, and *process-controlling*. *Task-examining*, *idea-generating*, and *idea-organising* match *Planning* in Flower and Hayes's model, and *text-generating* corresponds to *Translating*. As can be seen in the model in Figure 2.6, these activities are connected with lines and bidirectional arrows, representing the recursive nature of writing. Another interesting aspect of this model is that the three main writing processes and each subprocess are indicated by three different symbols, based on which language is dominant in each subprocess. For example, in the composing processor, L1 is assumed to be used dominantly in the process of idea generating, idea organising,

and process controlling; on the other hand, learners are held mostly to employ L2 while examining a task and generating texts.

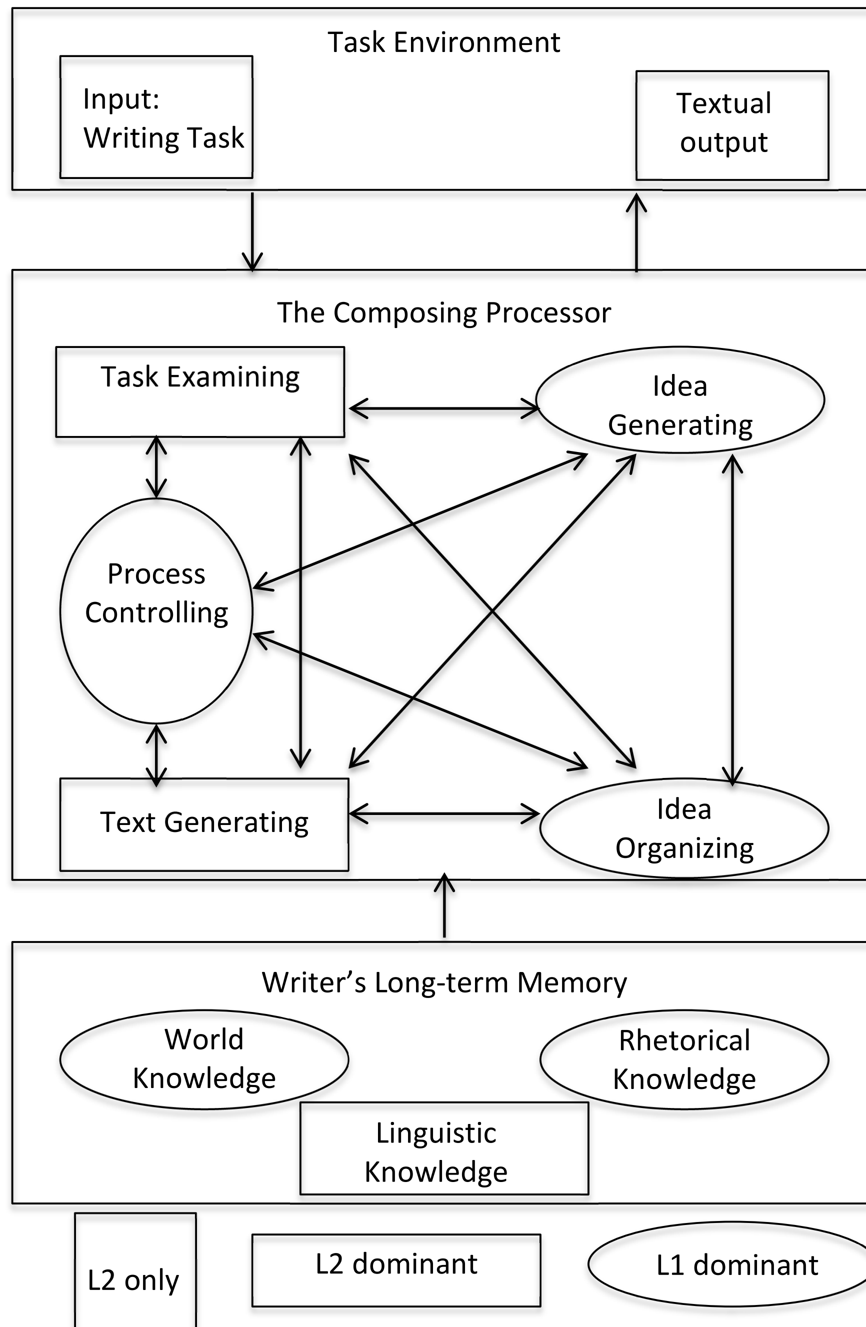


Figure 2.6 A descriptive model of the L2 composing process (Wang & Wen, 2002, p. 242)

In contrast, Abdel Latif (2009) posits six writing components: *planning, monitoring, retrieving, reviewing, text-changing*, and *transcribing*. He explains that planning is when learners are proposing ideas or texts for writing, and monitoring occurs when they reflect upon or reorganise the proposed or written ideas or texts. Retrieving indicates that learners are searching for ideas or texts, and finding a proposed or written text. Reviewing is when learners are checking the appropriateness of the proposed or written text, as well as reading what has been done so far. In the process of transcribing, ideas are converted into written language, and text-changing occurs when learners are either revising to change the meaning of the text, or editing grammar, spelling or punctuation without changing the meaning of the text. In his suggestions for a L2 writing model, Abdel Latif subdivides the writing process into smaller components, comparably to Flower and Hayes's model of the L1 writing process. For example, *Translating* in Flower and Hayes's model matches *textual planning*, *retrieving*, and *transcribing* components in Abdel Latif's model (the box with a dotted line in Figure 2.7). In addition, the *translator* in Chenoweth and Hayes's model covers *retrieving* in Abdel Latif's model while the *transcriber* corresponds to *transcribing*. The *evaluator/reviser* in Chenoweth and Hayes's model matches *reviewing* and *text-changing* in Abdel Latif's model. Moreover, *ideational planning* covers *task-examining*, *idea-generating*, and *idea-organising* in Wang and Wen's model, and *transcribing* and *reviewing* match *text-generating*.

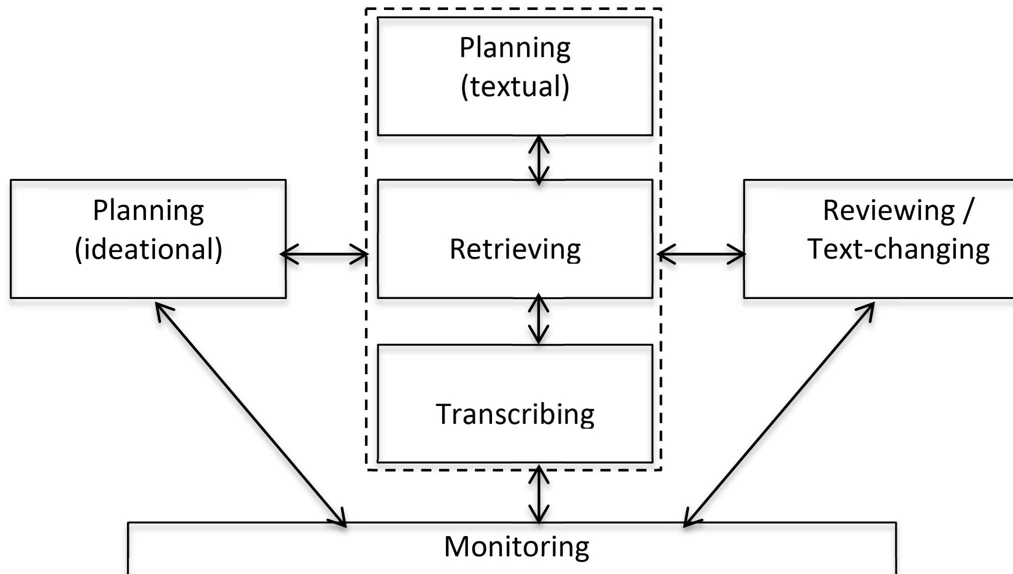


Figure 2.7 Abdel Latif's L2 writing model (Abdel Latif, 2009; developed by the researcher based on Abdel Latif's descriptions of the writing components)

Zimmermann (2000) also proposes an L2 writing model (Figure 2.8), emphasising even more strongly the recursive feature of writing processes. L2 writers may preplan and go on to planning either globally or locally. Then, they formulate, write, evaluate formulation, repair the written words and review the whole text, although they may also go back to earlier stages. Zimmermann argues that the L2 problem solving activity, the most noticeably different component in his model from other L2 writing models, appears at any point between formulation and review, or indeed at more than one point between the two stages.

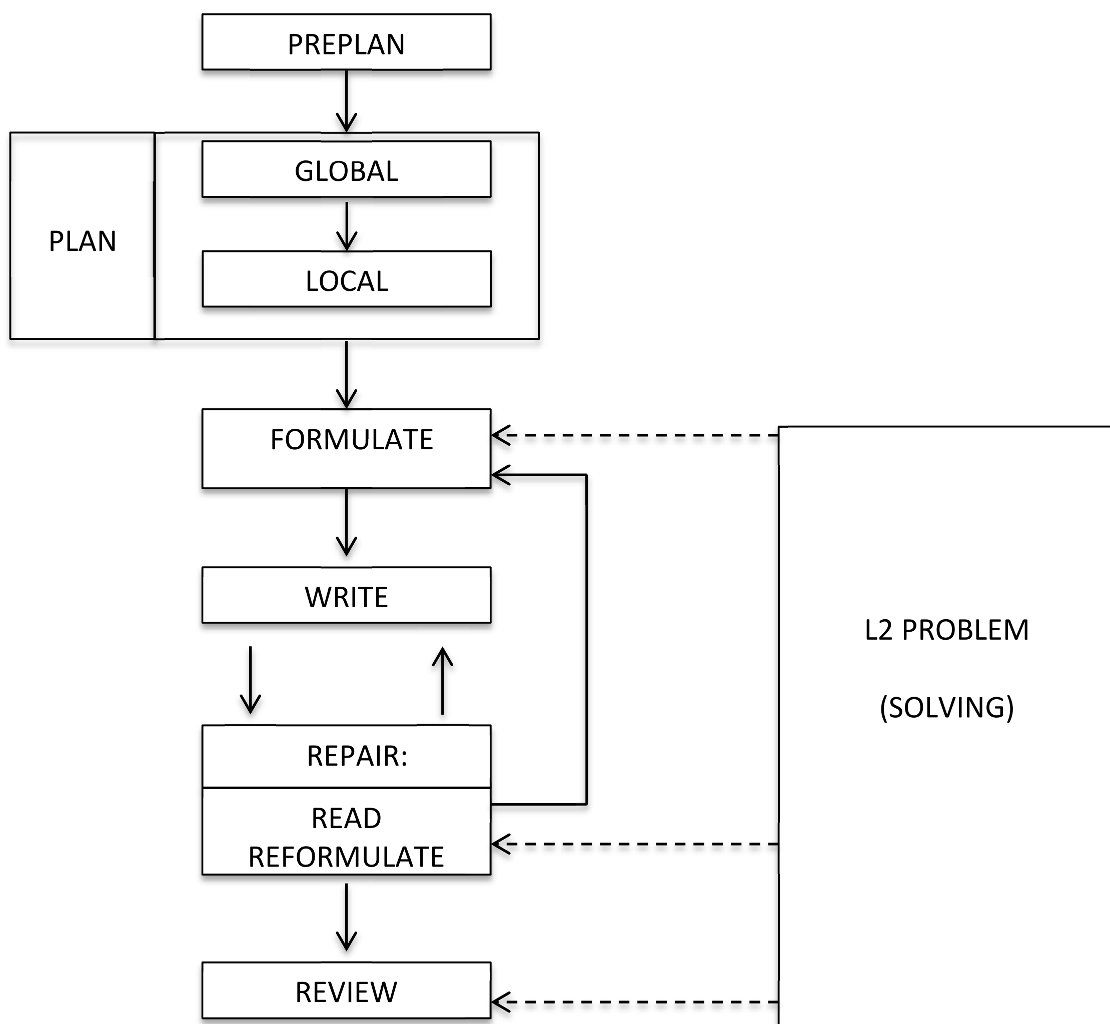


Figure 2.8 L2 writing: Zimmermann's model (Zimmermann, 2000, p. 85)

All three models of the L2 writing process above are mainly inspired by the models developed for L1 writing, especially by Flower and Hayes's model, and emphasise that writing processes in L2 occur recursively and simultaneously. However, in contrast to L1 writing models, the cognitive models of L2 writing tend to be focused on the formulating process where ideas are converted into words. L2 researchers have identified various subprocesses of the formulation process in writing, suggesting that the process of producing a text in a foreign language may be much more

complex than that in native language. This may mean that learners face linguistic difficulties during the L2 writing process. In particular, while Wang and Wen (2002) and Abdel Latif (2009) proposed specific writing components related to formulating, Zimmermann (2000) has paid attention to the L2 problem-solving process that appears most typically and can occur at any point when learners produce an actual text in L2. The present study is inspired by Zimmermann's model, since his model has introduced the element of the L2 problem-solving activity, which may be a distinctively differentiated process L2 writers experience compared to L1 writers and which may thus be an interesting topic to be investigated in the field of L2 writing. In the next section, the L2 problem-solving process will be examined in detail with a more in-depth discussion of the formulation process in L2 writing.

2.1.3 L2 problem-solving process in L2 writing

2.1.3.1 Features of the formulation process

Based on the examination of the cognitive models of the L2 writing process described above, it can be said that the formulation process is a crucial part of L2 writing, in that this is the process in which actual texts are produced. Van Weijen, Van den Bergh, Riglaarsdam, and Sanders (2008) argue that formulating is the most fundamental component of the writing process, since ideas are converted into texts in this process. They add that the process of formulation is language-dependent, so this process might be operationalised differently in different languages. In order to create L2 texts, learners need to retrieve appropriate lexical items or employ their

own grammatical knowledge; however, L2 learners may face language difficulties due to a lack of L2 knowledge during the process of putting the ideas into words. Therefore, formulating may be the process that differs the most between L1 and L2.

It can be said that both L1 and L2 writers have language problems while producing texts, but presumably, L2 writers are more likely than L1 writers to struggle with language problems in the process of formulating, since L2 writers need to use their second language, in which their resources are probably more limited. In fact, Cumming (2001:5) speculates that although there are similarities between L1 and L2 writing, L2 writers 'seem to devote much attention while they write to decisions about the form of the second language or to finding resources such as appropriate words'. Similarly, Wang and Wen (2002) argue that text-generating activity may be the most difficult of all composing activities. In their study of L1 use in the L2 writing process, 16 Chinese university learners (eight intermediate and eight advanced learners in terms of general English proficiency) were asked to complete two writing tasks (i.e., a narrative task and an argumentative task), and the think-aloud method was employed to gain insights into what was going on in their minds. It was found that nearly two thirds of the participants' attention while engaged in L2 writing was paid to sentence construction compared to idea generation or idea organisation, regardless of the types of writing tasks. This finding indicates that learners find it hard to create texts in L2.

Given that formulating is the subprocess of L2 writing that appears to engage the most writer attention and to be the most difficult, investigating it in depth will add significantly to knowledge about L2 writing. This in turn may provide useful knowledge for L2 writing teachers.

2.1.3.2 Fluent formulation vs. problem-solving formulation

According to Roca de Larios, Marín, and Murphy (2001), two main types of process may occur during formulation: a *fluent formulation process* or a *problem-solving formulation process*. They explain that the former process goes fairly fluently without long pauses or hesitation, indicating a lack of difficulty in creating sentences. On the other hand, the writer stops to solve problems during the problem-solving formulation process. This takes more time, as the writer encounters difficulties related to content, language, or organisation of the text. Two types of potential language problems are evoked: lexical searches (i.e., the search for words and expressions needed to convey the intended meaning) and restructuring (i.e., the search for an alternative syntactic plan once the original plan has been considered unsatisfactory for linguistic, ideational or textual reasons) (Roca de Larios, Murphy & Manchón, 1999).

The classification above applies to both L1 and L2 writers. However, because of the specificity of L2 writing, in which writers may be much more concerned about their language use in than in L1 writing, the problem-solving formulation process may be

more problematic in L2. Roca de Larios, Manchón, and Murphy (2006) conclude this from a comparison of time allocation in L1 and L2 writing. The aim of their study was to explore the allocation of composing time to problem-solving formulation processes in relation to two independent variables: 1) the language of composition (L1 vs. L2 writing); and 2) the writers' L2 proficiency. In this study, 21 Spanish EFL writers were asked to perform writing tasks in two different languages (L1-Spanish and L2-English) while thinking aloud. To compare participants' L2 proficiency levels, three different year groups in the Spanish educational system with 6, 9, and 12 years of instruction in English were selected. Each group consisted of 7 participants. L2 proficiency was assessed by the Oxford Placement Test. The results showed that the participants devoted twice as much time to dealing with formulation problems in the L2 as in the L1, and that the amount of time allocated to solving problems in the L2 did not depend on L2 proficiency. The findings should be cautiously interpreted due to the small sample size; however, it would be interesting to replicate the study with a larger sample and to examine whether the time spent on solving problems in the L2 is spent in the same way by more and less proficient learners.

2.1.3.3 L2 problem-solving processes in formulating

The L2 problem-solving process has been taken into account in some L2 writing models. For example, Krings (1992) examines a model of the L2 writing process (Figure 2.9), and focuses particularly on the L2 problem-solving process. In his model, six subprocesses related to formulating are posited: *expressing local plans in L1 and*

L2; *identifying L2 problems*; *activating L2 strategies*; *evaluating L2 problem solutions*; and *deciding on L2 problem solution*. In this model, the L2 problem-solving process consists of the four subprocesses in the shaded area in Figure 2.9.

Zimmermann (2000) also includes the L2 problem-solving process in his formulating model of L2 writing (Figure 2.10), which is based on an empirical study. For this study, college-level German students majoring in English were asked to complete various writing tasks (i.e., writing short film narratives, directions for finding the way, and letters of complaint in both L1 German and L2 English) while thinking aloud. Retrospective interviews were also conducted to examine the writing process. In this model, the formulating process consists of several typical but not obligatory subprocesses, and the most common formulating sequence is *Tentative Formulation in L2*, *Evaluation*, *Acceptance*, and *Writing Down*. Before being accepted, a tentative form is often modified and/or repeated, and evaluating sometimes results in rejection, simplification, and postponement. Tentative formulations in L2 can be preceded by a tentative formulation in L1 via *L2 Problem Solving* that is defined as 'a statement of L2 problems and activation of strategies' (Zimmermann, 2000:87).

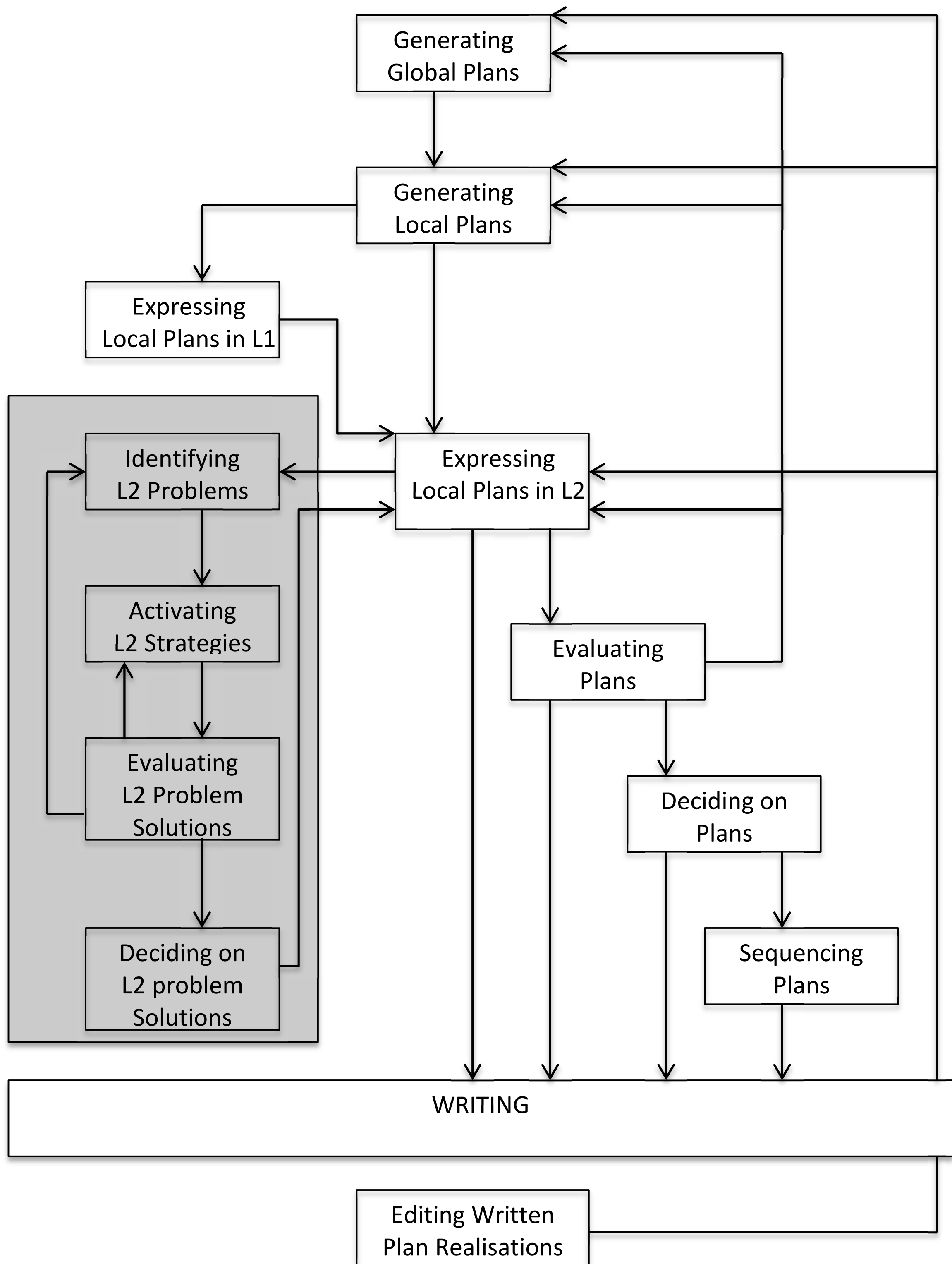


Figure 2.9 L2 writing model (Krings, 1992, p. 78; translated from German)

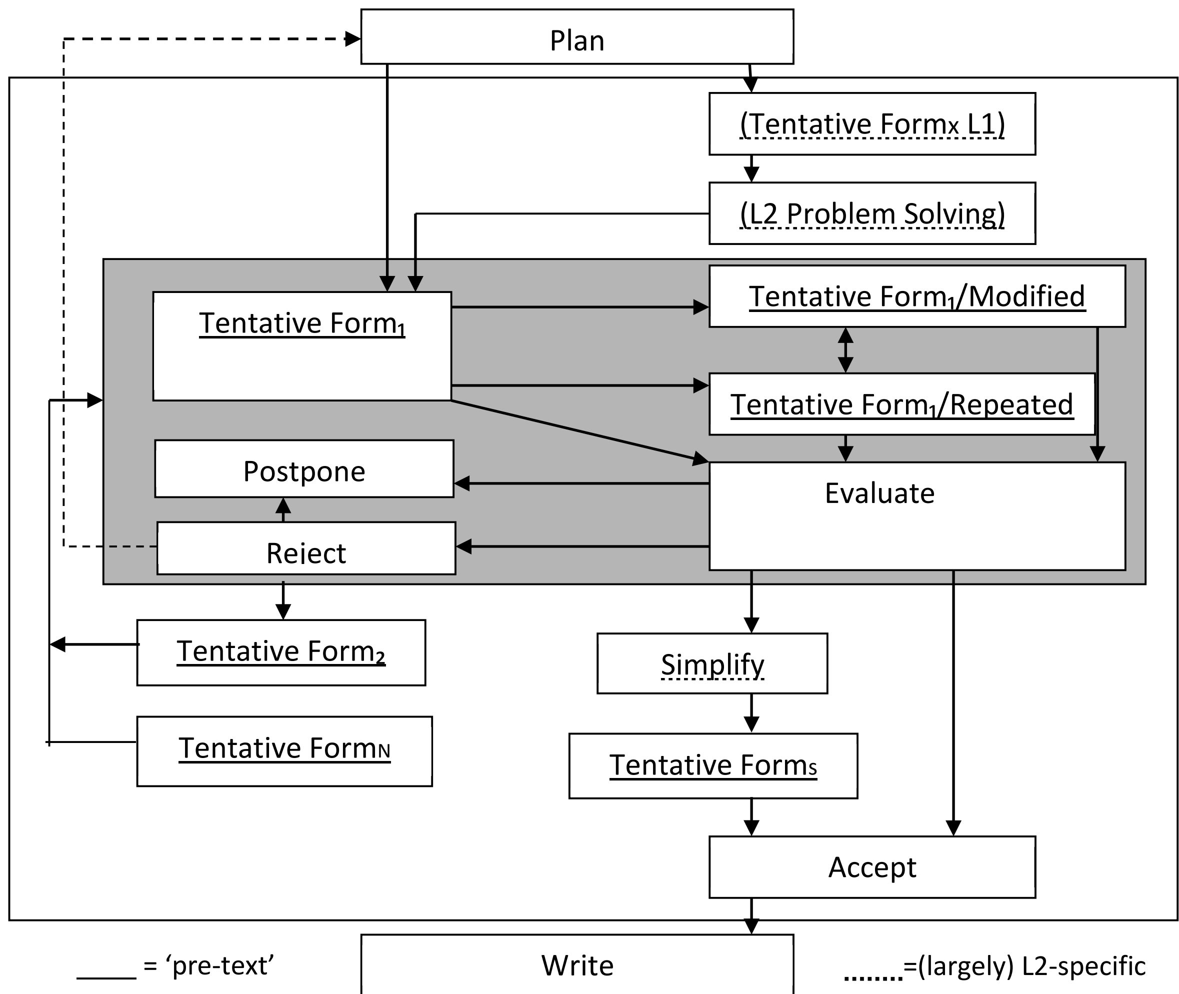


Figure 2.10 A model of formulating in L2 writing (adapted from Zimmermann, 2000, p. 86)

Among different subprocesses of the L2 writing process, examining the L2 problem-solving process reveals what language problems L2 learners face and how to solve them, on the basis of the unique L2 writing specificity different from L1 writing. Investigating this process will shed light on what happens during the L2 writing process, especially in terms of linguistic features. Furthermore, for L2 teachers, understanding what kinds of language difficulties (e.g., lexical or grammatical

problems) learners encounter will fortify teachers' ability to facilitate the learning process of L2 writing.

Both Krings' (1992) and Zimmermann's (2000) models posit that the L2 problem-solving process includes two subprocesses: 1) realising L2 problems and 2) activating strategies. Based on this, two crucial concepts will be discussed as a basis for the present study, in order to examine the L2 problem-solving process in L2 writing. First, as pointed out before, L2 learners often encounter linguistic problems due to lack of L2 knowledge when producing a text in L2, and they may notice deficiencies in their interlanguage system. It can be assumed that identifying or noticing a problem is the first step in the problem-solving formulation process, so the concept of *noticing* and studies of noticing in L2 writing will be examined later in this thesis. The second key concept that will be discussed is that of *knowledge sources*. Once a problem is identified, learners may use various types of knowledge to solve it. To understand how learners solve language problems, it may be important to scrutinise what strategies they activate. However, it is also worth investigating the knowledge sources that learners employ when making a decision about solving a linguistic problem, so identifying what kinds of *linguistic knowledge* are applied in L2 problem-solving circumstances will help L2 teachers to make more effective L2 writing preparation. Strategy-based and knowledge-based approaches to the L2 writing process will be examined in more depth in Section 2.4.1.1.

Regarding the concept of *noticing*, it is useful to review two theoretical perspectives on noticing in SLA: Swain's (1985, 1995) Comprehensible Output Hypothesis and Schmidt's (1990) Noticing Hypothesis. In the next section, the Output Hypothesis and the functions of output in SLA will be examined, leading to a review of L2 writing research on the noticing function of output. Schmidt's Noticing Hypothesis will then be examined in section 2.3.1.2.

2.2 Output in second language learning

2.2.1 Comprehensible Output Hypothesis

2.2.1.1 Input, interaction and output in SLA

In one current account of second language acquisition, there are three elements that have been argued to be required for successful second language learning: *input*, *interaction* and *output*. First of all, it has been repeatedly emphasised that input plays a pivotal role in facilitating language learning. In particular, through his Input Hypothesis, Krashen (1985) argues that L2 can be acquired when learners receive enough comprehensible input. In this view, language acquisition occurs only when the input that contains structures at the learner's next level is abundantly provided. Therefore, in classrooms, Krashen proposes that teachers need to provide learners with lots of rich input in order to help them acquire the L2, and contends that learners' language acquisition will emerge once they build up enough comprehensible input.

Following up Krashen's viewpoint about the roles of input in SLA, Long (1996) proposes that interactive input is more important than non-interactive input. In Long's Interaction Hypothesis, interaction plays a significant role for SLA, as a means of facilitating input comprehensibility and negotiation of meaning, and language development occurs through the process of interaction between learners and other speakers or certain types of feedback. Interactive input is said to provide learners with chances to realise what kinds of language problems they have through conveying the messages to others and being given modified input. Consequently, the interactional modifications that occur in negotiating meaning may lead to second language learning (Long & Robinson, 1998). Both Long and Krashen view comprehensible input as a source of acquisition; however, Long has a different perspective from Krashen. While Krashen argues that input needs to be simplified, Long stresses that interactional modifications are more important for the learner than simplified input.

However, these views of the role of input as a means of enhancing language acquisition have been challenged by a number of researchers (e.g., R. Ellis, 1990; Larsen-Freeman & Long, 1991; Sharwood Smith, 1986; White, 1987). These writers have criticised Krashen's Input Hypothesis, maintaining that how comprehension processes facilitate language learning is unclear and that comprehensible input is not sufficient for acquisition. In this perspective, producing language output is regarded as a very important process in language acquisition and learning. In particular, Swain (1985) emphasises the role of output in second language development. While

admitting the importance of input in SLA, she proposes that input is not the only source available for enhancing L2 development. Through her Output Hypothesis, Swain has introduced the notion of functions of output, which will be discussed in more depth in the sections that follow.

2.2.1.2 Swain's output hypothesis

Swain (1985, 1995, 2000) has developed the Output Hypothesis as a complement to the Input Hypothesis, and proposes a vital role for output in SLA. That is, she proposes that both comprehensible input and output are essential in language acquisition, and 'output pushes learners to process language more deeply than does input' (Swain, 1995:126). With regard to output, Swain's view is different from Krashen's, in that output has a more active role in second language development. In Swain's perspective, the production of language is regarded not merely as the result of acquisition, but rather as a significant contributor to acquisition. In her Output Hypothesis, Swain (1985) claims that it is important for learners to have opportunities for meaningful use of their linguistic resources for successful second language learning, and proposes that production may help shift learners' attention from semantic to syntactic processing. In this way, the act of producing language (i.e., speaking or writing) constitutes part of the process of second language learning.

As evidence for the Output Hypothesis, in Swain's (1985) study with 69 Grade 6 French immersion students in Canada, it was found that the young learners were

lacking accurate grammatical and syntactic competence. In addition, their speaking and writing performance lagged behind that of same-aged native speakers, despite their almost seven years of exposure to comprehensible input. Swain observed that the learners had limited chances to speak in French in the classroom and were not pushed to produce beyond their level of interlanguage. On these grounds, Swain concluded that to fully acquire the target system, understanding new forms is not enough, and that learners need to be given the opportunity to produce the forms. Krashen (1998) criticises the Output Hypothesis, arguing that 1) comprehensible output does not significantly contribute to the development of linguistic competence, 2) high levels of linguistic competence are possible without output, and 3) it is hard to find direct evidence that comprehensible output causes language acquisition. However, despite a negative perspective on the role of output in SLA, Krashen acknowledges that output has a potential role in supporting acquisition in that output can influence input quality and quantity.

Swain (1998) proposes that the reason output is necessary is that while learners can often comprehend a message without much syntactic analysis of the input, production forces learners to pay attention to the forms with which intended messages are expressed. Likewise, Gass (1997) notes that input only may not be a means of enhancing language acquisition, because comprehension does not always involve syntactic processing. During comprehension, learners only need semantic processing, that is, decoding the meaning of an utterance by accessing acquired linguistic knowledge. On the other hand, production stimulates learners to process

syntactically in order to encode their message in L2, and during this process, output makes learners recognise problems in their interlanguage and encourages them to solve these problems in the given situation. Consequently, learners discover what they can and cannot do in language production (Swain, 2000), and afterwards, learning can take place when learners are given certain types of subsequent feedback in relation to those difficulties they encounter (Baleghizadeh & Derakhshesh, 2012).

2.2.2 Functions of output

2.2.2.1 Hypothesis-testing

Building upon her Output Hypothesis, Swain (1995, 1998) identifies three functions of output: *hypothesis-testing*, *metalinguistic functions*, and *noticing*. The first function that Swain (1995) proposes for output is the hypothesis-testing function. Producing output can encourage learners to test hypotheses about the target language. According to Swain, learners use their output as a means of trying out new language structures to see what works and what does not in communication. That is, learners may experiment with new linguistic forms in their effort to convey the appropriate meaning in a given context during language production. In comprehension, on the other hand, learners may have relatively fewer chances to test their assumptions or hypotheses about the target language, since they have to wait for data which will confirm or falsify their hypothesis to emerge from the input. To test a hypothesis, it is immeasurably more efficient for learners to say or write something in the target language (Shehadeh, 2005).

In classroom activities, the hypothesis-testing process may be followed by interlocutors' feedback, and consequently, learners may try to modify their own output. To express the intended meaning in an appropriate context, as Swain (1995) suggests, learners may attempt to replace incorrect hypotheses or assumptions about the target language forms, on the basis of the internal (e.g., mental lexicon or grammar knowledge in L1 and L2) or external feedback available to them. Through the process of revising their own output, learners may get some new knowledge about the target language, and then try to incorporate the new knowledge into their own interlanguage knowledge. In this sense, 'hypothesis- testing can be perceived as a tool learners can use when pushing the limitations of the current interlanguages in order to contend with language they have not yet mastered' (Byrne, 2012:21).

Shehadeh (2003) has empirically examined the hypothesis-testing function of output. He investigated the hypothesis-testing function with 16 adult participants, of which 8 native speakers (NS) and 8 non-native speakers (NNS) in dyads speaking English. In each pair, a NNS's oral description of a picture to NS partner was audio-taped. A total of 8 audio-recordings were analysed and examined for non-native speakers' *hypothesis testing episodes* (HTEs). The results showed that NNSs tested out one hypothesis about the L2 every two minutes on average. In addition, of a total of 39 HTEs by NNSs, 24 grammatically well-formed instances of output and 15 ill-formed instances of output were found. Interestingly, it was also revealed that NS interlocutors provided no corrective feedback or negative evidence to the ill-formed

output, indicating that it may be rare for NS interlocutors to provide negative evidence to learners' incorrect or less native-like output unless it hinders comprehension. These findings seem to support Swain's claim that while producing output, learners test hypotheses about comprehensibility or linguistic well-formedness. However, learners may not always obtain evidence to confirm or falsify these hypotheses.

2.2.2.2 Metalinguistic function

The second function of output is the metalinguistic function, and this function comprises learners' reflections on their own language use. Swain (1995:132) notes that 'under certain task conditions, learners will not only reveal their hypotheses, but reflect on them, using language to do so'. That is, output prompts learners to think about the language they produce and to examine and reflect on whether their output is linguistically correct. Muranoi (2007) proposes that this function may be closely related to the promotion of learners' syntactic processing. As mentioned before, producing the target language pushes learners to process the language syntactically by encouraging them to pay attention to the means of expression necessary for conveying their intended meaning successfully (Swain, 1985). Consciously thinking about and analysing linguistic structures during the process of L2 production, as opposed to simply comprehending L2, may enable learners to move from a sematic to a syntactic use of language.

Learners' talking about language also makes it possible for researchers to understand what happens in language learning processes, since metatalk (i.e., language used to reflect on language) may be observed when learners face and solve language problems during a challenging production task (Swain, 1998). Note that conscious and reflective analysis on language use does not necessarily mean that learners are able to or need to use the correct linguistic terminology, defining metalinguistic items. Regardless of the use of metalinguistic terminology, learners' metatalk can represent the point at which they find themselves on the language learning continuum.

2.2.2.3 Noticing

With regard to the third function of output, noticing, Swain (1995:126) contends, 'in producing the target language learners may notice a gap between what they want to say and what they can say, leading them to recognise what they do not know, or know only partially'. That is to say, in the process of producing the L2, learners become aware of their lack of linguistic knowledge. This noticing prompts learners to attend to either external or internal feedback and pushes them to consciously reprocess their performance and modify their output (Shehadeh, 2005). Swain and Lapkin (1995: 374) argue that cognitive processes triggered by noticing 'may represent the internalization of new linguistic knowledge, or the consolidation of existing knowledge'. In other words, producing output allows learners to realise their

language problems, and consequently, the conscious recognition of problems may trigger learners' interlanguage development (Soleimani, Letabi & Talebinejad, 2008).

Some researchers have investigated the noticing function of output (e.g., Adams, 2003; Izumi & Bigelow, 2000; Rahim & Riasati, 2011; Swain & Lapkin, 1995). Sakai (2004) conducted a study with 16 Japanese university EFL students to explore the role of output. In this study, the participants were divided into two groups (the model group and the recast group), and performed communicative tasks. The model group had a picture description task without feedback and a picture identification task with model input by the researcher. On the other hand, the recast group completed only a picture description task with feedback from the researcher. After the tasks, both groups reported what they noticed about errors or linguistic problems in a retrospective interview. The results showed that the participants noticed linguistic problems by producing the target language, and that in terms of *noticing the gap,* recasts were more effective in enhancing learners' noticing than were models. Likewise, Mennim (2007) demonstrated that producing oral output prompted learners' noticing of L2 forms, and that there was improvement in the use of the forms that the learners had noticed. In this study, 17 Japanese university students were encouraged to notice any language problems or errors in their oral output during a nine-month course on giving presentations. Noticing was operationalised as learners' self-reporting through post-presentation questionnaires and transcription exercises using video recordings. The findings indicated that nine months on, learners' accuracy in the use of the noticed forms had significantly improved.

However, it is worth noting that the conclusion may lack generalisability because only two students' noticing data was analysed.

When speaking or writing in L2, learners must employ their current, and often incomplete, interlanguage knowledge to create messages that appropriately convey their intended meaning. During such attempts, they may recognise that they are unable to accomplish this successfully. Once linguistic deficiencies are found, learners try to solve them using internal or external resources. The noticing function of the Output Hypothesis may be critical for the process of second language development in that L2 learners' recognition of the linguistic problems they face is potentially the first step of the restructuring process.

In explaining the noticing function, Swain (1998) differentiates three different types of noticing. The first type is different from the other two types in that it occurs mainly in the process of comprehension rather than production. The other two types of noticing are both based on language production, and these two functions are closely related to the role of output that is held to make learners internalise their linguistic knowledge (Swain, 1995).

The first type of noticing, *noticing a form in the input*, occurs when learners simply notice the formal aspects of the target language in the input. Sakai (2004) explains that this kind of noticing may be influenced by the frequency or saliency of the input. That is, when a particular language item is prominent, or occurs frequently in the

input, learners may naturally recognise it on a conscious level. Noticing is also stimulated by external manipulation such as input enhancement. Sharwood Smith (1993) has introduced the notion of input enhancement as means by which language input becomes salient to the learner. A specific form can be made prominent in the input either implicitly by highlighting the form, for instance with distinctively different colouring, or explicitly, for instance by giving explanations (Batstone, 1996).

The second type of noticing is *noticing the gap between the interlanguage and the target language*. Learners may attend to forms in the L2 input that are different from their own interlanguage. This type of noticing occurs when the forms employed by a language learner in the process of producing L2 output are different to those present in the target language input. That is, the learner becomes conscious of a 'gap' in their interlanguage. This level of noticing may be different from the first type of noticing, because it can lead to language development in more direct ways, by giving learners chances to compare what they have produced to what it should be. As Izumi (2003) points out, as the consequence of identifying the difference between the interlanguage and the target language, learners may have opportunities to acquire a target-like form.

The last type of noticing is *noticing one's interlanguage deficiencies*. Learners may notice that they cannot say something exactly in the target language even though they want to say it. Doughty and Williams (1998:228) refer to this type of noticing as *noticing holes*. This level of noticing occurs when learners become aware of the fact

that they wish to express something in the target language but find that they are unable to do so due to a lack of knowledge about the target language in the process of language production.

Noticing the gap vs. noticing holes

Both *noticing the gap* and *noticing holes* occur in the process of language production; however, the two types of noticing may occur differently according to situations. Hanaoka (2007) makes the distinction between these two kinds of noticing. Noticing the gap happens when learners notice native-like forms from any type of models and realise that there is a difference between what they have said or written and what the correct model shows them. For this, there needs to be data to be compared with, such as native-like essays, or feedback from outside such as teachers or colleagues. On the other hand, noticing holes occurs when learners feel that there is an empty hole that they cannot fill due to a lack of L2 knowledge. They notice that they cannot say precisely what they want to say in the target language without any comparable sources or external feedback.

Another distinctive difference between two types of noticing is the level of intention when noticing occurs. Although attentional resources are used in both kinds of noticing, the focus of attention may be different in terms of the degree of the deliberateness when learners give focal attention to language features. Whereas learners may focus on what *difficulties* they have in the process of noticing holes,

learners emphasise what *differences* they recognise in the process of noticing the gap. For instance, for the studies of noticing the gap in L2 writing, participants are generally asked to find the differences between their own product and the native speaker's product. They try to detect noticeable differences purposely when comparing their own outcome and a type of input as an external source. On the other hand, for noticing holes, there is no input that may make learners draw focal attention to linguistic elements, and they are expected to notice the problems they are struggling with, if any. Learners are not required to find the difference, so learners are less likely to use their attentional resources intentionally.

It should also be noted that by investigating noticing of holes, researchers may get different findings than from examining noticing of gaps, since the two types of noticing occur at different points in the L2 writing process. That is, while noticing holes typically occurs *during* the formulating process, noticing the gap typically happens *after* the formulating process, because it occurs when learners compare their own written output to external feedback. In some studies that have examined the frequency of language-related episodes (LREs) both at the stage of composing a text and at that of comparing the original text to native-speaker models (e.g., Baleghizadeh & Arab, 2011; Hanaoka, 2007; Martínez Esteban & Roca de Larios, 2010), it has been found that learners notice more episodes related to lexis, grammar, and spelling at the initial writing stage than at the comparing stage. These results indicate that the degree of learners' focal attention on language may be different according to the points where noticing occurs. In contrast to any comparing

stage that may occur, learners may rely only on their interlanguage linguistic knowledge in the initial writing stage.

In L2 writing instruction, learners sometimes get feedback from external resources such as teachers or colleagues. In this situation, learners are likely to perceive the gap between their interlanguage and the target language. However, if feedback from external sources is not available, learners may depend only upon their internal knowledge during the process of L2 text production to notice deficiencies in their interlanguage. Therefore, in situations where L2 writing is mainly conducted individually instead of collaboratively, it may be more valuable to investigate noticing holes than noticing the gap.

2.2.3 L2 writing research on the noticing function of output

2.2.3.1 The role of noticing in L2 writing

Some empirical L2 writing studies have examined the noticing function of output; however, the results are inconsistent. For instance, Izumi, Bigelow, Fujiwara and Fearnow (1999) tested whether output opportunities followed by subsequent exposure would encourage learners to notice a certain grammatical feature (the English past hypothetical conditional) and to learn the feature. In a two-stage study with 22 college-level ESL learners, an experimental group was 1) given a first output opportunity, 2) provided with subsequent exposure to relevant input, and 3) asked to produce a second written output. A control group was provided with the same input

and then asked to answer comprehension questions about the input. A reconstruction writing task and an essay writing task were used as the output tasks for the experimental group. To measure noticing, the participants were required to underline parts of the sentences that they thought were necessary for subsequent production when they were provided with target-like input. The findings revealed that the numbers of underlined target forms were not significantly different in the two groups, but the experimental group performed considerably better than the comparison group on a post production test. A similar study with 18 adult ESL learners was conducted by Izumi and Bigelow (2000). There is a difference between the two studies; that is, in Izumi, Bigelow, Fujiwara and Fearnow's (1999) study, the reconstruction writing task was given in phase 1, and an essay writing task was given in phase 2; while Izumi and Bigelow (2000) reversed the order of the two tasks to examine a task order effect. In Izumi and Bigelow's study, there was no significant difference between the two groups regarding either noticing or acquisition of the target forms. In terms of noticing, both studies failed to show that the output group's level of noticing was significantly higher than that of the input group. However, it should be noted that the sample sizes were small.

On the other hand, Izumi (2002) provides evidence that output promotes noticing of formal elements in the target language input and subsequent learning of the form. In this study, 61 college-level ESL students were divided into five groups: one control group and four treatment groups, who differed regarding output requirements and exposure to enhanced input. A reconstruction writing task was used to produce

output, and noticing was operationalised as note-taking. The results indicated that output promoted detection of the forms in the input and also promoted noticing the gaps between the interlanguage form and the target language model. In addition, it was found that the participants required to produce output outperformed those without any output requirement in learning the target form as measured by four different written tests (a sentence combination test, a picture-cued sentence completion test, an interpretation test, and a grammaticality judgment test). In a similar study, Soleimani, Ketabi, and Talebinejad (2008) examined whether output-fronted activities enhanced learners' noticing of certain structures (rhetorical forms for contrast) in the input. In this study with 63 Persian college-level students, the experimental group and the comparison group were initially required to produce a paragraph. While the experimental group was given a contrast topic, the comparison group was provided with a non-contrast topic. Both groups then received a model contrast paragraph to underline the parts they thought would be helpful for their second writing attempt. They were required to produce a paragraph with a contrast topic as a second output. The number of underlined contrast-related words (e.g., *whereas*, *unlike*, and *however*) was examined. It was found that the experimental group noticed the contrast-related forms significantly more than the comparison group.

Although the results of the studies above were mixed and should be interpreted cautiously due to small sample sizes, the studies demonstrate that at least to some

degree, output opportunities promote learners' noticing and that language-related noticing does have an impact on learners' written products.

2.2.3.2 The role of written feedback in noticing

When examining the noticing function of output, some researchers employed native-like models, investigating the effects of written feedback, namely, *reformulation* and *model texts,* on learners' noticing in L2 writing. According to Cohen (1983:4), reformulation is defined as 'having a native writer of the target language rewrite the learner's essay, preserving all the learner's ideas, making it sound as native like as possible'. Adams (2003) argues that the use of reformulated writing may push learners to notice differences between their own essays and the native speaker's reformulated version. She also observes that reformulated writing may play a role in developing interlanguage. In Adam's study with a pre-test/treatment/post-test design, 56 American university students of L2 Spanish were randomly assigned to three groups: 1) Task repetition (repeating the tasks without additional treatment), 2) Noticing (repeating the task and comparing the original text to native speaker's reformulated writing), and 3) Noticing + SR (same as Noticing group with an additional stimulated recall session). A picture-based jigsaw puzzle task was employed as both the pre- and post-test. The results showed that learners participating in the noticing treatments incorporated more target-like forms from the reformulations in the post-treatment output. It was also found that the participants in the Noticing + SR group incorporated significantly more target-like forms in the

post output than the participants in the Noticing group. Learners might have had a chance to reflect on what they had noticed during the stimulated recall session, and this may have affected the post-task outcomes. Likewise, Rahim and Riasati (2011) conducted a study to investigate the role of reformulation on noticing with four adult Iranian EFL students. The participants were asked to write an essay, compare the original text and the reformulated text, and rewrite the original essay. It was found that reformulation promoted learners' noticing, and language-related noticing led to learners' subsequent writing development.

A *model text* is another type of written feedback that is given, in consideration of the writer's age, proficiency level, or the content and the genre of the composition (Martínez Esteban & Roca de Larios, 2010). The model text is different from reformulated writing in that the model is provided without reference to the learners' ideas, whereas the reformulated text is based on the content of the learners' text. Therefore, it is likely that reformulation leads learners mainly to identify linguistic gaps as they compare the original texts with the reformulated ones; on the other hand, model texts give learners new content knowledge as well as linguistic knowledge. Several researchers have studied the effect of model texts on noticing in L2 writing. For instance, Hanaoka (2007) investigated the role of model texts with 37 Japanese university students, engaging in a four-stage writing task: a composing stage, a comparison stage, and two revision stages. In the comparison stage, the participants were asked to report on whatever they noticed in their original text (e.g., vocabulary, grammar or content) when comparing their original text with the model

texts. It was found that the native-speaker models of writing played a role in promoting learner noticing, and that some features noticed in the models were incorporated in subsequent revisions. The results also showed that the participants noticed lexical features more frequently than other features such as grammar and content. Abe (2008) conducted a study to examine what aspects of language learners may notice when comparing their original texts to model texts and to explore the usefulness of model essays as a feedback tool. 14 Japanese ESL learners were given two writing tasks drawn from the IELTS writing test and asked to say what they noticed while comparing their own essays with the model essays. The findings of the study were that the model essays led the L2 learners to notice various aspects of language such as vocabulary and grammar.

Hanaoka (2006) examined different roles of these two types of written feedback (reformulation and model text). In this study, two adult Japanese female learners of English at different proficiency levels were asked to write a story in response to two sets of pictures while thinking aloud. One week after the writing session, the participants compared each of their original stories with a different feedback text (a reformulation text and a model text), again while thinking aloud. Immediately after the comparison session, the participants were asked to revise their original texts. The results showed that both participants overwhelmingly noticed lexical features. It was also found that the number of problematic language features noticed by the two participants was almost the same during the composing task; however, the more proficient learner noticed nearly three times more episodes than the less proficient

learner during the comparison task. Concerning feedback type, both learners noticed more episodes from the reformulation text than from the model text. It may be because the reformulated text is developed on the basis of participants' own writing, so it is easy to notice differences between the original and the reformulated texts. However, interestingly, the participants incorporated more features from the model text than from the reformulated text when revising their original texts. The findings of the study suggest that both reformulation and model texts can play a role as feedback tools in learners' noticing and subsequent writing development, but it should be cautiously interpreted because the analysis was conducted on the basis of only two students' noticing data.

On the basis of the findings of the studies above, it can be concluded that both reformulating and model texts have impacts on learners' noticing in L2 writing. That is, both written feedback resources encourage learners to notice language features when they compare their own text with the provided input. Furthermore, the linguistic features noticed in compared texts appear to lead to learners' subsequent writing development.

2.2.3.3 L2 writing studies on noticing holes

It seems that whereas many studies have investigated the noticing function of output using external written feedback, there are few studies directly exploring what problematic aspects of language L2 writers become aware of without external

feedback and further, how they solve linguistic problems by themselves while writing in L2. One of these is Swain and Lapkin's (1995) study, which used the think-aloud method as a noticing measure with eighteen Grade 8 French-immersion students (average age 13) to examine whether learners' own output can lead them to a conscious awareness of language problems during the L2 writing process. The results showed that the participants indeed noticed deficiencies in their linguistic knowledge during the L2 writing process, and that they engaged in certain thought processes, including grammatical analysis, when they encountered language problems. Armengol and Cots (2009) also employed the think-aloud method as a way of accessing writers' awareness in their study. From the analysis of the think-aloud protocols obtained from two Catalan university students, it was found that learners focused on global aspects of text production (e.g., text structure, text cohesion, or rhetoric) as well as language-related features. While the particular language problems that learners become aware of have been thoroughly documented in these two studies, how learners resolve the linguistic problems by themselves without external feedback has not been fully explored. This represents an avenue for further research that may provide important pedagogical implications in field of L2 writing.

In Section 2.2, the Output Hypothesis, the functions of output and empirical studies on noticing in L2 writing have been examined. In the next section, noticing in the context of L2 writing will be discussed from the point of view of Schmidt's Noticing Hypothesis, and factors influencing learners' noticing will be explored.

2.3 Noticing in second language acquisition

2.3.1 Noticing Hypothesis

2.3.1.1 Attention, awareness and noticing

Recently, *attention* and *awareness* have been greatly emphasised in SLA research, and the importance of noticing as a cognitive process has been increasingly recognised by many researchers (e.g., Batstone, 1996; Cross, 2002; R. Ellis, 2008a; Jin, 2011; Robinson, 1995; Schmidt, 1990, 1993, 1994, 1995, 2001; Skehan, 1998; Tomlin & Villa, 1994). Although these concepts have been defined in different ways, it has been generally agreed that their role is crucial in the L2 learning processes. To conceptualise *attention*, *awareness* and, especially, *noticing*, which is one of the key concepts for the current study, it may be necessary in addition to examine the term *consciousness*, since this term has various overlapping meanings such as 'awareness' and 'recognition'.

Schmidt (1990, 1994) suggests that a concept of *consciousness* is needed to resolve a number of issues in second language learning and claims that conscious processing of language input and output is important in language learning. He classifies the concept of consciousness into four dimensions. The first dimension is *intention*, and this refers to the deliberate attempt to attend to a stimulus. This meaning of consciousness is often associated with intentional versus incidental learning. Second, there is consciousness as *attention*, and this refers to the detection of a stimulus. Regarding this sense of consciousness, learners pay conscious attention to some elements in the

input for learning. The third dimension of consciousness is *awareness*, which represents the learners' subjective experience that he or she is detecting a stimulus. Schmidt (1995:29) introduces two different levels of awareness: *noticing* as a lower level of awareness, 'conscious registration of the occurrence of some event', and *understanding* as a higher level of awareness, 'recognition of a general principle, rule or pattern'. The fourth dimension of consciousness is *control*, which refers to the extent to which the language learners' output is controlled. This implies that the actual use of knowledge in performance involves conscious processes of selection. Schmidt (1994) differentiates c*ontrol* (an aspect of output processing) from *attention* (an aspect of input processing). He also posits that *control* may require either learners' considerable or minimal mental processing effort in the process of language production, depending on the development of automaticity in language processing.

While acknowledging that it is difficult to make a clear distinction between attention and awareness, Schmidt (1995, 2001, 2010) argues that *noticing* involves attention to only the surface structure of utterances in the input, not to any abstract rules or principles. In this sense, noticing is similar to *apperception* as articulated by Gass (1997). In Gass's L2 acquisition model, there are five stages that explain the conversion of input to output (i.e. Apperceived input - Comprehended input - Intake - Integration - Output); in the first stage, learners realise that there is a gap between what they already know and what there is to know. This is called *apperception*, and Gass (1997:4) defines it as 'an internal cognitive act in which a linguistic form is related to some bit of existing knowledge (or gap in knowledge)'. Schmidt (2001)

points out that *noticing* is equivalent to *apperception* in that it involves only a very low level of awareness.

2.3.1.2 Schmidt's noticing hypothesis

Schmidt (1990) proposes the Noticing Hypothesis, stating that 'intake is that part of the input that the learner notices'. That is, if a learner notices a form in input, it becomes intake for learning. As evidence for his argument, Schmidt refers to his own foreign language learning experience (Schmidt & Frota, 1986). While learning Portuguese in Brazil for five months, he kept a diary to make a note of new target forms he noticed in the input and also tape recorded conversations once a month. The input included his lessons and what he heard in daily life. The diary was analysed to see which features in the input he had consciously attended to, and a comparison was made between his subjective comments on what he thought he was learning and the recorded conversations. The findings indicated that the target forms he took notes on in his diary began to appear in his speech, and that there was a substantial correspondence between his reports of what he noticed and the linguistic forms he was actually using himself. However, it is worth noting that Schmidt's study can be criticised in terms of the generalisability of the results. His diary study is based on subjective data, so it is difficult to compare his data with the data from other studies to verify the conclusions. In addition, Schmidt is an experienced researcher, so the data may not be representative of typical language learners.

Schmidt (2001) provides both strong and weak versions of the Noticing Hypothesis in relation to the issue of whether learning is possible without attention and conscious involvement. In much of his earlier work, the strong version insists that noticing is necessary and sufficient for SLA. That is, learning does not occur at all from input that is not noticed by learners. On the other hand, the weak version, which reflects his later position, states that noticing is a necessary but not sufficient condition for SLA. Schmidt (2001:40) claims, 'people learn about the things they attend to and do not learn much about the things they do not attend to'.

In his Noticing Hypothesis, Schmidt (1990, 1994, 2001) argues that *attention* to input is a conscious process, and learners need to attend to and notice certain aspects of language in order to acquire them. In this sense, among the four dimensions of consciousness discussed above, *attention* seems to embrace the Noticing Hypothesis (R. Ellis, 2008a). On the basis of his study described above, Schmidt differentiated two kinds of noticing: *noticing*, referring to 'detecting certain language forms in the input' and *noticing-the-gap*, referring to 'identifying how the input learners are provided differs from the output learners can produce'. In other words, noticing can occur when learners allocate attentional resources to specific features of language in the input, or when learners find a mismatch between their own interlanguage forms and the target language forms provided in the input. As described in Section 2.2.2.3, Swain introduced three types of noticing, and *noticing a form in the input* and *noticing the gap between the interlanguage and the target language* in Swain's classification are aligned with Schmidt's *noticing* and *noticing-the-gap,* respectively.

Unlike Schmidt, Swain explored *noticing one's interlanguage deficiencies* (termed *noticing the holes* by Doughty and Williams, 1998:228) as a type of noticing. In the next section, I shall examine the empirical evidence for and against the Noticing Hypothesis.

2.3.1.3 Review of the role of noticing in SLA

Schmidt's Noticing Hypothesis and the role of noticing in SLA have been examined by a number of researchers with both some support and some criticism. For instance, Leow (1997) conducted a study to examine whether noticing indeed occurs and whether different levels of awareness lead to differences in L2 learners' performance. 28 adult learners of Spanish were asked to think aloud while completing a crossword puzzle task to manipulate the participants' noticing when exposed to some Spanish stem-changing verbs, and then two post-exposure assessment tasks, a recognition task and a written production task. From the analysis of the think-aloud protocols, the learners indeed noticed new targeted linguistic forms in the L2 data, and learners with a higher level of awareness performed significantly better than those with a lower level of awareness on the post-exposure assessment tasks. Likewise, in Leow's (2000) similar study with more participants (32 learners) and a different puzzle task, it was found that the group who demonstrated awareness of the targeted forms during the experimental exposure produced significantly more of these forms in writing when compared with the group that showed a lack of such awareness. Mackey (2006) demonstrated that noticing is

closely connected to L2 development on the basis of her study with 28 college-level ESL learners. While the experimental group had opportunities to receive interactional feedback from the teacher during the oral communication activities, the control group carried out the activities without feedback. Noticing was operationalised as the learners' report indicating a mismatch between their own production and the target language form, and data on noticing were collected through multiple measures (i.e. questionnaire, learning journals, and stimulated recall interviews). It was found that learners reported more noticing when feedback was provided, and learners who demonstrated more noticing developed more than those who did less noticing. However, the results should be cautiously interpreted due to the small samples size in this study.

On the other hand, some researchers have pointed out weaknesses in the Noticing Hypothesis. For example, Truscott (1998) argues that the hypothesis is not based on strong and rational grounds of cognitive psychology and linguistic theory. He points out that the notion of consciousness is confusing, and that there is no consensus on Schmidt's (1995) argument that awareness is almost isomorphic with attention. Truscott adds that the Noticing Hypothesis is not based on any coherent notion of what language is, and consequently, what learners must notice for acquisition is vague. Cross (2002) insists that the notion of noticing has been supported on the basis of intuition and assumption rather than on the findings of extensive empirical research. Similarly, Wen (2008) indicates that Schmidt's own evidence may not be strong enough to support his arguments, and this example alone is far from enough

to support the claim that L2 learners need to notice before they can learn anything. However, even these critics agree in some ways regarding the role of noticing in SLA. For instance, while arguing that distinctions between conscious and unconscious knowledge play a crucial role in language learning, Truscott (1998:124) reformulates the Noticing Hypothesis, saying 'the acquisition of metalinguistic knowledge is tied to (conscious) noticing; development of competence is not'. This view echoes Krashen's (1981) distinction between unconscious *acquisition* and conscious *learning*, representing a non-interface view of acquisition which is different from Schmidt's or Swain's perspective that the conversion of conscious, explicit knowledge to unconscious, implicit knowledge can occur.

Thus far, the concept of noticing has been discussed. However, it can be hypothesised that the ability to notice is not the same between learners and that there are diverse factors that influence noticing. In the SLA research literature, it seems that research on the factors that have impacts on noticing has mainly focused on input, while comparatively little attention has been paid to the factors in output. The present study is expected to fill a gap in the literature by exploring some factors affecting noticing in L2 writing. In the next section, first, the factors influencing noticing in input will be examined and then, L2 writing studies related to the factors that affect learners' noticing will be reviewed.

2.3.2 Factors influencing learners' noticing

2.3.2.1 Factors influencing noticing in input

Proposing his Noticing Hypothesis, Schmidt (1990) maintains that there are six factors that influence noticing in input. First of all, *frequency of input* gives L2 learners more chances to notice language forms in input. That is, when a language item is repeatedly presented, it is more likely to be noticed. *Perceptual salience of input* is another factor that is said to affect learners' noticing. If a language form in input is prominent, learners are likely to notice it. These two factors are related to the qualities of the input. In other words, language items that appear more frequently or are perceptually salient are more noticeable in input than the items that less frequently occur or are less prominent.

Next, *instruction* may have an impact on learners' noticing of language forms in input, by establishing expectations about language. In relation to the two factors described above, a teacher can encourage learners to have more chances to notice language forms, while providing them with a specific language item repeatedly or making less prominent language features more salient through instruction. Similarly, *task demands* may play an important role in improving learners' noticing. According to Schmidt (1990), task demands refers to 'the way in which an instructional task causes learners to notice particular features that are necessary in order to carry out that task'. Skehan (1998) points out that noticing may be dependent on whether the level of processing for tasks is low (e.g., the task that asks learners to exchange familiar

information), or high (e.g., the task that requires learners' imaginative and abstract decision-making abilities).

In addition to these learner-external factors, there are two factors that are internally related to learners: *expectations* and *skill level.* Expectations refer to how learners anticipate certain language features in input, and this factor is regarded as an important determinant of perceptibility and noticeability. Finally, skill level is related to how well learners are able to routinise previously met structures, and in turn, how ready they are to notice new language features in input. Both factors concern learners' capacity to deal with the range of forms in input (Skehan, 1998), and these are associated with individual differences. It can be assumed that due to variations in individual characteristics, the ability to notice can be different. Schmidt (2001) thinks that some people may have more effective input processing abilities than others. As a result, they are better able to notice language forms in input and further integrate them into their language development.

The factors above have been discussed in the literature on input. However, there may be some factors that have an impact on learners' noticing in output. In particular, learners' individual differences related to noticing during the L2 writing process are the focus of the present study, so previous studies of the factors that have effects on learners' noticing in L2 writing will be briefly reviewed in the following section, and several learner-internal factors will be discussed.

2.3.2.2 Studies on learner-external factors influencing noticing in L2 writing

Some studies have explored the learner-external factors that may influence noticing in the process of L2 writing. For example, regarding task differences as a learner-external factor, Song and Suh (2008) investigated the role of output and the efficacy of different types of output tasks on noticing. A total of 52 adult Korean learners divided into three groups (i.e. reconstruction, picture-cued writing, and non-output group) were asked, after completing a first task, to underline the parts of an input text that they felt were necessary for a subsequent task. In terms of the total amount of noticing, the results indicated that the picture-cued writing task led to more noticing of the target form (i.e. the English past counterfactual conditional) than the reconstruction task while both output tasks triggered the participants' noticing significantly more than the non-output task did. Likewise, in Abe's (2008) study of 14 Japanese ESL learners completing two writing tasks in the IELTS writing test, it was found that the quantity of learners' noticing in the model essay for a descriptive writing task was higher than in the model essay for an argumentative writing task.

In addition, Martínez Esteban and Roca de Larios (2010) have investigated learners' noticing, comparing individual and collaborative writing. In the study, seventeen Spanish secondary school students aged 15 were asked to perform a three-stage writing task: 1) writing a picture-based story, 2) comparing their written texts with models from native speakers, and 3) rewriting their texts. For comparison between writing conditions, 5 out of 17 participants did the writing task individually, and 12

participants were put into six pairs and tasked with collaborative writing activities. During the task, the participants were asked to notice any problematic features, and note-taking was used as a means of measuring noticing. The results demonstrated that both individuals and pairs noticed mainly lexical problems while writing their initial compositions; however, both groups mostly noticed features in relation to ideas and expressions when comparing their original texts to native-speaker models. In terms of the quantity of noticing between the two groups, individuals noticed more language problems than pairs in writing original texts; on the other hand, individuals noticed fewer language features than pairs in the stage of comparison. It may be concluded that different writing conditions (i.e., individual and collaborative work) have an impact on learners' noticing during the L2 writing process.

2.3.2.3 Learner-internal factors of noticing in L2 writing

As mentioned before, the present study focuses on learner-internal factors rather than learner-external factors such as task differences. Three learner-internal factors, namely, 1) *study abroad experience*, 2) *L2 proficiency*, and 3) *working memory*, are considered as independent variables that may influence learners' noticing. Each of these elements will be discussed in turn below.

Study abroad experience

It can be hypothesised that there will be effects of study abroad experience on noticing, since the large amount of exposure and practice in learners' previous study abroad experience may facilitate automatic processes such as retrieving lexical items or determining the correct surface structure of the sentence (Lafford, 2006). Regarding automatic processes, it can be assumed that study abroad experience immerses students in the native speech community and that learners' exposure to the presumably rich linguistic environment is responsible for gains in their use of the target language (Segalowitz, Freed, Collentine, Lafford, Lazar, and Diaz-Campos, 2004). According to Taguchi (2013), through study abroad experience, for learners, idiosyncratic interlanguage usage of routines will be moved to more conventional, target-like usage. In other words, a study abroad context is considered advantageous for the acquisition of routines in that it provides learners with plentiful opportunities for exposure and practice in daily interaction.

When the language process is routinised, less cognitive effort may be required by learners to access their interlanguage. Automatic processes happen as a result of 'consistent mapping of the same input to the same pattern of activation over many trials' (McLaughlin, 1987:134). As a result of frequent practice, the information processes involved in language use require fewer attentional resources. That is, the more learners practise, the less attention they need to allocate to a task. Compared to L1, L2 production is often more effortful and requires more attention due to a lack

of automatised knowledge (DeKeyser, 1997). When producing L2 texts, novice writers may need a high degree of attention to access knowledge about the words and structures they want to express; however, they may require fewer attentional resources to perform writing tasks once language processing becomes more routinised. Therefore, previous study abroad experience may have an effect on noticing in L2 writing.

A fairly large number of Korean university students have experience studying English abroad. According to Han (2005), the number of Korean learners studying in English-speaking countries (USA, UK, Australia, Canada, and New Zealand) has increased significantly since the Korean economy started to grow at the mid of 1970s. Some students may have education abroad experience before entering university, and others may improve their English language skills through student exchange programs provided by universities. For this reason, it is worthwhile to examine the effect of previous study abroad experience on noticing in L2 writing in the present study.

L2 proficiency

Learners' L2 proficiency may influence noticing in their production of an L2 text; that is, it may have an effect on the quantity and quality of the noticing episodes that occur (Storch, 2011). Numerous studies have examined the relationship between noticing and learners' L2 proficiency (e.g., Abe, 2008; Hanaoka, 2007; Iwanaka & Takatsuka, 2007; Swain & Lapkin, 1995). Qi and Lapkin (2001) have found that

noticing varies among learners according to their proficiency levels. In their study, two Chinese adult ESL learners at different levels of L2 proficiency performed a three-stage writing task: a composing stage, a reformulation stage, and a rewriting stage. Noticing data were collected by the think-aloud method. The results showed that the reformulation technique enabled students to notice a gap between their interlanguage and the target language. It was also found that the learner with a higher level of proficiency noticed more language-related problems than the lower proficient learner in the composing stage, and that the more proficient learner's noticing occurred in a higher level of awareness (i.e., noticing with providing reasons) while the less proficient learner's noticing happened at a lower level of awareness (i.e., noticing without giving reasons) in the reformulation stage. However, the results need to be interpreted carefully due to the very small sample size.

Besides Qi and Lapkin's study, other studies have shown fairly consistent results (e.g., Abe, 2008; Hanaoka, 2007; Swain & Lapkin, 1995). That is, the findings generally indicate that learners with higher L2 proficiency tend to notice more linguistic items than learners with lower L2 proficiency, whether they compose alone or compare their own texts with written feedback. However, this conclusion has been drawn from studies with small sample sizes. For instance, the number of participants in each proficiency group ranged from 10 to 15 in Hanaoka's (2007) study. Indeed, Swain and Lapkin (1995) compared two differently proficient groups consisting of only two participants each, and the noticing data from five students in each proficiency group was analysed in Abe's (2008) study. Because of the small sample sizes, it is hard to

generalise these results to other contexts. Therefore, to address the limitations of these previous studies with regards to sample size, the present study was conducted with a larger population (108 participants).

It may be difficult to define and measure L2 proficiency because of the complex specification of the elements of language proficiency. In fact, a number of the L2 writing studies on noticing discussed above have employed different types of constructs to assess L2 proficiency (e.g., TOEFL, IELTS, TOEIC, C-test and so on). According to Bachman and Palmer (1996), in a narrow sense, the construct of L2 proficiency can be defined as learners' knowledge of L2 grammar and vocabulary. Since one of the aims of the current study is to investigate what linguistic problems learners face during the L2 writing process, it may be more reasonable to assess discrete linguistic components of learners' proficiency rather than their general language skills (e.g., reading, listening, and speaking) through a standardised L2 proficiency test. For the present study, therefore, to measure participants' L2 proficiency, two tests were used: one is a version of Vocabulary Levels Test (VLT) for assessing vocabulary knowledge, and the other one is a C-test for gauging grammar knowledge. These instruments will be examined in more depth in Section 3.2.2.

Working memory

Working memory may also be a factor that can affect learners' noticing in L2 writing. According to Baddeley (1992:556), who has proposed the most influential model of

working memory, the concept of working memory is defined as ‘a brain system that provides temporary storage and manipulation of the information necessary for such complex cognitive tasks as language comprehension, learning, and reasoning’. Baddeley (1986, 1992) suggests that working memory includes three separable components: 1) the central executive, a system responsible for the attentional control and regulation of cognitive processes, 2) the visuospatial sketchpad, a component providing temporary storage and manipulation of visual and spatial information, and 3) the phonological loop, a part of working memory that temporarily processes and stores phonological information. The main supervisory system (the central executive) interacts with the two subsidiary systems (the visuospatial sketchpad and the phonological loop) during the process of complex task performance (Baddeley & Logie, 1999). Later, while attempting to account for the effects of long-term knowledge on working memory, Baddeley (2000) introduces a fourth component of the working memory model, the *episodic buffer,* which is assumed to be a limited-capacity temporary storage system that is capable of integrating information from a variety of sources.

Working memory seems to be closely related to attention, and this may be linked to a function of the central executive. Baddeley (1986, 1996, 2003, 2007) posits that while the visuospatial sketchpad and the phonological loop are mainly involved with the storage of information, the central executive is a system which controls attentional processes rather than memory storage. That is, one of the functions of the central executive is determining the focus of the working memory’s attention. Given that all

of the three components of working memory are limited in capacity (Baddeley, 2007; Baddeley & Logie, 1999), it can be assumed that individuals differ in their use of attentional resources that are constrained by working memory.

Regarding L2 writing, working memory capacity may determine how much attention L2 learners can pay to various stages of the writing process and how they manage their attention to content, organisation or language processing. Kormos (2012) contends that subprocesses of the L2 writing process are influenced by learners' working memory capacity. In particular, the formulating process, which is the most highly automatised mechanism in L1 writing, may demand attention in L2, especially for learners whose L1 is very different from the L2. As Hayes (1996) points out in his revised model of writing, working memory may be related to the non-automated activities of the writing process. Due to a lack of L2 linguistic knowledge, learners may experience greater cognitive demands when they write in L2 than in L1, and L2 processing may thus be constrained by individual differences in working memory capacity.

Several researchers have referred to the effects of working memory on noticing. Schmidt (1990) argues that an individual's processing ability determines how he or she notices new forms in the input. Skehan (1998) acknowledges that some learners may be more able to notice the range of forms in input, since they may have a larger working memory capacity or faster analytic processes within working memory. Mackey, Philp, Egi, Fujii, and Tatsumi (2002) explored the relationship between

working memory, noticing and second language development. In this study with a pre-test/post-test design, a total of 30 adult Japanese ESL students were given communicative tasks which provided contexts for the targeted forms (i.e. features of *wh*-question formation) during the treatment sessions. As noticing data, the participants' comments about the target forms were obtained from stimulated recall interviews and questionnaires, and phonological short-term memory and verbal working memory were measured. L2 development was operationalised as advances through the developmental stages of English question formation. The study found a significant positive relationship between verbal working memory and noticing of the targeted forms in recasts. Likewise, Bergsleithner (2011) investigated the relationship between noticing of L2 formal features, working memory capacity and grammatical accuracy in L2 oral performance. In this study, 30 Brazilian adult EFL students were asked to perform a speaking span test in L2 English to assess working memory capacity, and three oral tasks to assess grammatical accuracy (pretest / immediate posttest / delayed posttest). Noticing data was collected from participants' retrospective answers about the target structure (indirect questions) through questionnaires. It was found that a significant positive relationship exists between noticing and working memory capacity.

However, although some degree of relationship between working memory and noticing was found in the context of L2 speech production from both Mackey et al. and Bergsleithner's studies, it seems that there has been no study on the relationship between working memory and noticing in the L2 writing process. Furthermore,

various studies have examined the relationship between both L1- and L2-based working memory operations and L2 comprehension skills, such as L2 reading comprehension (e.g., Harrington & Sawyer, 1992; Ikeno, 2006; Walter, 2004) and L2 listening comprehension (e.g., Gu & Wang, 2007; Satori, 2012; Tsuchihira, 2007); however, again, there is an absence of research on the process of L2 production. Therefore, by examining individuals' working memory capacities both in L1 and in L2 as independent variables, the present study will contribute to a better understanding of learners' noticing during the L2 writing process.

In Section 2.3, the concept of noticing in SLA has been examined by reviewing theoretical backgrounds and empirical studies of noticing in L2 writing. As mentioned before, once a language problem is identified, learners may use various types of knowledge sources to solve it during the L2 writing process. In addition to noticing, therefore, *knowledge sources* as another key concept in this study will be examined in the next section.

2.4 Knowledge sources for solving linguistic problems in L2 writing

2.4.1 Knowledge sources in L2 writing

2.4.1.1 Strategy-based and knowledge-based approaches to the L2 writing process

Investigating the strategies L2 writers use can enrich understanding of how they might react when facing linguistic difficulties and how their reactions lead to the successful resolution of language problems. However, it may also be important to

investigate learners' linguistic knowledge. Research on strategies, particularly that related to the process of formulation, may overlook the linguistic knowledge that learners possess and activate as part of their L2 problem-solving. Therefore, examining knowledge sources may help to capture a picture of what type of linguistic information is accessed during the process of L2 written production.

In L2 learning, strategies and knowledge sources may be linked. Although it is difficult to make a clear-cut distinction between the two concepts, they can be distinguished in that the former is about how knowledge is used while the latter focuses on what kind of knowledge is employed. Nassaji (2003:655) describes *strategies* as 'conscious cognitive or metacognitive activities that the learner uses to gain control over or understand the problem without any explicit appeal to any knowledge sources as assistance' while defining *appeals to knowledge sources* as 'instances when the learner made an explicit reference to a particular source of knowledge such as grammatical, morphological, discourse, world, or L1 knowledge'. That is, knowledge sources seem to be associated with writers' declarative knowledge about L2. However, as García Mayo (2002) points out, procedural knowledge about L2 can also be found as a type of knowledge source. Explicit/declarative and implicit/procedural knowledge will be discussed in more depth in Section 2.4.2.1. In the present study, aiming at exploring the L2 problem-solving process in L2 writing, *a knowledge source* is defined as 'a ground or a reason for justifying an individual's lexical or grammatical judgments during the L2 writing process'. Knowledge sources can be regarded as L2 problem-solving resources during the L2 writing process.

In relation to the formulating process in L2 writing, the knowledge-based approach will help researchers to focus on L2 learners' current state of knowledge about L2 (i.e., interlanguage) and to elucidate what aspects of L2 lexical or grammatical knowledge are used to convert ideas into text. Swain and Lapkin (1995) argue that it is important to study the reasoning learners engage in when they move from encountering an L2 problem to developing a solution to it. A variety of studies have been conducted on L2 writing strategies (e.g., Aliakbari & Karimi Allvar, 2009; Arndt, 1987; Chimbganda 2000, Roca de Larios, Murphy & Manchón, 1999; Sasaki, 2000). On the other hand, there are few empirical studies that have straightforwardly investigated knowledge sources used during the L2 writing process (e.g., García Mayo, 2002; Storch, 1998a, 1998b), and these studies have focused on only grammatical knowledge sources. It seems that there have been no studies examining lexical knowledge sources for L2 writing. Therefore, the present study will not focus on L2 writing strategies, but will explore knowledge sources for L2 writing. As one of the research aims, it will establish a taxonomy of lexical knowledge sources as well as one for grammatical knowledge sources.

2.4.1.2 Studies on knowledge sources for L2 writing

Some researchers propose knowledge sources that are used in L2 writing at a general level. Schoonen, Gelderen, Glopper, Hulstijn, Simis and Snellings (2003) propose several types of language-related knowledge sources that are needed for learners'

successful writing performance. Above all, learners must have a certain level of L2 word knowledge, and vocabulary size is likely to be highly correlated with the quality of written compositions. It is reasonable to assume that limited lexical resources prevent learners from converting their ideas into proper written forms. Learners also need some grammatical knowledge in order to connect individual words into proper clauses or sentences. To adequately express the intended meaning, it is important to possess the ability to recognise and produce the distinctive grammatical structure of L2. Next, unlike speaking, writing requires learners to have word spelling knowledge. This kind of knowledge source may be differently activated according to the degree of correspondence between spelling and pronunciation for the language that is involved in writing. Lastly, beyond clause or sentence level, learners need to be aware of the organisation of their texts at discourse level, and furthermore, to understand text functions in their community, in order to write more effect texts.

In addition, although the primary purpose is not to examine knowledge sources, some studies have provided findings to better understand the particular sources learners might rely on when they experience L2 problems in writing. For instance, in a study with three Japanese ESL adults completing both L1 (Japanese) and L2 (English) essays, Wolfersberger (2003) observes that learners often employ their L2 knowledge, use a dictionary, or ask another person (the researcher) in order to deal with the L2 lexical problems. Santos (2006) finds that while attempting to solve lexical problems during the L2 writing process, learners employ their own resources (e.g., mental lexicon or grammar knowledge in L1 and L2) or external sources (e.g.,

bilingual dictionary, monolingual dictionary, or thesaurus). Both internal and external knowledge sources are addressed in the studies above; however, it seems that information about the use of learners' internal knowledge sources is not specific or clear enough.

In summary, although the above studies examined the necessity of linguistic knowledge sources for L2 writing, there is a need to look at what particular aspects of linguistic knowledge (e.g., L2 vocabulary or grammar) are involved when learners face and solve language-related problems during the L2 writing process, in order to understand leaners' current state of knowledge about L2 and draw implications associated with L2 writing instruction. Following this line of reasoning, the present study carries out a fine-grained analysis of knowledge sources employed in the L2 problem-solving process.

2.4.2 Types of L2 knowledge

2.4.2.1 L2 Explicit and implicit knowledge

Both explicit and implicit knowledge are fundamental constructs in the field of second language acquisition. According to R. Ellis (2004), explicit L2 knowledge is the declarative knowledge of the phonological, lexical, grammatical or pragmatic aspects of L2. It is held consciously and is potentially available for verbal report. On the other hand, implicit knowledge of L2 is said to be intuitive and unarticulated knowledge. Bialystok (1981) defines implicit knowledge as an intuitive feeling for what is correct

and acceptable. R. Ellis (2008a) asserts that this knowledge is unconscious knowledge which learners are usually not aware of processing. Implicit knowledge is hidden, but it becomes apparent when learners are producing language. Table 2.2 shows the summary of main distinguishing features of explicit and implicit knowledge.

Table 2.2 Key characteristics of explicit and implicit knowledge (R. Ellis, 2005:151)

Characteristics	Explicit knowledge	Implicit knowledge
Awareness	Conscious awareness of linguistic norms	Intuitive awareness of linguistic norms
Type of knowledge	Declarative knowledge of grammatical rules and fragments	Procedural knowledge or rules and fragments
Systematicity	Anomalous and inconsistent knowledge	Variable but systematic knowledge
Accessibility	Access to knowledge by means of controlled processing	Access to knowledge by means of automatic processing
Use of L2 knowledge	Access to knowledge during planning difficulty	Access to knowledge during fluent performance
Self-report	Verbalisable	Nonverbalisable
Learnability	Any age	Potentially only within critical period

In SLA, there are three main theoretical positions taken with regard to the relationship between explicit and implicit knowledge. First, the non-interface position holds that these two types of knowledge are acquired in different ways, are located in different areas of the brain, and are accessed by different processes, and that explicit knowledge cannot be converted into implicit knowledge (Krashen, 1981). Next, the strong interface position maintains that explicit knowledge can become implicit knowledge after learners have had abundant opportunities for practice and

use (DeKeyser, 1998). Lastly, the weak interface position argues that explicit knowledge facilitates language processing and thus enables learners to acquire implicit knowledge (N. Ellis, 2005). However, from the weak interface position, explicit knowledge is not directly convertible into implicit knowledge, and it can evolve into implicit knowledge only if the learner is ready to acquire the target language feature (R. Ellis & Natsuko, 2013). The strong and weak interface positions both support the role of consciousness and noticing in language learning (Schmidt, 1990, 1994).

Concerning the role of each type of knowledge in language production, implicit L2 knowledge is predominantly relied upon for spontaneous language production tasks such as conversation, where time constraints interrupt learners' ability to reflect on the correctness and appropriateness of the language used (R. Ellis, 2008a; R. Ellis, 2009). On the other hand, compared to oral production in L2, learners are likely to need to access explicit knowledge in order to successfully complete written production activities in L2 (Gunnarsson, 2012). Furthermore, N. Ellis (2005:308) argues that explicit L2 knowledge has an important role in linguistic problem-solving activities, saying that 'when automatic capabilities fail, there follows a call recruiting additional collaborative conscious support'. Similarly, R. Ellis (2008b) contends that explicit knowledge is usually accessed through a controlled process when learners experience language problems during the L2 production process. Therefore, it can be assumed that learners rely on their explicit knowledge about language in the process

of producing an L2 text, and that knowledge sources as L2 problem-solving tools may be represented in explicit forms more than in implicit ones.

2.4.2.2 Metalinguistic knowledge

Explicit or declarative knowledge is commonly associated with the use of metalanguage, which may be linked to a student's ability to describe language. According to R. Ellis (2005:152), 'metalinguistic knowledge is not required when the constructs of L2 implicit knowledge are operationalised; on the other hand, for explicit knowledge, metalinguistic knowledge is encouraged'. While implicit knowledge cannot always be brought into awareness or articulated, explicit knowledge can be brought into awareness and can be reported (Roehr, 2007). With regard to language production, as one of the functions of output (Section 2.2.2.2), metalinguistic awareness can be promoted when learners speak or write in L2. That is, it is highly likely that learners present some knowledge about L2 in the process of L2 production, and explicit knowledge can be expressed in language that is used to describe, analyse, or explain language in a spoken or written text.

Metalinguistic knowledge in general has been defined as learners' explicit knowledge about language (Alderson, Clapham, & Steel, 1997; Bialystok 1979). More specifically, according to Roehr (2007:179), the construct of L2 metalinguistic knowledge can be defined as 'a learner's explicit knowledge about the syntactic, morphological, lexical, phonological, and pragmatic features of the L2'. Metalinguistic knowledge can be

accessed when learners face linguistic difficulty when attempting to produce language. It can be expected that when learners are consciously aware of particular L2 problems while making L2 sentences, they may employ metalinguistc knowledge to solve their problems; furthermore, through the use of metalanguage, it may be possible to examine what knowledge sources are used as a tool for solving L2 problems. However, as pointed out earlier, it should be noted that using metalanguage does not necessarily mean that learners must use metalinguistic terminology (technical terms about language) while describing a language. Students can express how they think about the target language without using metalinguistic terminology (Swain, 1998; Fortune, 2009).

Although investigating patterns of metalanguage usage in detail is not a research aim of the present study, by examining instances where metalanguage is used in relation to lexical or grammatical episodes it may be possible to get a glimpse of the use of knowledge sources in the L2 problem-solving process. For example, Fortune and Thorp (2001) have studied the use of metalanguage in Language-Related Episodes (LREs) in the context of L2 writing. In their study of the effect of pre-task focus-on-form work on task output processes, they examined students' use of metalanguage and the extent to which students gave explicit reasons for LRE outcomes. A total of thirty adult intermediate EFL learners from Europe and Asia were divided into ten triads and asked to complete four dictogloss tasks that contained one of four selected grammatical features respectively (i.e., Task 1: conditional sentences, 2: indirect speech, 3: tense for expressing future time, and 4: reduced relative clauses). For each

task, all interactions during the text writing stage were recorded. The results showed that when learners faced lexical problems, they solved the problems through the use of three main approaches: 1) explaining the meaning of the word, 2) giving another example of the use of the word, or 3) using world knowledge of the word. In grammatical episodes, four types of metalanguage use were found: 1) M, metalanguage 'alone', 2) M+G, metalanguage with use of grammatical terminology, 3) M+R, metalanguage with a grammatical rule or generalisation, and 4) M+T, metalanguage with knowledge of text content given as a reason for a decision.

Fortune (2009) conducted a similar study with different participants (eight advanced EFL learners from Europe and Asia) and different target grammatical features for dictogloss tasks (Passive voice, Count/Uncount Nouns, Past Perfect, 'If' sentences, and Relative clauses). In his study, the same patterns of use of metalanguage were found when the participants gave a reason for their grammatical decisions (i.e., M, M+G, M+R and M+T) from Fortune and Thorp's (2001) study. However, Fortune developed a new taxonomy of the reasoning employed in lexical episodes, and there are four types of metalanguage use: 1) M+EXP, explanation of the meaning of a lexical item, 2) M+SY, the provision of a synonym or an antonym, 3) M+EXA, employing an example of the item used in another context or reference to another context to illustrate its meaning, and 4) M+ STY, reference to the relationship between lexical selection and level of formality.

Although the main purpose of both studies above was to look into the nature of metalanguage use in LREs, several types of knowledge sources learners used were identified when they faced linguistic difficulties during the form-focused collaborative writing tasks (dictogloss tasks) in L2. For instance, learners often use semantic knowledge (definitions or sense relations) and sometimes employ analogy (referencing another context) when solving lexical problems. Regarding grammatical episodes, learners tend to justify their decisions by using grammatical terminology or rules. However, it should be noted that the data from the studies above was analysed on the basis of the recorded and transcribed interactions between the participants. Although Fortune (2009) conducted follow-up interviews after each of four dictogloss sessions, aiming to enhance the accuracy of the coding, there were no retrospective interviews to get in-depth data. That is, only verbalised data during the writing session was analysed in both studies.

There are some empirical studies that have been more directly focused on knowledge sources in relation to lexical or grammatical problems, and these studies will be discussed in the sections that follow.

2.4.3 Review of studies on knowledge sources

2.4.3.1 Research on lexical knowledge sources

As pointed out earlier, it seems that there have been no empirical studies that directly investigate lexical knowledge sources used by learners in the process of L2

written production. However, there are some studies that introduce different knowledge sources employed by learners in the process of L2 lexical inferencing for reading comprehension. For instance, Haastrup (1991) presented three main knowledge sources, namely, contextual, intralingual (e.g., morphology, collocations, or semantics), and interlingual knowledge, while Nassaji (2003) categorised five knowledge sources (i.e., grammatical, morphological, world, discourse, and L1 knowledge) used to make lexical inferences. Bengeleil and Paribakht (2004) distinguished two categories of knowledge sources: linguistic (e.g., word morphology, word association or word collocation) and non-linguistic knowledge (e.g., knowledge of topic). Although the knowledge sources were categorised in different ways, in general, each taxonomy includes 1) word-level knowledge (e.g., phonology, orthography, or morphology), 2) sentence-level knowledge (e.g., sentence meaning or grammar), 3) discourse-level knowledge (e.g., discourse meaning or textual schemata), 4) world knowledge (i.e., a learner's background knowledge on what comprises a certain word), and 5) contextual cues.

In addition, there are a few studies that examine the knowledge sources employed to infer word meaning in listening comprehension. For example, Cai and Wu (2005) developed a taxonomy of knowledge sources, identifying a total of six knowledge sources: co-text (referring to local or global contextual information), world knowledge, phonetics, morphology, word class, paralinguistics. Furthermore, Cai and Lee (2012) presented a similar taxonomy of knowledge sources for lexical inferencing in listening comprehension. Emphasising *semantics* as a knowledge source, they

distinguished two broad levels of knowledge sources. One is textual knowledge that includes semantics and all kinds of knowledge sources found in Cai and Wu's study except world knowledge. The other one is extra-textual knowledge, which refers to world or background knowledge.

It may be worth examining the particular knowledge sources employed to solve lexical problems in L2 writing in that 1) it can be hypothesised that the patterns of the use of knowledge sources associated with lexical problems are different between the process of language comprehension and production, and 2) there may remain room for elaboration and improvement related to lexical knowledge sources employed during the L2 problem-solving process in a situation where external resources are not allowed.

2.4.3.2 Research on grammatical knowledge sources

Compared to knowledge sources for solving lexical problems, reasons or justifications learners employed to resolve grammatical problems during the L2 writing process have been more straightforwardly studied by some researchers. For example, Storch (1998a) investigated with 30 tertiary ESL students what grammar features concern L2 learners and how learners resolve grammar problems in a text reconstruction task. This was a collaborative writing task, and the whole process was audio-taped. The results showed that the participants were mostly concerned about 'verb tense or aspect', 'preposition', and 'articles'. 'punctuation' and 'sentence structure' were less

focused upon. As for the reasoning supporting the participants' grammatical decisions, several categories of knowledge source were found, such as *Grammar* (justifications which referred to rules or analogies), *Meaning* (appeals to semantics, meaning of words in the text, or meaning outside the text), *Discourse* (justifications based on reference to text organisation, text beyond the sentence level), *Intuition/conviction* (statements which reflect an innate sense of what sounds right and what does not; or a strongly expressed conviction), and *No justification articulated*. It was found that the participants mainly employed grammatical rules when resolving difficulties, particularly in relation to verb tense or articles, and they also tended to frequently rely on intuition or conviction for resolving grammatical problems.

In another study by Storch (1998b), similar but more detailed grammatical knowledge sources were identified. In her study, nine adult ESL learners performed four different tasks focusing on grammar (i.e., multiple choice, cloze test, text reconsruction, and short composition) in dyads (or a triad). All collaborative tasks were audio-taped, and the recorded pair talk was transcribed to elicit grammatical episodes. A total of seven grammatical knowledge sources were examined: 1) *apply a grammatical rule*, 2) *meaning of words or phrases or knowledge of the topic*, 3) *analogy or memory*, 4) *intuition*, 5) *use contextual clues*, 6) *no reason given*, and 7) *other*. The findings revealed that the participants frequently gave no reasons while solving grammar problems across all the tasks; the smallest number of instances where they gave no reasons emerged in the cloze task, and the most in the text reconstruction task. It

was also found that all the kinds of knowledge sources listed above were used when the participants performed the text reconstruction task.

Similarly, García Mayo (2002) conducted a study with 14 Spanish adult EFL learners in order to examine the quantity and nature of attention to form in form-focused tasks. For this, the participants completed a Dictogloss task and a text reconstruction task in dyads. The interaction of the seven dyads was audio-taped in each task, and the language-related episode (LRE) was used as the unit of analysis. The results showed that the text-reconstruction task generated eight times more grammatical LREs than the Dictogloss task. With regard to learners' justifying their grammatical choices, four knowledge sources (i.e., *Grammar, Discourse, Intuition*, and *No explanation)* were called upon in the process of solving grammar problems during the tasks. The percentages of learners' justifications on both tasks were compared. The result showed that there was a high percentage in both tasks of LREs in which no explanation for their resolution was provided (88% for Dictogloss and 59% for Text reconstruction). Explanations based on the learners' knowledge of grammar were mainly provided in the text-reconstruction task for determiners, sentence structure, verb tense/form/aspect and word order (6% for Dictogloss and 29% for Text-reconstruction). Discourse clues were only used in the text-reconstruction task (6%). Learners relied very little on intuition in both tasks (6% for both tasks).

Interestingly, instances where learners did not articulate the reason for their grammatical choices were found in the studies mentioned above, and it might be

because they were not able to sufficiently verbalise the reasons. However, with regard to the methods of analysis, these unarticulated cases might occur owing to the data about knowledge sources having only been obtained from the transcripts of participants' pair talk. Therefore, follow-up interviews would enable a more thorough investigation of the certain knowledge sources used during the L2 writing process. Following in this line of reasoning, the present study attempted to identify internal knowledge sources through individually conducted retrospective stimulated recall interviews. This approach is considered to best enable learners to fully articulate the reasons for justifying their choices of grammatical items.

On the basis of the rationale of the proposed study and the literature discussed so far, the research aims and questions will be presented in the next section.

2.5 Aims and research questions

The overarching aim of this research is to examine the features of L2 problem-solving processes in L2 writing. The specific aim is to investigate what learners notice while they are writing in L2, what variables are related to noticing during the L2 writing process and what internal knowledge sources learners use when they face language problems. This research focuses on the following research questions.

1) What aspects of language do Korean university learners notice while writing in L2?

2) Does these learners' previous study abroad experience have effects on noticing during the L2 writing process?

3) Does these learners' L2 proficiency have effects on noticing during the L2 writing process?

4) Does these learners' L1 and L2 working memory capacity have effects on noticing during the L2 writing process?

5) What internal sources of knowledge do these learners employ in order to resolve the language problems they face?

The next chapter will present a detailed overview of the methodological framework of the study with the introduction of the information on the participants and sampling procedures. The research instruments and the data collection and analysis methodology will be also presented.

3. METHODOLOGY

3.1 Participants

The data for this research was collected from freshman to senior students majoring in English at three high-ranked universities in Korea. High-ranking university students were chosen because it was hypothesised that these students might be more proficient in L2 than those in low-ranked universities, and that these students would thus be more likely to have better L2 writing skills. In Korean secondary school English classes, reading and listening has been focused upon more than speaking and writing (Flattery, 2007). This is because many English teachers feel their English language competence may not be enough to teach productive English skills (Jeong, 2004); and because the English section of the College Scholastic Ability Test (CSAT), the national college entrance exam, includes only reading and listening. Therefore, most students rarely have a chance to learn how to write in English until they enter university. Consequently, they may not feel confident about English writing, and it may be difficult to recruit volunteer participants for L2 writing studies. It was expected that high-ranking university students would be less reluctant to participate in the L2 writing study. For the same reason, English major students were selected as participants in this research. Learners majoring in English are likely to have had more exposure to English than non-English major students. While non-English major students in Korea have few opportunities to write essays in English, English major

students often write English essays, and in most cases, have to take English composition courses.

With this rationale for sampling, the following steps for recruiting participants were undertaken. First, the top ten ranked universities in Korea were determined, based on the university league table provided by Joongang Education Development Institute (JEDI) in 2010. Next, three of the ten universities were excluded because there is no English department at two universities and the third university is a women's university. Although gender is not a variable in this research, in order to get a gender-mixed group of participants, only coeducational universities were included. This was not expected to ensure equal numbers of male and female participants: in Korea, there has been a trend for male college students to study subjects related to natural sciences or engineering, and for female students to study humanities or social sciences (Kang, 2004). Thus, there are usually more female students than male students in language-related departments. Furthermore, male sophomore and junior students are often away from university doing their obligatory military service. It was expected that these conditions might lead to an unbalanced number of male and female students in the current study.

After seven universities were selected, a request to participate in the study (Appendix 1) was sent to the head of the English Linguistics and Literature department in each university. Three universities (here designated Univ. A, Univ. B and Univ. C) showed willingness to participate, and finally, after providing them with my CUREC

application (Appendix 2) and the approval letter giving consent to my project (Appendix 3), I was given permission to recruit students by the head of the English department in each university. Once permission from the head of department was obtained, almost all undergraduate students in the department received information about the study through the department homepage or their instructors. With the help of the department's staff, I also had some opportunities to explain my research aims and procedures to students in class, and participant information sheets (Appendix 4) were posted on the department's notice board. Students were asked to phone or email me if they were interested in my research. In other words, recruitment was based on students who volunteered. It is important to note that volunteer sampling can be unrepresentative because students who volunteer might only be the ones available at a given time. Despite this drawback, this convenience sampling method was adopted because participants' motivation to take part in this study was considered crucial for the quality of their verbal reports as data. Therefore, the participants were composed of only those who showed the willingness to volunteer.

A total of 110 students from the three universities initially participated in this study (32 out of 400 English major students from Univ. A; 39 out of 320 students from Univ. B; 39 out of 400 students from Univ. C). However, two students dropped out during the data collection procedures (one from Univ. B and Univ. C, respectively), so finally, data from 108 students were used for analysis. The mean age of participants was 21.5 (SD = 1.6), and the age range was 20-28. Of the 108 students, 25 were male and

83 female. More detailed demographic information is presented in Appendix 5. As all of the participants had to take CSAT to apply to universities and achieved the first (i.e., the highest) level of the nine grade scales in the English section, they formed a fairly homogeneous sample in terms of general English competence.

3.2 Data collection methods

The hypotheses of this study are that learners' previous English learning experience, L2 proficiency and working memory capacity affect their noticing during the processes of writing. The constructs in this hypothesis were operationalised by the following instruments:

- Previous study abroad experience: face-to-face interview reports
- L2 proficiency: Vocabulary Levels Test and C-test
- L1 and L2 working memory capacity: measure based on Walter (2004)
- Noticing: think-aloud protocols and an argumentative essay
- Knowledge sources: stimulated recall interviews

Each of these instruments is described in the sections that follow.

3.2.1 Previous study abroad experience: face-to-face interview reports

Learners' previous study abroad experience has been shown to have an impact on their L2 learning, and in particular, this experience can significantly influence

learners' L2 productive skills (Sasaki, 2011; Taguchi, 2013). Especially for learners in EFL contexts, where students do not generally use English outside the classroom, and in situations where English classes mostly consist of reading and listening, it is more likely that study abroad experience will have an effect on their L2 writing. For the current study, information about participants' study abroad experience was obtained at the same time as demographic information (Appendix 6). To investigate any study abroad experience, several questions were asked, such as whether they had had learning experiences in English-speaking countries or similar classroom environments and if they had, when they had studied and how long they had studied.

Of 108 participants, 65 students had no study aborad experience at all, while 43 students had studied abroad before they participated in the current study. Table 3.1 presents the information about the 43 participants' study abroad experience.

Table 3.1 Information about the participants having study abroad experience

Total N = 43	Before entering college		After entering college
	English-speaking countries	Non-English speaking countries	
N	22	10	11
Countries	Australia, Canada, New Zealand, U.S.A	China, Indonesia, Japan, Saudi Arabia, Singapore Spain	Canada, France, Sweden, U.K, U.S.A
Mean years of study; range	1.9 years; 1 to 6 years	4.3 years; 1 to 6 years	1 year
Starting age	13-18	13-18	21-24

The 10 students in non-English speaking environments were educated in international schools where English was the medium of instruction. Another 11 participants, who had gone abroad to learn English after they entered college, had attended overseas universities through Student Exchange programs. Since they were all majoring in English Linguistics and Literature, they had taken classes conducted in English and had been required to do all academic assignments in English during the programs.

3.2.2 L2 proficiency: Vocabulary Levels Test and C-test

3.2.2.1 Vocabulary Levels Test (VLT)

The VLT, originally devised by Nation (1983, 1990), is a test to examine learners' vocabulary size, or breadth; that is, it estimates how many words learners know. Vocabulary size tests are developed on the basis of word frequencies, and in general, it is assumed that higher frequency words are normally acquired first. It is the case that vocabulary size tests have been criticised in that only learners' passive knowledge is assessed (Laufer & Goldstein, 2004). However, it is widely recognised that these tests can discriminate between proficiency levels of learners (Vermeer, 2001; Zimmerman, 2005), and in fact, many empirical studies have found a strong relationship between an individual's vocabulary size and their general language proficiency. For instance, Zareva, Schwanenflugel, and Nikolova (2005) studied the relationship between lexical competence and language proficiency with three

different groups of learners: native speakers of English, L2 advanced learners, and L2 intermediate learners (the L2 learners' L1 was Bulgarian). The proficiency level of the L2 participants was determined by three proficiency tests, namely the Cambridge Certificate in Advanced English (CAE), the Cambridge First Certificate of English (FCE) (for the test format, see University of Cambridge ESOL Examinations, 2013) and the TOEFL (for the test format, see Educational Testing Service, 2013). Vocabulary size as a part of lexical competence was tested with words selected from *Oxford Student's Dictionary of Current English* (OSDOCE) (Hornby, 1978). Of the 35,000 entries in the dictionary, 73 words were selected as test items through several word sampling procedures, such as excluding some types of words (e.g., abbreviation and interjections), and using a spaced sampling process (i.e., selecting every first new boldface main entry from every 20th column). It was found that there was a relationship between breadth of vocabulary and language proficiency. That is, the higher the learners' language proficiency was, the larger their vocabulary size was. Likewise, Nemati (2010) found that there was a high positive correlation between vocabulary size and language proficiency for EFL and ESL students. In his research, a total of 80 male and female freshmen students (40 Iranian students as representatives of an EFL context; 40 Indian students for an ESL context) majoring in English Language and Literature took the Nelson Proficiency Test and the VLT (Test B). The results showed that in general, proficiency and vocabulary size tended to be positively correlated both for Iranian and Indian students, although for Iranian participants, there was no statistically significant correlation between proficiency and two of the vocabulary levels (i.e., 5000 level and Academic level). In addition, it was

found that the group of Indian participants (ESL students) had higher proficiency and larger vocabulary size than their Iranian counterparts (EFL students).

The VLT was initially developed as a measure of learners' breadth of lexical knowledge. It contains four sections at different word frequency levels (i.e., 2000, 3000, 5000, and 10,000 words) and one academic vocabulary section. Read (1988) maintains that the VLT is a highly reliable and scalable test. In his study, 81 adult learners of English from Asia, South Pacific, and Latin America took the original version of the VLT (Nation, 1983) during a three-month English language course. The test was given twice: at the beginning and the end of the course. The results showed that both tests had high reliability coefficients (0.94 and 0.91 respectively), and the scores decreased from highest to lowest frequency levels. It was also found that the scores in both tests were highly scalable, on the basis of a Guttman Scalogram analysis (scalability: 0.90 and 0.84 respectively). That is, if learners successfully reached a certain level, for instance, the 5000 word level, then they would have most probably acquired the 2000 and 3000 word levels as well.

In 1993, Schmitt revised the original VLT (Version A) and wrote three new forms of the test (Versions B, C and D). Later, Schmitt, Schmitt and Clapham (2001) conducted a validation study of VLT Versions A-D, and based on validity evidence, two new revised and expanded versions of the VLT were created (Versions 1 and 2). In this study, it was found that the two new VLT versions provided valid results and produced similar scores, so the two versions can be generally considered equivalent.

For the current research, VLT Version 2 was employed. Xing and Fulcher (2007) point out that while other levels in the VLT Version 1 and 2 can be treated as parallel, the 5000 word level cannot be treated as parallel although the two 5000 level tests are highly correlated and reliable. They hold that the 5000 level in Version 2 contains harder items than Version 1. That is, for test-takers, Version 2 may be more difficult than Version 1. However, the participants in the current study were all advanced-level learners, so it was anticipated that Version 2 would be appropriate for them. It was also expected that the more difficult test could differentiate better between these advanced participants' L2 proficiency.

The VLT uses a word-definition matching format; that is, test-takers are required to match words to definitions. As mentioned above, there are five different levels of vocabulary in the test, and each level contains 30 target items. Both test words and their corresponding definitions (i.e., target items) appear at each of ten blocks in each frequency level, and there are six test words and three definitions in each block, as in the example below:

1 business	
2 clock	_______ part of a house
3 horse	_______ animal with four legs
4 pencil	_______ something used for writing
5 shoe	
6 wall	

The words in each block are from the same part of speech, and the ratio of nouns, verbs and adjectives in each level is 3:2:1. The words in each block are

decontextualised, and are also semantically unrelated to each other. According to Read and Chapelle (2001), the VLT is a discrete and context-independent test; that is, learners' vocabulary size is measured with no particular context or reference. In other words, to select the right word, participants may need a superficial knowledge of the basic meanings of the words instead of knowledge about other aspects of the word such as its grammatical form, collocation, function, and so on (Golkar & Yamini, 2007). VLT Version 2 as used for this study is presented in Appendix 7.

3.2.2.2 C-test

A C-test was also employed to measure participants' L2 language proficiency. In 1981, Raats and Klein-Braley developed the C-test as a replacement for the cloze test, using a new deletion procedure called the C-Principle. While the whole words are deleted from the text in the cloze test, some parts of words are deleted in the C-test (Klein-Braley, 1997). The changed deletion technique addresses the shortcomings of the classical cloze test, such as the extreme difficulty of the test. According to Khodadady and Hashemi (2011), C-tests were developed on the basis of Reduced Redundancy Principle (RRP) first explained by Spolsky (1973), postulating that native speakers are able to restore missing or distorted texts by resorting to surrounding textual information and making use of natural redundancy in texts. Through C-tests, learners' language proficiency can be measured on the basis of the assumption that 'knowing a language involves the ability to understand a distorted message by formulating valid guesses about a certain percentage of omitted elements' (Khodadady, 2007:3). While

the VLT assesses learners' vocabulary knowledge only, the C-test makes learners use their grammatical ability as well as their lexical ability to accurately complete the missing parts, using contextual information. Eckes and Grotjahn (2006:316) say, in fact, 'lexis and grammar are important components of general language proficiency as measured by C-tests'.

Many researchers have confirmed a positive relation between C-tests and language proficiency, while validating various types of C-tests. For example, Dörnyei and Katona (1992) conducted a study with 155 Hungarian EFL learners to investigate whether the C-test is valid as a measure of general language proficiency. Four different language tests were administered (i.e., Department Proficiency Test, Test of English for International Communication (TOEIC) (for sample questions, see Educational Testing Service, 2012), Oral interview, Cloze test); 102 freshmen university students majoring in English and 53 secondary school students participated in the study. The results showed that the C-test correlated positively with other language proficiency measures, although the C-test was too difficult for the EFL students at the secondary level. It was also found that the C-test was a better measure of general language proficiency than the cloze test. Likewise, Chihara, Cline and Sakruai (1996) suggest that the C-test is a reasonable measure of general language proficiency. In their study, 440 Japanese junior college students majoring in English took four C-tests of two different types: in the two basic tests, deletion of the second half of words began from the second word of the second sentence, while in the two experimental tests deletions started from the first word of the second

sentence. Of the 440 participants, 175 took TOEFL (Educational Testing Service, 2013) as a measure of language proficiency. It was found that participants performed significantly better on the basic C-test than the experimental C-test. Positive correlations were found between the four C-tests and the TOEFL total score as well as between the four C-tests and the scores of the subtests in TOEFL (i.e., listening, structure, and vocabulary and reading comprehension). Several other researchers have validated C-tests in different languages (e.g., a German C-test in Eckes & Grotjahn, 2006; a Korean C-test in Lee-Ellis, 2009). The results of these studies support the claim that C-tests are a good indicator of general language proficiency.

Klein-Braley (1997) suggests that a C-test should consist of four to six thematically distinct passages in which half of the letters of every second word are deleted, and that the test should contain at least 100 items (i.e., 100 missing parts). Although a C-test can be easily constructed and administered, Klein-Braley cautions that the test should be used only after careful consideration of its suitability for the specific target test takers. Bearing in mind this caution, I created a C-test for this study through several developmental steps, which are described below.

C-test development procedures

First, with regard to text selection for the C-test, 12 short passages were initially collected: 4 passages from Klein-Braley's original C-test (1997) and 8 passages from three ESL textbooks. The ESL textbooks are widely used as lesson materials for

college-level students in Korea, and each textbook includes twelve texts with different topics. On the basis of Klein-Braley's instructions (1997), rigorous criteria were employed to select the eight texts. Above all, texts were authentic, so certain types of texts such as literary texts were excluded, because these texts may contain non-frequent language items or non-standard usage. In addition, only 'self-contained' or complete passages were selected for test development. The length of texts was also taken into consideration: texts needed to be relatively short (around 250 words long), but at the same time, long enough to contain at least 100 target items. Furthermore, texts needed to vary in subject field, but texts that contain specialised information were excluded, as what C-test measure is not specialised knowledge but language proficiency. The eight texts are presented in Appendix 8.

Next, the readability of each passage was estimated through the Flesch Reading Ease readability scale (Flesch, 1948), using Microsoft Word 2007. In many previous studies using C-tests, Flesch's 'reading ease' score has been adopted to examine the difficulty of texts selected for the C-tests (e.g., Atai & Soleimany, 2009; Hosseini, Hassanzadeh & Shayegh, 2012; Jafarpur, 1999; Khodadady & Hashemi, 2011). The average readability score of the eight texts was 50.04, with texts scores ranging from 21.00 (the most difficult) to 83.90 (the easiest). That is, the selected texts varied in difficulty. Klein-Braley (1997) suggests that a C-test includes texts of varying levels of difficulty. Lee-Ellis (2009) believes that texts of varying difficulties represent authentic samples of the language that L2 learners will confront. Table 3.2 presents the readability scores for each text. These scores were compared with the readability

scores of each English reading passage from the College Scholastic Ability Test (CSAT) conducted in 2011. There were 33 English passages in the CSAT, and the average readability score of the passages was 49.61, ranging from 26.35 to 70.80. Thus, it can be said that the comprehension difficulty of the selected texts is acceptable for university-level students, based on the readability scores.

Table 3.2 Readability scores of each of the eight texts from ESL textbooks

Text	1	2	3	4	5	6	7	8
Readability	83.90	68.31	48.21	24.01	68.84	40.42	45.66	21.00

Next, piloting was conducted with 10 Korean university students not participating in the main study. They were asked to complete C-tests with all twelve texts. All of the passages but one passage from Klein-Braley's C-test (with 24 missing parts) had 25 missing parts, so a participant could get 25 points at most in each text. Almost all of the students reported that they felt Klein-Braley's passages were much more difficult than the eight texts chosen from the ESL textbooks. Therefore, I decided not to use Klein-Braley's C-test and selected 4 out of the 8 texts from the ESL textbooks to create the C-test for this study.

Selection of four texts was done by considering several factors that may have an influence on the C-test scores. First of all, the length of each text was considered. Table 3.3 shows the number of words in each text.

Table 3.3 Numbers of words in each of the eight texts

Text	1	2	3	4	5	6	7	8
Words	90	121	78	85	97	91	78	79

Longer texts may give participants more support, in that more unbroken text can provide a better context for the test-taker to guess the target words in the missing parts. Thus, Text 2, obviously longer than other texts, was excluded.

Another exclusion criterion was the text's lexical frequency. It may be difficult for participants to complete missing parts when they deal with a text including less frequent words. Thus, the frequency ratings of target words in each text (except Text 2) were examined, based on *Collins Cobuild English Dictionary for Advanced Learners* (Cobuild, 2001), and the result is displayed in Table 3.4 below.

Table 3.4 Lexical frequency of target words in each text

Category	Text 1	Text 3	Text 4	Text 5	Text 6	Text 7	Text 8
5	17	14	13	10	16	16	12
4	2	4	3	2	4	5	3
3	4	4	1	1	3	1	4
2	2	1	8	6	0	2	2
1	0	2	0	5	2	1	3
$	0	0	0	1	0	0	1

5 = in most frequent 680 words; 4 = 1040 words; 3 = 1580 words; 2 = 3200 words; 1 = 8100 words; $ = Less frequent than category 1

The table shows that more low-frequency words were included in Text 5 than in the other texts. This would tend to make Text 5 more difficult for participants. In fact, as

can be seen in Table 3.5 below, the 10 pilot study participants achieved the lowest mean C-test score for Text 5.

Table 3.5 Descriptive statistics of the C-test scores in the pilot study

N = 10	Minimum	Maximum	Mean	SD
Text 1	11	23	20.2	4.0
Text 2	4	21	12.1	5.6
Text 3	12	22	18.1	3.8
Text 4	4	21	14.5	4.5
Text 5	2	14	9.4	3.8
Text 6	4	19	11.3	5.3
Text 7	8	21	15.6	4.7
Text 8	11	16	13.3	1.8

The ten pilot participants obtained the highest score with Text 1 (20.2), and the lowest score with Text 5 (9.4). Klein-Braley (1997:51) says, 'It is unfair to ask groups of examinees to tackle tests which are overall too difficult for them. It is also counterproductive in terms of testing, since all examinees will make very low scores, and differentiating between them will not be possible'. In the same vein, overly easy tests for test-takers may also make differentiation difficult. Therefore, based on the lexical frequency of the target words and the results of the C-test in the pilot study, Text 1 and Text 5 were excluded in order to avoid ceiling and floor effects.

The reappearance of the target words in the text was the last factor that was hypothesised to have a potential effect on the C-test scores. If a target word appears elsewhere in the full text, or if it appears more than once as a target, this will make

the word easier to guess. Thus, the frequency of reappearance of the target words was examined in the five texts that had not previously been excluded (i.e., Texts 3, 4, 6, 7 and 8). Table 3.6 shows how many target words appear more than once in each full text, and the numbers in parentheses indicate how many target words appear more than once as a target.

Table 3.6 Frequencies of reappearance of the target words

Text	Number of target words (Number appearing more than once)	Target words
3	7 (3)	**and**, animals, how, **the**, **they**, to, trying
4	5 (1)	and, decreases, efficiency, to, **using**
6	9 (3)	all, and, can, **drug**, enough, for, **long**, of, **the**
7	7 (2)	**and**, **can**, crime, of, the, they, to
8	11 (3)	**access**, been, **diffusion**, has, have, information, Internet, sharing, the, **this**, to

The bold words are the target words that appear more than once as a target

As mentioned before, both lexical and grammatical knowledge are assessed through C-tests (Eckes & Grotjahn, 2006). Because of this, the type of target words in the test may affect participants' scores. That is, it may be reasonable to assume that among target words in the text, repeated content words are easier to guess than repeated function words. The repetition of the target function words such as articles, pronouns, auxiliary verbs, and conjunctions may have less of an effect on scores, because these words can be seen as testing grammar rather than vocabulary. On the other hand, it is more problematic when content words such as nouns and full verbs

are repeated in the text, since test-takers may find it easier to guess them correctly, and especially to guess the spelling of the target words. As can be seen in Table 3.6, there are no repeated target content words in Text 3 or Text 7, so these passages were selected as part of the C-test. In the other texts, there are some content words that appear more than once as a target. In these cases, the text can be replaced by another text, or the problematic parts in the text can be modified. I decided to amend some parts, and finally, Text 6 was excluded, because it was hard to find the alternatives for the word 'drug' and 'long'. Instead, the repeated content words in Text 4 and 8 were changed into other words in consideration of the context of the passage. For instance, the word 'using' in Text 4 was replaced by 'taking', and the word 'diffusion' in Text 8 was replaced by 'distribution'.

Then I deleted 25 parts of words in each of the four texts (i.e., Texts 3, 4, 7, and 8), following Klein-Braley's (1997) deletion technique. The first and last sentences of each text were left intact, to provide the participants with appropriate context when they filled the gaps in the test. The second half of every second word beginning from word two in sentence two was deleted. If a word had an odd number of letters, then the larger 'half' was deleted, and words having only one letter, such as *I* and *a*, were ignored in the counting.

As the last step of the C-test development, the four texts were rearranged in order of text difficulty, so as to prevent the participants from getting demotivated and frustrated. While the texts in Klein-Braley's (1997) C-test were ordered intuitively

according to difficulty, I arranged the four texts in the C-test for this study based on the degree of readability. That is, based on the readability scores, the easiest text was placed first while the hardest was placed at the end. These four C-tests will henceforth be designated as C-test1 (using Text 3), C-test2 (using Text 7), C-test3 (using Text 4), and C-test4 (using Text 8), and they are presented in Appendix 9.

Finally, the test items were analysed in order to examine reliability and validity of the C-test. For this, another 10 Korean university students were recruited and asked to do the C-test. To test the internal consistency of the test items, reliability coefficients were obtained through the Kuder-Richardson formulae 21 (KR-21). As Klein-Braley (1997) points out, although KR-21 is likely to overestimate true reliability, this measure can be used as a rough indicator of the relative levels of reliability of the test items. In addition, *p*-values were calculated to examine the difficulty of each item in the C-test. The *p*-value of an item indicates the percentage of participants who correctly answered the item. Table 3.7 presents the descriptive statistics for the scores, reliability coefficients, and mean *p*-values of the C-test (C-TEST) with each of the four subtests (C-test 1, 2, 3 and 4).

Table 3.7 Scores, KR-21 reliability coefficients and mean p-values of the C-test overall (C-TEST), with details for each text

N=10	No. of items	Minimum	Maximum	Mean (SD)	KR-21	*P*
C-test1	25	8	24	15.80 (4.89)	.85	.69
C-test2	25	8	20	10.80 (4.13)	.79	.51
C-test3	25	7	21	13.50 (4.53)	.81	.56
C-test4	25	6	18	11.60 (3.50)	.75	.55
C-TEST	100	35	79	60.50 (13.47)	.81	.58

As can be seen, the overall reliability coefficient of the C-test is .81, and this is acceptable for a good assessment test (Bachman, 1990). In addition, the C-test has a mean *p*-value of .58, which is also considered acceptable, because it falls within the range of .25 to .75 (Baker, 1989). To examine the external validity of the C-test, Pearson product-moment correlations were carried out between the scores on the C-test and the reported TOEIC scores of the 10 participants, and the result showed that the C-test is positively related to the TOEIC, $r = .59$, $p < .05$. On the basis of the pilot study and item analysis, therefore, it was concluded that the C-test developed could be used for the current study.

3.2.3 Working memory capacity

L1 and L2 working memory capacity were tested with a measure adapted from Walter's (2004) verbal working memory measure and using the Psyscope programme (Cohen, MacWhinney, Flatt, and Provost, 1993). Walter (2004:318) defines working memory as 'a system of mechanisms by which humans process the information they

need for the performance of complex cognitive tasks and maintain it in an accessible form'. Therefore, both *processing* and *storage* were measured in the current study.

For the working memory measure, seventy unrelated complex sentences, eight to eleven words long, were written in each of the two languages (L1 Korean and L2 English). There is a difference between the sentences on Walter's measure and ones used for this study. The L2 English sentences in Walter's working memory measure were all simple sentences, as were the L1 French sentences. However, for this study, L2 English sentences were complex sentences, due to the features of L1 Korean sentences. Korean has a different word order from English (i.e., Korean: *subject-object-verb*; English: *subject-verb-object*). To design a reliable working memory test, it was necessary to use the same type of the sentences for L1 and L2. Therefore, a verb should be at the end of the English sentences, as in the Korean sentences, and consequently, all of the L2 sentences were complex sentences (e.g., *We don't know when he's arriving*). Using complex sentences instead of simple ones may make the test more difficult; however, the participants were all advanced English learners, so it was assumed that employing complex English sentences would not be problematic.

Of seventy sentences, half the sentences were 'logical', and the other half were 'illogical'. In 'illogical' sentences, the argument requirement of the verb was violated, in that an inanimate subject was used with a verb that requires an animate one (e.g., *The film doesn't know if I have started*). Sentences in each language were randomly ordered, and then divided into four series of five increasingly longer sets of

sentences. That is, the first series consisted of five two-sentence sets, and the last series consisted of five five-sentence sets. Respecting the randomly established 'logical' and 'illogical' order, adjustments were then made to ensure that the sentence-final words in a given set were not phonologically similar and did not have obvious semantic links. Next, the sentences were entered into the Psyscope programme on a Macintosh laptop computer. One sentence appeared at a time in the centre of the computer screen, and each set of sentences was followed by a screen showing a line of asterisks. Each series of five sets was preceded by a screen announcing the language and length of the next set (e.g., English -3 or 한국어 -3 (Korean -3)).

During the working memory test, participants were asked to read a sentence on the computer screen, to judge whether the sentence was logical or illogical, and to press either '1' or '0' on the computer keyboard based on their decision on the logicality judgment of the sentence. Pressing one of the keys triggered the next sentence or the line of asterisks on the screen. When the line of asterisks appear on the screen, participants were required to say the last word of each sentence in the set in order, and the words participants said were recorded on paper by the researcher.

There were four different versions of the test based on two parameters: 1) the order of randomised sentences, and 2) the order of languages. In each language, two sentence lists were made; one is the original randomised list, and the other is a reversed list. For the reversed list, the sentence order in the original list was

reversed, and if necessary, small rearrangements were made to avoid phonological similarities and semantic links among sentence-final words in a set, as with the original list. In addition, each version began either with a Korean or an English group of two-sentence sets. In all versions, the language was changed after the first group of sets and then after every two groups of sets (e.g., Korean: five two-sentence sets -> English: five two-sentence sets -> English: five three-sentence sets -> Korean: five three sentence sets -> Korean: five four sentence sets, and so on). To sum up, each participant did the working memory test in one of four different conditions: 1) starting the test in Korean with the original list, 2) starting in Korean with the reversed list, 3) starting in English with the original list, and 4) starting in English with the reversed list. All this counterbalancing structure was for parallel treatment of sentences and languages. A sample list of the test items is presented in Appendix 10.

3.2.4 Noticing: think-aloud protocols and an argumentative essay

3.2.4.1 Think-aloud protocols

A think-aloud protocol was used to obtain data on the linguistic problems that participants noticed. Before exploring the think-aloud method in detail, it may be worthwhile to discuss different methods that have been used to measure learners' noticing in L2 writing studies. First of all, *note-taking* has been employed to measure learners' noticing, because of its several advantages. Hanaoka (2007:464) says, 'as an online measure, it is less likely to be affected by memory loss than offline measures'. That is, note-taking allows more direct access to learners' ongoing internal processes

and reflects mental processes that may be unavailable for recall at a later time due to limited memory capacities. In addition, according to Izumi (2002), this technique is capable of being used with tasks such as the reading task (i.e., while reading a text, participants are writing any word that they think is useful for another task), so it may be adequate for discovering the differences learners notice between their own text and the model text. Furthermore, Kang (2010) demonstrates that note-taking is effective in encouraging learners to incorporate linguistic forms presented in the model input. A total of 23 tertiary-level ESL learners from different countries were divided into two groups (a note-taking and a non-note-taking group) and asked to complete a three-stage writing task: describing a picture, comparing the description to a native speaker's model text, and rewriting the description. The results showed that note-taking helped learners better use specific linguistic forms included in subsequent input during the rewriting process.

Next, some studies have used *underlining* as a method of measuring noticing (e.g., Izumi, Bigelow, Fujiwara &Fearnow, 1999; Soleimani, Ketabi & Talebinejad, 2008; Song & Suh, 2008). Like note-taking, underlining is an online measure, so it has several advantages such as more direct accessibility to learners' ongoing internal processes and less memory loss. Izumi and Bigelow (2000) argue that using this measure is appropriate for eliciting learners' noticing, since it can tap into conscious processes in which learners attend to form in the real time of the task. They add that underlining can be used with a reading task for three main reasons: 1) it is not intrusive, 2) it is familiar to students, and 3) it can be done quickly and easily. For

these reasons, like note-taking, underlining may be suitable for research on *noticing the gap* between learners' interlanguage and the target language.

However, while note-taking and underlining may be appropriate for measuring noticing in reading, they are less appropriate for measuring noticing in writing, as they risk interfering with the writing process. Taking notes and underlining both require the writer to re-read what has been written, interposing a reading process (and in the case of taking notes, another writing process) within the writing. *Think-aloud protocols*, on the other hand, may be less likely to hinder learners' noticing during the writing process, because learners do not need to re-read what they have written or additionally write what they have noticed, which may interrupt the writing process. Numerous studies have employed the think-aloud technique for measuring noticing (e.g., Abe, 2008; Adams, 2003; Qi and Lapkin, 2001). In addition, compared to other methods of measuring noticing, the think-aloud method may be appropriate for measuring the noticing of interlanguage deficiencies (*noticing holes*), as distinct from measuring the noticing of *gaps* between the interlanguage and some instantiation of the target language such as feedback or a model text. In fact, think-aloud protocols were employed in both Swain and Lapkin (1995) and Armengol and Cots's (2009) studies on noticing holes (see Section 2.2.3.3). Therefore, the think-aloud method was used for the present study to examine *noticing holes*.

Someren, Barnard and Sandberg (1994) explain that 'Thinking aloud during problem-solving means that the subject keeps on talking, speaks out loud whatever thoughts

come to mind, while performing the task at hand'. In other words, this technique comprises the concurrent vocalisation of one's 'inner speech' without describing or explaining these thoughts; participants provide information that is in short-term memory (Dörnyei, 2007; Kormos, 1998). Since one of the main goals of this study is to identify the cognitive processes of noticing holes during L2 writing tasks, a data collection method that accesses information about the learner's ongoing activities is necessary. Ericsson and Simon (1980, 1993) posit that concurrent verbal report (think-aloud) data, although incomplete, are a thoroughly reliable source of information about cognitive processes. They have developed a theoretical framework and a procedure for collecting valid and reliable think-aloud data on the basis of the assumption that the information stored in short-term memory is available for retrieval through verbal report.

Like other research methods, the think-aloud method has limitations, such as the possibility that the method may affect the content of participants' cognitive activities (Stratman & Hamp-Lyons, 1994). However, Ericsson and Simon (1993) hold that think-aloud protocols will be valid data if the participants are asked to verbalise only what they are thinking during the task rather than to describe or justify any reasons for their thoughts. On the basis of their review of a number of studies, they conclude that there is no evidence that thinking aloud affects writers' sequences of thoughts when they are doing a task, although it may increase the amount of time needed to complete the task. Likewise, Ransdell (1995) found that even though the think-aloud method makes learners take somewhat longer to complete tasks, it appears to have

no effect on the nature of writing processes. In her study of the reactivity of think-aloud protocols, 38 college students were asked to use word processing software to write a letter in L1 to a close friend about the first days of school, and to complete the task in three different conditions: 1) a think-aloud protocol, 2) a retrospective-replay protocol, and 3) no protocol. All participants wrote for 12 minutes in each condition. The findings showed that the rate at which words and clauses were composed per minute was slower in the think-aloud condition, but that think-aloud protocols were no more intrusive than other protocol conditions.

Leow and Morgan-Short (2004) empirically investigated the issue of reactivity of the think-aloud method with L2 learners. In this study, 77 adult college-level L1 English learners of Spanish were asked to undertake a reading comprehension task and a controlled written production task with a targeted linguistic form (i.e., the impersonal imperative in Spanish). Participants were divided into two groups by condition. Participants in the control group read and completed the tasks silently; while participants in the experimental group read and completed the same tasks while thinking aloud. The results revealed no significant difference between the two groups on either task. Bowles and Leow (2005) also conducted a similar study on the reactivity of two types of think-aloud protocols. In their study, 45 fifth-semester L1 English learners of Spanish were assigned to one of three groups: a silent group, a nonmetalinguistic verbalisation group, and a metalinguistic verbalisation group. All participants were asked to do a multiple-choice comprehension task and two written production tasks after reading a text including the target structure (i.e., the

pluperfect subjunctive in Spanish). There were no significant effects on the comprehension and the writing tasks for either verbalisation group compared to the silent group. This was despite the fact that for both verbalisation groups, it took significantly more time to read the text and complete the tasks than it did for the silent group. Furthermore, it was found that metalinguistic verbalisation caused a significant decrease in text comprehension compared to nonmetalinguistic verbalisation. This indicates that requiring participants to verbalise additional specific information such as a justification for their reasoning had reactive effects on task performance.

Since the think-aloud method provides researchers with data on ongoing thought processes and yields a wealth of descriptive data, it is a valuable technique for studying learners' cognitive processes (Young, 2005; Cohen, 1998). Weijen, Bergh, Riglaarsdam, and Sanders (2008) also note that think-aloud protocols have been widely used in studies on writing processes because concurrent verbalisations can reveal what happens in writers' minds during text production. For the current study, therefore, it was expected that think-aloud protocols would provide significant information about cognitive processes such as noticing during the L2 writing process.

3.2.4.2 An argumentative essay

For the think-aloud protocols, an argumentative essay was used to elicit participants' noticing. Although an argumentative essay is regarded as a more cognitively

demanding writing task than other tasks such as narrative essays (Ransdell & Levy, 1994; Wang & Wen, 2002), it represents a typical academic assignment that students commonly deal with in university language classrooms (Roca de Larios, Marín & Murphy, 2001). In addition, Korean university students usually have to write argumentative essays in L1, and students who continue on to second-language medium postgraduate studies will typically have to write argumentative essays in L2. One of the writing sample prompts for TOEFL by Educational Testing Service (2010) was used as the essay topic. This topic is students' views on taking classes in university, with the following writing prompt.

> *Some universities require students to take classes in many subjects. Other universities require students to specialize in one subject. Which is better? Use specific reasons and examples to support your answer.*

Among various TOEFL writing topics, this topic was chosen since it seems to be general so that the content is relatively unconstrained by differences in test-takers' knowledge of the world.

While completing the argumentative essay, the participants were not allowed to access to dictionaries or other external knowledge sources because the focus of the study is the internal knowledge sources that L2 learner writers use.

3.2.5 Knowledge sources: stimulated recall interviews

Stimulated recall interviews were also conducted to further determine how the participants justify their lexical and grammatical choices. Stimulated recall, an introspective method, takes place immediately or a short time after participants perform a task, and it is used to elicit data about thought processes involved in the task (Dörnyei, 2007; Gass & Mackey, 2000). According to Bosher (1998), this method is based on the assumption that access to mental processes is enhanced by a prompt that helps in the recall of information. Thus, participants can retrieve and verbalise what went through their mind during the event with some visual or oral reminder of an event, and the retrospective verbal reports can be used to explore the learners' thought processes. In this sense, this method aimed to help to elucidate participants' initial thinking and to determine what knowledge they used in L2 problem-solving processes. Of course, some sources of knowledge can be found through participants' meta-comments in think-aloud protocols; however, this concurrent method may not be enough to reveal all of the knowledge sources, because participants do not need to explain how they make decisions while thinking aloud. Therefore, the retrospective verbal reports through stimulated recall interviews can reveal the process of participants' justification for solutions of language problems in more detail. Fortune and Thorp (2001) suggest that post-task interviews can be helpful to shed light on what learners were thinking during the process of language-related decision-making.

Moreover, it was expected that the stimulated recall interview could be used as a complementary method for clarifying what language problems participants noticed while completing the writing task. Compared to pair writing activities, in individual writing, it may be rarer to identify language-related episodes (LREs), because there is no partner who can share the ideas and discuss linguistic problems during the writing task. For example, a participant's rising intonation or a long pause can be a cue for an LRE; however, there is a possibility that these signs of uncertainty actually do not imply his or her noticing on language problems. Rather, the participant might be distracted from the writing task, and be thinking something unrelated to the task. Another possibility is that these behaviours might result from a participant's consideration of content or organisation issues, which are not the main concern of this study, rather than language issues. As a result, the information obtained from stimulated recall interviews was designed to help me to confirm whether participants actually noticed linguistic problems.

Several ways of improving the quality of stimulated recall data have been recommended. For instance, Ericsson and Simon (1993) suggest that for more reliable and accurate retrospective data, participants should be asked to comment on their performance immediately after the completion of the task, because a longer time lapse will make it difficult to recall prior thoughts. In fact, Gaier (1954) conducted a study with 16 university students in the U.S to examine the validity of stimulated recall. In his study, a regular class session was recorded, and the recording was used as a stimulus for later interviews. The participants were divided into five

groups, to be interviewed 1, 2, 4, 8, and 16 days following the class, and the same questions about what had happened in the class were given. The results demonstrated that 95% of accurate recall remains within two days of a task, whereas the accuracy rate declines to about 65% two weeks later.

Another suggestion is that during stimulated recall interviews, participants should be provided with rich contextual information to enhance recall of events that occurred during a task (Gass & Mackey, 2000; Kormos, 1998). Furthermore, Dörnyei (2007) suggests that if possible, the exact goals or details of the upcoming retrospective interview should not be evoked before the participants complete the task, because their task performance might be affected by foreknowledge.

3.3 Data collection procedures

3.3.1 The pilot study

In order to examine the feasibility of the research methods for this study, piloting was conducted before the main data collection. The think-aloud protocols and the stimulated recall interviews were piloted with a sample of ten English major students at a university in Korea. First of all, they were given participant information sheets (Appendix 4) and the opportunity to ask questions for clarification. Then, a consent form was given with the explanation of anonymity and confidentiality (Appendix 11), and all of the ten students were asked to sign it if they agreed to take part in the study. For the think-aloud protocols, since participants' responses are closely related

to the quality of the think-aloud data, training was necessary. It is important for participants to fully understand how to keep thinking aloud while doing a given task before the stage of data collection, because their verbalisations are used as primary research data. In addition, producing think-aloud data is difficult, so it is better for students to familiarise themselves with the think-aloud method through practice. A one-hour training session was given to students participating in the pilot study, and they were provided with an explanation of the think-aloud method and chances to verbalise any thoughts in their mind while writing a short paragraph. After the training session, the participants were asked to do an L2 writing task while thinking aloud for 20 minutes. After the writing task was completed, the ten students reported that the writing topic was not difficult, and that they had no problems with the think-aloud protocol.

For the stimulated recall interviews, out of the ten participants, five volunteers individually participated in a stimulated recall interview to examine how they resolved the language problems they had faced during the writing session. In order to obtain a higher rate of recall accuracy, all interviews were conducted within two days after completion of the writing task, and the most appropriate time for the interview sessions was set by each student. Before the interviews, the five think-aloud protocols were analysed to identify LREs. The guideline questions (Appendix 12) were used to structure a semi-structured interview around each LRE. Each interview lasted approximately 35 minutes. The five interviewees reported that understanding and completing the task was not difficult.

For the working memory test, the measure using the Psyscope programme (Cohen, MacWhinney, Flatt, and Provost 1993) was piloted with eight participants, consisting of four graduate students studying at Oxford University and four college students studying English at a language institute in the U.K. All participants' L1 was Korean. Before the experiment, participants were provided with several exercise trials, and practice continued until they were comfortable with the procedures. In the experiment, each participant needed to 1) press either '1' or '0' on the computer keyboard based on the logicality judgment when each sentence appears on the screen, and 2) say the last word of each sentence in the set in order when the line of asterisks appeared on the computer screen. The details of the procedures of the working memory test will be given in the next section. It took on average 30 minutes to complete the test, and all of the eight students reported that there was no particular problem while doing the test.

Overall, at the stage of piloting, it seemed that the participants had no difficulty with the data collection methods, so I concluded that the methods were feasible for the current study. The time measured during each task and responses to the tasks from the participants in the pilot study allowed me to develop a balanced schedule for the main study. Furthermore, the data obtained from the pilot study was helpful for data analysis at the stage of the main study. For example, preliminary classification of LREs and knowledge sources provided good guidance to make a clearer classification at the later stage.

3.3.2 Procedures for the main data collection

As described above, three universities agreed to participate in my study. To save time and cost, I decided to collect data from one university at a time. I began with the university which first showed interest in my research. For data collection, two separate sessions were individually conducted in a quiet office near each university for the participants' convenience. Figure 3.1 below shows what tasks participants did in each session.

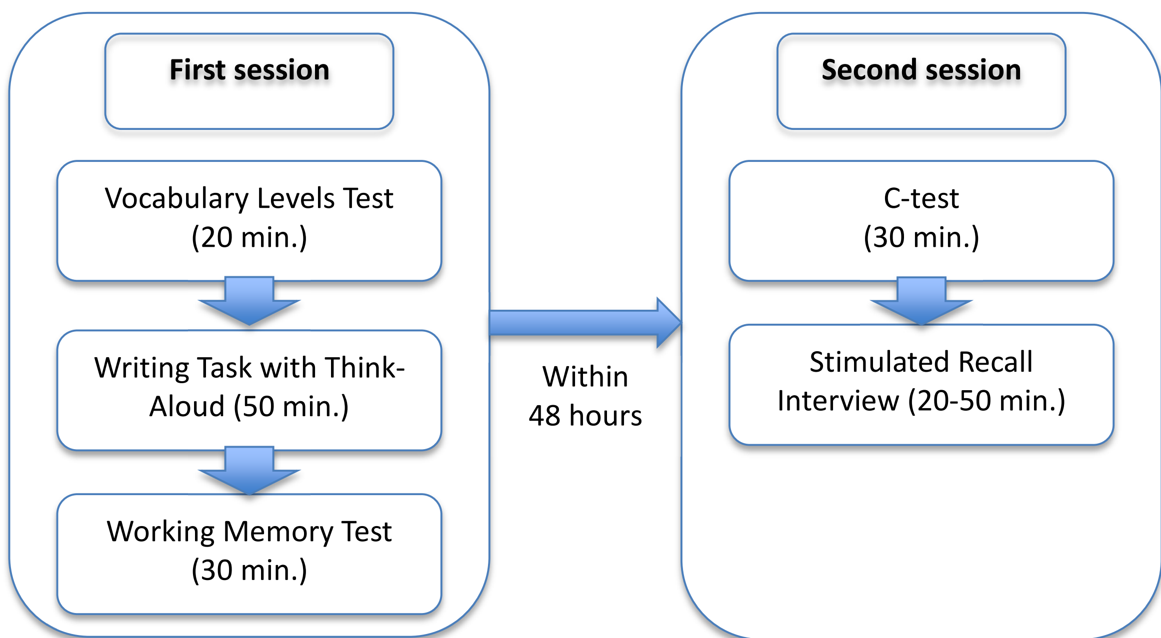


Figure 3.1 Summary of the main data collection procedures

The second session was scheduled within two days after the first session in order to get more valid stimulated recall data. It took approximately two hours to complete the tasks in the first session while the second one lasted for one to one and a half hours. The duration of each stimulated recall interview varied, since the number of

the language problems each participant had noticed was different, and only those parts of the recording where LREs had been found were discussed during the interview. The procedures for each data collection session are presented in detail below.

The first session

To begin the first session, each participant was informed in detail about the study, both verbally and in writing (Appendix 4), and given the opportunity to opt in or out of the study. A consent form was provided (Appendix 11). To ensure that participants fully understood, they were urged to read the form and ask questions for clarification. Then they were asked to sign it if they agreed to take part in the study. Once permission from each student was gained, he or she was asked to answer some questions about personal details such as name, year of study, and educational background. For this, a face-to-face interview (Appendix 6) was used instead of the paper self-completion questionnaire because the interview might make participants feel comfortable before doing the tasks. All information from the interview was stored in my personal laptop and held securely with a password.

Then, participants were asked to do the VLT on paper as one of the L2 proficiency tests. As mentioned before, the test consists of five sections with different levels of vocabulary (i.e., 2000, 3000, 5000, 10000, and Academic words), and the test sheets were given to participants in order of word frequency. According to Schmitt, Schmitt,

and Clapham (2001), unlike other sections, the words in the Academic section are not frequency-based, ranging between the 2000 level and the 10000 level. Therefore, they suggested that the Academic section could be placed anywhere between the 2000 level and the 10000 level. For this study, participants were given the Academic section between the 3000 level and the 5000 level. This is because, based on the results of the pilot study for the VLT, the mean score of the Academic section was between the 3000 level and the 5000 level, and in fact, the participants in the pilot reported that they felt the words in the 5000 level were more difficult than ones in the Academic section. Participants are required to match the words to the correct definitions. When they were not sure that their answer was correct, they were allowed either to answer based on their own best guess or not to answer. They were informed that they would not be penalised for guessing an incorrect answer. It took on average 20 minutes to complete the test.

Next, noticing data was collected through a think-aloud writing session. Before the writing session, a training session for think-aloud protocols was given individually to each student. I first explained what the think-aloud method is and demonstrated speaking out any thoughts in my mind while writing a short paragraph that consisted of five English sentences. After observing the sample procedure, each participant had a chance to verbalise every single thought that occurred in his or her mind in both Korean and English while producing several sentences in English about what they did the day before. Participants were asked not to interpret, but simply to report their thoughts. The training session lasted until the participant was comfortable with the

think-aloud technique; the average duration of the training session was about 30 minutes. After the training session, the participant was asked to perform a writing task in L2 and to verbalise everything that went through their mind while producing the hand-written text, again being asked not to filter their thoughts or evaluate them, but simply to report them. Participants were allowed to speak in either their L1 (Korean) or L2 (English) while thinking aloud. They were given 5 minutes for planning, and 20 minutes for writing (i.e., producing text). Since this study focuses on language problem solving processes in *formulating* rather than *planning* or *revising*, only the process of the actual text production for 20 minutes was audio-recorded. I assumed that 20 minutes might not be enough for participants to revise their own essay. For 20 minutes, in fact, most participants actually did not revise the essay, and some participants were not even able to complete the essay. During the writing session, they were not allowed to use any external aid like a dictionary. There was no interruption during the writing session; however, if a participant stopped talking for more than 10 seconds, I reminded them to continue to think aloud.

The last task was a working memory test. First of all, I briefly explained what working memory is, what would be measured, and what they should do during the experiment. Next, since it was necessary for participants to be familiar with how to do the working memory test, they were provided with several exercise trials before the main test. For practice, a couple of sample working memory tests were created. To avoid a fatigue effect, these tests were all made shorter than the main test. The practice continued until participants were comfortable with the procedures. With

their confirmation of test familiarity, the main test started. During the test, participants needed to 1) read each sentence when it appeared on the screen, 2) judge whether the sentence was logical or illogical, 3) press a key on the computer keyboard to indicate their decision on the logicality of the sentence, and 4) when the line of asterisks appear at the end of each set, say the last word of each sentence in the set in order. Before starting the experiment, participants were allowed to choose between '0' and '1' which key they prefer for 'logical' and 'illogical' choices. Since these two keys are widely separated on the keyboard, it was expected that participants were unlikely to make an error during the logicality judgment task. Pressing one of the keys triggered the next sentence or the line of asterisks on the screen. I recorded the words participants said on paper. When a participant failed to recall (i.e., either incorrect recall of any sentence-final word, or correct recall of sentence-final words in incorrect order) on two out of five sets, only the next higher level was attempted, but no higher levels in the same language were attempted to avoid discouraging the participant.

The second session

The second session consisted of the C-test as an L2 grammar proficiency test, and a stimulated recall interview. As mentioned above, this session was scheduled within two days after the first session, to retain a high rate of recall accuracy in the stimulated recall interview. For each student, the date and time was set right after

the first data collection session through discussion with me. The tasks in the session were also conducted individually.

First, participants did the C-test. Since it was assumed that most of the participants were not familiar with the C-test format, before starting the test, an instruction was given to participants along with several examples. For practice, several sentences with some blanks were given, and each participant had a chance to learn how to do the task. Through the practice, all participants seemed to feel confident in doing the task. During the test, they were not allowed to use other aids or to ask questions, and 30 minutes was allotted at most for the task. As in the VLT test, participants were informed that there would be no penalty for guessing. They were also allowed to leave a blank if they were not sure of an answer. It took participants from 15 to 30 minutes to complete the test.

Then the stimulated recall interview was conducted, to examine how participants resolved the language problems they had faced during the writing task. Each participant's think-aloud protocol had been transcribed and analysed to identify LREs prior to the stimulated recall session. At the beginning of the interview, each participant was given his or her own writing sample from the writing task. Those parts of the recording where LREs had been found were played (to save time, rather than playing the entire recording), so that all of the language problems identified in the think-aloud protocol could be discussed. Guideline questions (Appendix 12) were used to structure a semi-structured interview around each LRE. During the

interviews, participants were asked to answer the questions while recalling what they were thinking during the writing session. For their comfort, the interview was conducted in their mother tongue, Korean. Care was taken to make sure that the participants' answers were based on what had been going on in their mind when they did the writing task. All interviews were audio-recorded, and the length of each interview varied from 20 to 50 minutes, depending on how many LREs were discussed.

3.4 Data analysis

3.4.1 A unit of data analysis of the think-aloud protocols: language-related episodes

A total of 108 think aloud protocols were transcribed from participants' audio-recordings, and each protocol was analysed to quantify what language problems participants noticed. For this, LREs were employed as the unit of analysis. A LRE is defined for the purposes of this project as any segment of the protocol where learners talk about the language they are producing or solve a language problem, either correctly or incorrectly (Swain, 1995). Jackson (2001) proposes that LREs are units of analysis identifying what problematic features of the target language learners become aware of. Therefore, it is possible to determine what types of language problems learners notice by themselves during L2 writing by identifying and analysing LREs in participants' think-aloud protocols.

A number of studies of L2 writing have included LREs as unit of analysis (e.g., Armengol and Cots, 2009; Leeser, 2004; Qi and Lapkin 2001; Suzuki, 2008), and each

study has used different classifications of LREs. Table 3.8 shows a summary of studies where LREs have been used. Some researchers have included *orthographic* episodes (e.g., Fortune and Thorp, 2001; Swain and Lapkin 1995) while several studies have found *content* episodes (e.g., Abe, 2008; Hanaoka, 2007). However, for this study, a content episode was excluded because this type of episode is not considered as precisely 'language-related'. In addition, orthographic episodes were classified as lexical episodes, since a decision about spelling is a part of the process of representing written forms of words.

Table 3.8 Studies on use of LREs as an analytical tool

Authors and year	Participants	Instruments	Data collection methods	Classification of LREs
Swain and Lapkin, 1995	18 young adolescent students in a French immersion program	An argumentative writing task	Think-aloud	1) Sounds right/doesn't sound right (lexical and grammatical); 2) Makes more sense/ doesn't make sense; 3) A grammatical rule; 4) Lexical search; 5) Translation; 6) Stylistic; 7) Spelling
Fortune and Thorp, 2001	30 mixed nationality of EFL learners	Four different dictogloss tasks	Audio-recording of interactions	1) Lexical; 2) Grammatical; 3) Discourse; 4) Orthographic
Qi and Lapkin, 2001	2 adult Mandarin-speaking ESL learners	A narrative writing task	Think-aloud; Retrospective interviews	1) Lexical; 2) Form; 3) Discourse
Leeser, 2004	42 adult L2 Spanish learners	A dictogloss task	Audio-recording of interactions	1) Lexical; 2) Grammatical
Hanaoka, 2006	2 adult Japanese-speaking EFL learners	A narrative writing task	Think-aloud	1) Lexis; 2) Grammar; 3) Content
Hanaoka, 2007	37 Japanese college students	A narrative writing task	Note-taking	1) Lexis; 2) Grammar; 3) Content; 4) Other
Watanabe and Swain, 2007	12 Japanese learners	An argumentative writing task	Audio-recording of interactions; Stimulated recall interviews	1) Lexical; 2) Grammatical
Abe, 2008	14 Japanese ESL learners	Two writing tasks	Think-aloud; Semi-structured interviews	1) Lexical; 2) Form; 3) Discourse; 4) Content; 5) Other
Suzuki, 2008	24 Japanese university students	Two descriptive writing tasks	Think-aloud; Stimulated recall interviews; Audio-recordings of interactions	LREs: 1) Word level; 2) Sentence level; 3) Discourse level TREs (text-related episodes): 1) Topics, content, and ideas of texts; 2) Audience of text RREs (revision/writing task-related episodes): 1) Purpose; 2) Procedure

Table 3.8 Studies on use of LREs as an analytical tool (continued)

Authors and year	Participants	Instruments	Data collection methods	Classification of LREs
Armengol And Cots, 2009	5 English major college students	Two argumentative writing tasks	Think-aloud; Recall reports	1) Procedural AE (awareness episodes); 2) Language AE 3) Language-procedural AE (word-choice –> process management)
Abe, 2010	4 Japanese EFL university students	A narrative writing task	Audio-recording of interactions;	1) Lexical; 2) Form; 3) Content
Esteban & Roca de Larios, 2010	17 Spanish secondary school students	A narrative writing task	Note-taking	1) Lexis; 2) Spelling; 3) Grammar; 4) Ideas and expression; 5) Other
Baleghizadeh and Arab, 2011	31 Iranian university students	A narrative writing task	Note-taking	1) Lexical; 2) Form; 3) Discourse; 4) Content; 5) Other
Rahim and Riasati, 2011	4 adult Iranian EFL students	An argumentative writing task	Stimulated recall interviews	1) Lexis; 2) Form; 3) Discourse
Yazdi Amirkhiz, Bakar, Samad, Baki and Mahmoudi, 2013	4 Malaysian and 4 Iranian university students	IELTS Academic Module task 1	Audio-recording of interactions	1) Form-oriented (Grammar); 2) Lexis-oriented (Lexical); 3) Mechanics-oriented (Orthography and punctuation)

3.4.2 Scoring

3.4.2.1 L2 proficiency tests

Scoring both the VLT and the C-test is simple and fast. In the VLT, participants who matched each target item correctly with its definition were given one point. Only one answer for each target item exists. No penalty for guessing was imposed, either when participants gave an incorrect answer or when they gave no answer. There are a total of thirty target items in each of five levels of the test, so the maximum score participants can get is 150.

For the C-test, an exact word scoring method was adopted. As one of the criteria for making C-tests, Klein-Braley and Raatz (1984) propose that only exact scoring should be used to ensure objectivity. Due to the half word deletion technique, it is likely to be rare that there are two possible correct answers for an item; therefore, only the exact word scoring method is employed in the C-test (Weir, 1990). However, Dörnyei and Katona (1992) claim that the exact word scoring method can be combined with a tolerance of spelling mistakes, while suggesting that the sample and purpose of the study should be considered to select the more appropriate scoring method. For the current study, it was assumed that spelling 'errors' would be more the case than spelling 'mistakes', because the participants in this study are all adults and relatively high proficient English language learners. In other words, if a participant spelled target words wrong in the C-test, the misspellings might arise from his or her lack of knowledge of the target words instead of a temporary lapse. In addition, since

orthography is regarded as one of the language problems participants may notice during the L2 writing process in this study, and since orthographic correctness seems important in the academic context (Eckes & Grotjahn, 2006), spelling errors were counted as incorrect when the C-test was scored. Therefore, only when participants successfully provided the original word that had been deleted from the text, was one point given to them. There are one hundred deleted blanks (25 blanks in each of four texts), so 100 points is the maximum score of the C-test.

To measure the participants' L2 proficiency, the two test scores were converted into *z*-scores, and the mean of the two z-scores was obtained. According to Urdan (2010), *z*-scores provide a way to standardise different metrics through a process of converting individual raw scores in the distribution into standard deviation units. This standardised score can be used when a composite score of different tests is calculated. For each participant in this study, the raw scores from each proficiency test, which have different numbers of items, cannot be simply combined, because each item from the VLT and the C-test is differently weighted. Therefore, it is necessary to weight these two tests equally. Finch and French (2012:2) say, 'the unit-weighted method for obtaining composite scores typically involves the summation of a set of all observed variables or items associated with a common measure in order to obtain a total score, or summation of subsets of items to create subscale scores'. To obtain unit-weighted composite scores, the raw scores should be converted into *z*-scores that have a distribution with a mean of 0 and a standard deviation of 1. By

converting to *z*-scores, the two tests with different raw items were converted to comparable distribution and the mean was calculated.

3.4.2.2 Working memory capacity

Following the principles of Walter's (2004) measurement, working memory scores in both languages were calculated for each participant, on the basis of three figures: 1) *recall span*, 2) *percentage of correct logicality judgments* and 3) *reaction time for correct answers at recall span*. The first element is a measure of storage while the other two elements are processing measurements. It is worth noting that since all of the three components are equally weighted, the overall working memory measure is weighted in favour of processing. The score for recall span was determined by the highest level at which participants correctly recalled the sentence-final words in three out of five sets; an extra half-point was given for correct recall in two of the five sets at the next higher level (as in Osaka, Osaka, & Groner, 1993; Lustig, May, & Hasher, 2001; Walter, 2004; Watanabe, 2012; Waters & Caplan, 1996). For instance, when a participant recalled all sentence-final words correctly on three out of five three-sentence sets, and recalled correctly on two out of five four-sentence sets, his or her recall span score was 3.5. The percentage of correct logicality judgments was calculated by dividing the number of correctly judged sentences in terms of logicality by the number of all attempted sentences. Mean reaction time for reading the sentence and making a decision on logicality was measured by the Psyscope programme, in milliseconds, and retained only for sentences where the logicality

judgment was correctly made. Since wrong responses indicated inappropriateness in process, and since incorrect reaction times tend to be longer than correct reaction times, especially when accuracy is emphasised during the task (Ratcliff & Rouder, 1998; Takane & Sergent, 1983), only the reaction times for correct responses were included in the computations.

To obtain an overall working memory score, as with the L2 proficiency score, *z*-scores were employed because the three measurements, recall span score, percentage, and reaction time, have different raw-units (e.g., 3.5; 90%; 4758ms, respectively). All of the three elements were converted into z-scores. In addition, the reaction time *z*-scores were multiplied by -1, because higher reaction times show less good processing, while higher scores on recall span and percentage of correct logicality judgments indicate participants' better storage and processing. Since there were L1 and L2 working memory tests, each participant had two values. Overall working memory scores in each language were calculated as the means of the three *z*-scores.

3.4.3 Quantitative analysis

Research questions 1 to 4 were answered on the basis of quantitative data analysis. First of all, descriptive statistics for the frequency of each type of LRE were calculated to answer the question about what aspects of language Korean university learners notice while writing in L2. However, the study did not focus on whether or not LREs were successfully solved (i.e., outcomes of LREs) because this research did not set out

to explore learners' success in resolving language problems during the L2 writing process. Since Swain (1998) categorised LREs into three types of possible outcomes (i.e., outcome type 1: correctly resolved, type 2: unresolved/abandoned, and type 3: incorrectly resolved), many studies have coded LREs according to their outcomes, for the purpose of examining whether the use of collaborative tasks positively influence L2 development (e.g., Ismail & Samad, 2010; Leeser, 2004). These studies have mainly used form-focused tasks which require learners to produce output collaboratively, such as dictogloss tasks or passage reconstruction tasks. In contrast, the present study focuses on the patterns of learner attention to linguistic features during a less structured task (i.e., composition) in the individual writing environment, rather than during the grammar-focused tasks in pair work. However, it may be worth investigating the outcomes of LREs in a future study, for example by rating the writing quality in terms of accuracy.

Next, several inferential statistical tests were used to answer the research questions about what variables are related to noticing during the L2 writing process. There were four independent variables (i.e., *Study abroad experience, L2 proficiency, L1 working memory capacity, and L2 working memory capacity*) and one dependent variable (i.e., *the number of LREs*). All statistical analyses were performed using SPSS 20.0 (IBM Corp., 2011), and specifically, independent samples *t*-tests and multiple regression were employed to explore the data.

3.4.4 Qualitative analysis

To determine the different types of knowledge sources participants used in L2 writing, qualitative data analysis was employed. For this, both the think-aloud protocols, which were initially transcribed verbatim, and the transcripts of stimulated recall interviews were carefully examined. Since the aim of analysis of stimulated-recall interview data is to develop a classification of knowledge sources learners employ to resolve language problems during the L2 writing process, it is reasonable to analyse all of the LREs rather than some of them. A few researchers have studied the nature of attention to form (e.g., García Mayo, 2002; Storch, 1998a, 1998b), and a taxonomy of knowledge sources with several categories has been established. For instance, learners justify their grammatical choices based on *grammatical rules*, *context* or *intuition*. However, it is worth noting that this taxonomy was developed on the basis of information from collaborative writing environments. In the individual writing circumstances of this research, it was expected that different categories of the sources of knowledge would emerge. The classification of knowledge sources emerged mainly from the obtained interview data rather than from pre-existing categories. Moreover, as mentioned in Section 3.5.1, all of the identified LREs were divided into two categories (i.e., lexical and grammatical); therefore, knowledge sources in each type of LRE were examined respectively.

3.5 Reliability and validity

According to McKay (2006:11), two qualities, *reliability* and *validity*, are crucial for sound research. Concerning the reliability of think-aloud protocols, Someren, Barnard, and Sandberg (1994) note that it is better for the same data to be coded by different coders, and for the coding procedures to be compared and evaluated. Similarly, Li (2004) stresses that intercoder reliability is essential in think-aloud protocol analysis. In addition, generating a coding scheme that accurately captures behaviours is important for reliability in think-aloud protocol analysis (Green, 1998). Therefore, a suitable coding scheme on the basis of various previous studies was developed and used to analyse participants' protocols, and a second rater coded a percentage of the think-aloud protocols. The second rater was a Korean speaker, and had much experience analysing think-aloud protocols in L2 writing studies. She coded about 20% (i.e., 20 transcriptions) of the entire transcribed think-aloud protocols (108 transcriptions in total) according to the coding scheme. When the second rater did the initial coding, there were twelve discrepancies for LREs, but after discussing the discrepant cases, there were only three discrepancies. After the initial coding and discussion stage, both raters coded and categorised another 10 transcriptions, and the result of the inter-rater reliability for LREs was obtained by using Cronbach's alpha (0.94).

For the stimulated recall interviews, as described above, timing of the interview and memory retrieval cues are essential for reliable data (Henderson, Henderson, Grant &

Huang, 2010). Thus, the time interval between the occurrence of a thought and its verbal report was less than 48 hours, and to trigger accurate memory recall, writing samples and audio recordings were provided to participants who were interviewed. Moreover, as for think-aloud protocols, coding reliability is critical. However, as pointed out earlier, while there have been a large number of studies on what language problems are noticed in L2 writing (e.g., Abe, 2008; Hanaoka, 2007, Leeser, 2004; Qi and Lapkin 2001), there are fewer studies on the sources of knowledge for language problem solving (e.g., García Mayo, 2002; Storch, 1998a, 1998b). Consequently, it was necessary to develop a new coding scheme for interview data analysis based on my research aims, and the provisional coding scheme was discussed and refined with my supervisor.

Regarding the validity of the think-aloud method, Ransdell (1995) argues that if learners' verbalisation does not precisely reflect the underlying processes involved, a think-aloud protocol is invalid. Therefore, she emphasises that the most valid verbalisation data will be produced when the writer speaks out loud without evaluation of his or her own cognitive process. Addressing this argument, Woodall (2002) asked participants not to interpret but simply to report their thoughts, to maximise validity. In this sense, for this study, participants were asked not to filter their thoughts while thinking aloud, and they practiced reporting any thoughts that occur in their minds during a training session.

For stimulated recall interviews, the nature of the researcher's interview questions is closely related to validity. The questions should be non-directive (Henderson, Henderson, Grant & Huang, 2010), and researchers have to avoid asking leading questions to minimise the effects of researcher bias (Kormos, 1998). Furthermore, Dörnyei (2007:149) argues, 'the researcher should only encourage the recall of directly retrievable information rather than explanations or interpretations'. That is, the interview questions should not induce participants to infer or generalise in the retrospective report. To achieve this, the questions should be connected with specific problems or themes (Ericsson & Simon, 1993). The guideline questions for the stimulated recall interviews (Appendix 12) were developed with every effort made to adhere to this principle.

3.6 Ethical considerations

This study involves two possible ethical issues: anonymity and confidentiality. McDonough and McDonough (1997:68) insist that every participant needs to be protected in all procedures to ensure anonymity and confidentiality. Even though anonymity and confidentiality are usually promised, it is necessary to inform the participants of these issues and to make sure that participants understand them before data is collected (Bell, 1993:129). In the current study, therefore, anonymity and confidentiality were explained and ensured before the procedure of the data collection, in order to help participants respond without anxiety to the tasks they were asked to undertake.

Learners' participation should be based on informed consent. With regard to the principle of informed consent, Bryman (2008) notes that participants should be fully informed about the research process. Furthermore, Dörnyei (2007) recommends that respondents must be aware of the purpose of the research, possible risks or discomforts, and the right to withdraw or refuse to participate at any time without any penalty. Thus, participants must be told all the information about the research before their participation. These principles follow the *Ethical Guidelines for Educational Research* provided by the British Educational Research Association (BERA) in 2011. Application for ethical approval by the Oxford University Central University Research Ethics Committee was made (Appendix 2) and granted (Appendix 3). All participants were told all the information about this study (Appendix 4) and gave a signature on the consent form (Appendix 11) before data collection was undertaken.

In this chapter, the methodological framework for the study has been discussed. In the next two chapters (Chapters 4 and 5), the results from quantitative and qualitative analyses will be presented.

4. RESULTS 1: QUANTITATIVE RESULTS

4.1 Introduction

In this chapter, the results of the quantitative data analyses are presented and set out in two main parts. First, the language problems confronted by participants while undertaking the L2 writing task are introduced with descriptive statistics, and this part will give an answer to Research Question 1: what aspects of language Korean university learners notice while writing in L2. Second, the effects of learner-related variables on noticing are investigated to answer Research Questions 2, 3 and 4 about whether learners' *previous study abroad experience*, *L2 proficiency* or *L1 and L2 working memory capacity* have effects on noticing during the L2 writing process. For this, inferential statistical tests such as correlation, independent samples *t*-test, and multiple regression were employed in order to examine the data and address the research questions.

4.2 Types of linguistic problems noticed by Korean university learners

A total of 586 LREs were identified in the 108 think-aloud protocols. As mentioned in Section 3.5.1, for this study, LREs were divided into two categories: *lexical* and *grammatical*. Table 4.1 shows the numbers and percentage of each type of LRE.

Table 4.1 Numbers and percentages of each type of LRE

N = 108	Minimum	Maximum	Mean (SD)	Numbers	Percentages
Lexical	0	14	4.9 (3.1)	533	91.0
Grammatical	0	3	0.5 (0.8)	53	9.0
Total	0	14	5.4 (3.3)	586	100.0

Overall, participants reported noticing an average of 5.4 language problems during the 20-minute L2 writing process. That is, each participant verbalised about five language problems related to vocabulary or grammar while working on an essay in L2 for 20 minutes. As can be seen, some students did not notice any language problems, while other students noticed as many as 14 language problems. In addition, the participants verbally expressed more lexical episodes than grammatical episodes overall ($Z = -8.568$, $p < .001$). Note that the standard deviation of the number of grammatical episodes (0.8) is greater than the mean (0.5). This indicates an uneven spread of grammatical LREs across the participants. In fact, 69 out of 108 participants did not verbalise any grammatical episodes, while only 10 participants noticed more than one grammatical episode. Figure 4.1 shows the histograms of the frequency of each type of LRE, suggesting a more normal distribution of lexical than grammatical episodes.

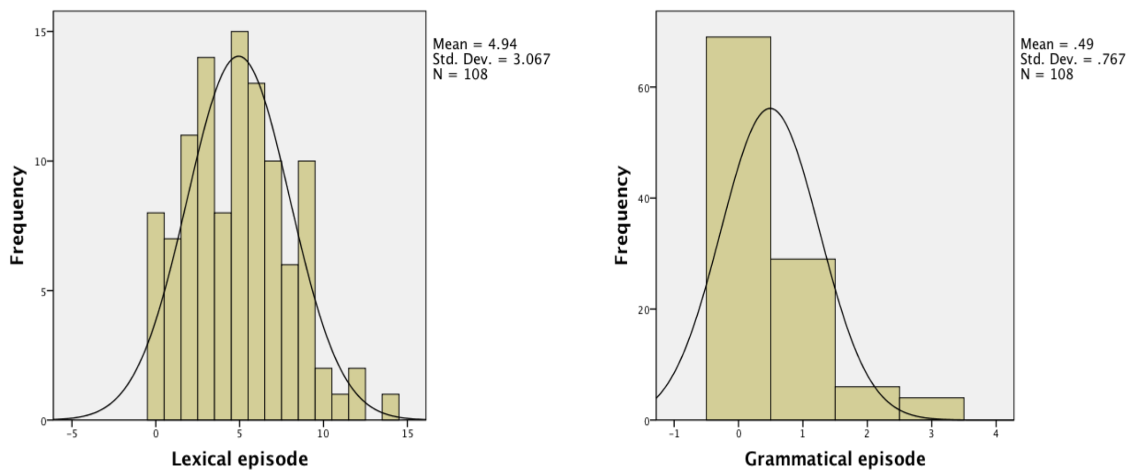


Figure 4.1 Histograms of the frequencies of lexical and grammatical LREs

The data on the frequency of grammatical episodes was highly skewed in a positive direction. This explains why the standard deviation is greater than the mean of the number of grammatical episodes. Each type of episode will be discussed in detail with examples in the sections below.

4.2.1 Lexical episodes

Lexical episodes were divided into three types: *identification*, *selection*, and *orthography* (Fortune & Thorp, 2001). While the first two types were classified on the basis of the meanings of words, the last one was a form-based lexical category. *Identification* involved only one individual lexical item, and this kind of episode occurred when participants asked themselves whether certain words existed, or when they tried to find an L2 translation equivalent for an L1 word. In contrast, *selection* occurred when participants chose between lexical items on grounds of

meaning. *Orthography* occurred when participants had difficulties with spelling words. A total of 533 lexical episodes were identified. Table 4.2 shows the number and the percentage in each subcategory, and Figure 4.2 displays the percentage of each subcategory in lexical episodes in a pie chart.

Table 4.2 Numbers and percentages of subcategories in lexical episodes (N = 108)

Identification	Selection	Orthography	Total
385	123	25	533
72.2%	23.1%	4.7%	100%

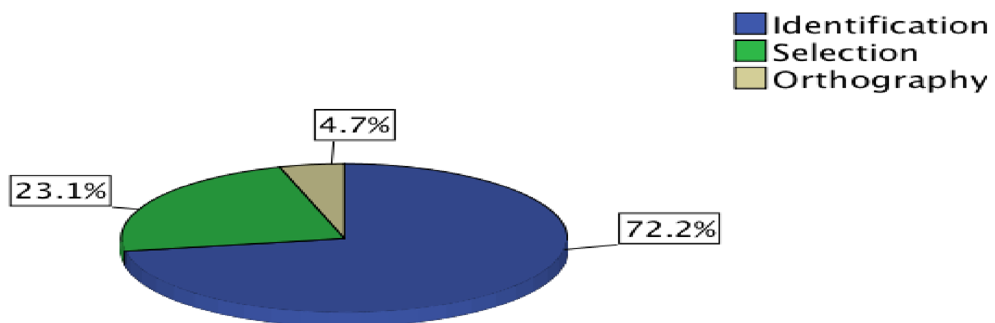


Figure 4.2 Percentage of subcategories in lexical episodes

Examples of each type of lexical episode are presented below. In the following excerpts,

- underlined segments represent L2 (English)
- segments without underlines are all L1 (Korean)

- segments within single quotation marks ('x') in segments without underlines are L2 (English)
- pauses are shown by dots (Three dots indicates a 3 second pause, and five dots represent a longer pause)

Example 1. Lexical: *Identification*

university is ah … university universities are optional I mean um institution institution? institution what is an English word for an institution? I mean um ah it is … easily easily um um place it's the it is the place

Example 2. Lexical: *Selection*

third ah the classes the classes about so many things so many subjects do not help do not actually help … ourselves promote promote expand? promote promote? increase increase which one is correct? ….. to increase increase increase our ourselves increase the knowledge increase the knowledge

Example 3. Lexical: *Orthography*

re results results in synergy does this word start with 'S' or with 'C'? ... C-Y-N-E-R-G-Y C-Y-N-E-R-G-Y … S-Y-N-E-R-G-Y S-Y-N-E-R-G-Y is the spelling correct? it looks wrong ... synergy result in synergy synergy

4.2.2 Grammatical episodes

Based on Fortune and Thorp's (2001) taxonomy, each grammatical episode was classified into one of 6 categories on the basis of its grammatical features. First, *morphology* (Morph.) entails two main branches of morphology: 1) *inflectional morphology* includes such features as noun plurals and possessive '-s', but does not include verbal morphology, and 2) *derivational morphology* covers episodes related to word class. In addition, there are episodes related to *articles* (Art.) and *pronouns* (Pron.). *Verb* covers verb tense, focusing on choice of tense, and verb form, including the voice, and the argument requirements of the verb (e.g., 'makes me to know' or 'makes me know'). *Subject-verb agreement* (SVA) is another subcategory. There are also some episodes related to *word order* (WO).

A total of 53 grammatical episodes were identified and divided according to this classification, with Table 4.3 below showing the numbers of each subcategory.

Table 4.3 Numbers of subcategories in grammatical episodes (N=108)

Morph.	Pron.	Art.	Verb	WO	SVA	Other	Total
14[14]	2[2]	13[11]	10[10]	8[7]	1[1]	5[5]	53

Numbers in brackets indicate how many participants contributed to each subcategory

Of the six subcategories, *morphology* and *articles* took up about half of all of the grammatical episodes (27 out of 53 episodes). Concerning *morphology* (14 instances),

it was found that the participants had more difficulties with inflectional morphology (13 instances) than with derivational morphology (1 instance), and interestingly, all of the 13 LREs related to inflectional morphology involved noun countability. On the other hand, *pronoun* episodes were found only twice, and only one episode related to *subject-verb agreement* was identified in the data. Examples of some subcategories of grammatical episodes are presented below. As before, underlined segments represent L2, and segments without underlines are all L1. Segments within single quotation marks in segments without underlines are L2, and pauses are shown by dots.

Example 4. Grammatical: *inflectional morphology*

<u>who have many knowledge? much knowledge? knowledge? knowledges? knowledge? knowledges?</u> can this word be used as a plural noun? um ... <u>many knowledges</u>

Example 5. Grammatical: *articles*

<u>university university required required students</u> should I put 'the' here? <u>the students? the?</u> just <u>students? the students to take classes in different subjects</u>

Example 6. Grammatical: *verb*

it makes students solve solve is this correct? solve solve solve solve problem in various way to solve problem? solve problem? ah to ….. 'make' is a causative verb, so 'to' should be not used .. just 'solve' makes students solve problems

To summarise the analysis so far, 108 participants in this study noticed approximately 5 language problems each while working on an L2 text for 20 minutes, and verbally expressed many more lexical episodes than grammatical episodes. Of 533 lexical episodes, participants tried to search for individual items 72 percent of the time, and attempted to choose between alternatives 23 percent of the time; on the other hand, only 5 percent of lexical episodes related to spelling words. In grammatical episodes, participants generally reported more problems related to articles and morphology than to other categories employed in this study. In Section 4.3, the results of inferential statistical tests will show which variables are related to and have effects on learners' noticing.

4.3 Effects of the variables influencing learners' noticing

4.3.1 Preliminary data analysis

Before doing inferential statistical tests, a preliminary analysis of the data was conducted. Table 4.4 displays the dependent and independent variables, and the corresponding observations.

Table 4.4 Summary of the variables and the corresponding measures

Dependent variable		Measures
	Noticing	The frequency of LREs
Independent variables		
	Study abroad experience	Having some or no experience
	L2 proficiency	VLT scores
		C-test scores
	L1/L2 working memory capacity	Recall span in L1/L2
		Logicality judgment in L1/L2
		Reaction time in L1/L2

All variables are continuous variables except study abroad experience, which is a dichotomous variable (i.e., having some or none). Participants' noticing and prior study abroad experience were each represented by a single indicator; on the other hand, the variables related to L2 proficiency and L1 and L2 working memory capacity were measured by two or more indicators. Table 4.5 presents the descriptive statistics for the observed variables, except for the participants' study abroad experience, which will be discussed in detail in the next section.

Table 4.5 Descriptive statistics of the observed variables

N = 108	Minimum	Maximum	Mean (SD)
LREs	0	14	5.4 (3.3)
VLT	104	148	130.3 (8.3)
C-test	21	84	59.9 (13.5)
L1 Recall span	2.0	5.0	3.9 (0.7)
L2 Recall span	2.0	5.0	3.4 (1.1)
L1 Logicality judgment	71	100	93.8 (4.5)
L2 Logicality judgment	68	100	93.7 (6.0)
L2 Reaction time	1497	16835	4391 (1719)
L2 Reaction time	2741	25654	6584 (2677)

Maximum possible scores: VLT=150; C-test=100; Recall span=5.0; Logicality judgment=100

Before conducting the tests using SPSS, the data was probed for outliers. 'An outlier is an extreme numeric value in a distribution' (de Vaus, 2002:93). The problem with outliers is that when they are included in a dataset, statistical tests based on sample means and variances can be incorrectly performed, and consequently, the results can be seriously distorted (Dörnyei, 2007; Urdan, 2010). For the data in this study, six outliers were detected, on the basis of *z*-scores (i.e., any *z* value > 3), and they were excluded from the final data set with the aim of achieving reliable test results. Thus, the data from a total of 102 participants was finally used to explore which variables are related to and affect learners' noticing. Each independent variable was examined one by one. The effect of previous study abroad experiences on learners' noticing was firstly investigated, and the results will be reported in the next section.

4.3.2 Effects of previous study abroad experience on noticing

Of 102 participants whose data was used for inferential statistical tests, 40 students (21 students studying in English-speaking countries before entering college; 8 students studying at international schools where English was the medium of instruction in non-English speaking environments before entering college; 11 students studying at overseas universities through Student Exchange programs after entering college) had studied abroad before they participated in the current study, while the other 62 students had no study abroad experience at all.

It can be hypothesised that the 40 participants are distinctively different from the other 62 participants in terms of amount of exposure to English. Even though there were differences in the length of time the participants were educated in English immersion environments, the participants in the 'having experience' group had had more opportunities to speak and write in English than ones in the 'no experience' group. In general, the students in the 'no experience' group had engaged in four hours of English class per week before entering university. Almost all of their lessons would typically have been provided by a Korean teacher in L1 Korean and would have focused on reading and listening skills. In other words, they would have had very few chances to develop productive skills in L2 English. In this context, with regard to L2 writing, which is the main topic of this current study, the 'having experience' group had had greater opportunities to undertake writing tasks in English than the counterpart.

To examine the effect of prior study abroad experience on learners' noticing, an independent samples *t*-test was employed. This test enabled the means of the frequency of LREs from the two groups to be examined in order to determine if there was a significant difference. Table 4.6 shows the descriptive statistics of the frequency of LREs of the two experience groups, and Figure 4.3 presents the bar chart for the frequency of LREs of the two groups.

Table 4.6 Frequency of LREs for two experience groups

Group	N	Mean	SD	Std. Error Mean
Having experience	40	3.5	2.4	0.4
No experience	62	6.8	3.0	0.4

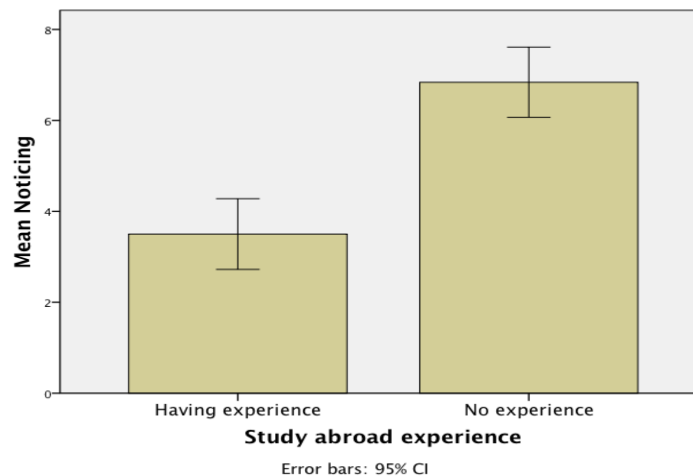


Figure 4.3 Frequency of LREs for each of the two experience groups

Before conducting the independent *t*-test, several assumptions were tested. One of the assumptions is that the dependent variable should be approximately normally distributed for each category of the independent variable (Field, 2009). It is

important to check this assumption before doing independent *t*-tests because if this assumption is violated, a non-parametric alternative to the independent t-test (i.e., *Mann-Whitney U* test) should be used. Therefore, the normality was assessed using the Kolmogorov-Smirnov test of normality (K-S test) to confirm whether the data met this assumption or not. The result showed that the frequency of LREs was indeed normal within the two groups since the K-S test was not significant ($p > .05$). Therefore, it was appropriate to carry out an independent *t*-test with the data.

Another assumption for independent t-tests is that the variances in the two groups should be equal. In order to check this assumption, Levene's test for homogeneity of variances was used, and it was found that the variances in two groups were equal ($p > .05$).

The independent *t*-test showed that participants having prior study abroad experience noticed fewer language problems (M = 3.5, SE = 0.4) during the L2 writing process than ones having no experience (M = 6.8, SE = 0.4), and this difference was significant $t(100) = -5.848$, $p < .001$. In order to examine how substantial the effect was, the effect size was calculated, using Pearson's correlation coefficient *r*. According to the guideline for effect size suggested by Cohen (1992), it can be said that the effect was large, $r = .50$.

In summary, based on the result of the independent samples *t*-test, it was found that previous study abroad experience has an effect on learners' noticing during the L2

writing process. This result indicates that participants with study abroad experience tend to verbally express fewer lexical or grammatical problems while producing an L2 text than those with no experience. The effect is large and so represents a substantive finding. In the next section, the effects of L2 proficiency on learners' noticing will be examined.

4.3.3 Effects of L2 proficiency on noticing

To answer this research question, it was decided to compare the incidence of noticing (i.e., the frequency of LREs) by two groups distinguished by L2 proficiency. The descriptive statistics for the two L2 proficiency test scores are presented in Table 4.7.

Table 4.7 Scores on the VLT and the C-test scores

N = 102	Minimum	Maximum	Mean (SD)
VLT	111	148	130.7 (7.9)
C-test	22	84	60.5 (12.7)

Maximum possible scores: VLT=150; C-test=100

Figure 4.4 displays the histograms of the scores of each proficiency test, showing that the distribution of the C-test scores is somewhat negatively skewed.

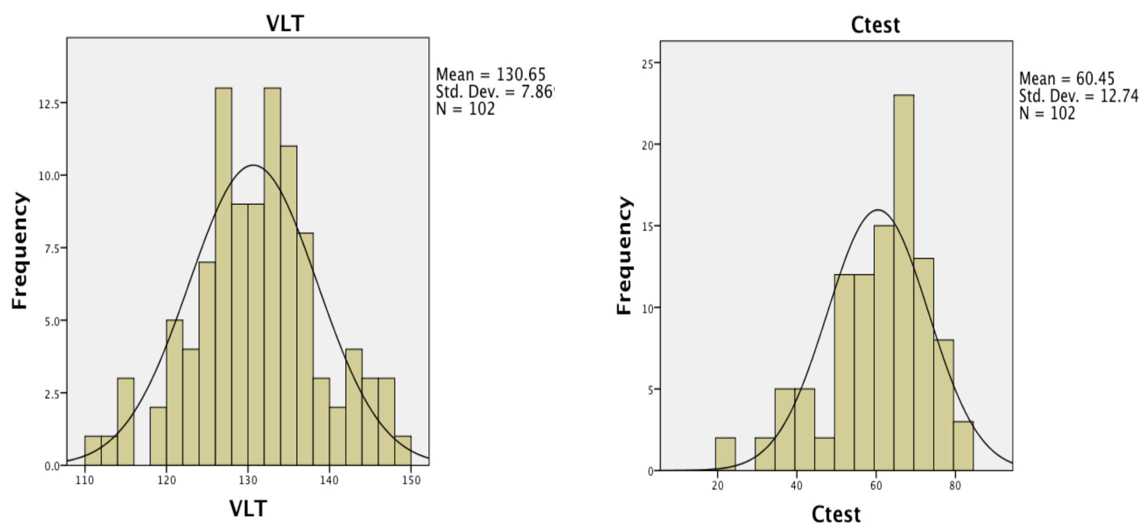


Figure 4.4 The VLT and the C-test scores

In order to examine whether L2 proficiency had effects on noticing, an independent samples *t*-test was employed. For this, two proficiency groups (a more and a less proficient group) were set up, based on the mean *z*-scores of the two proficiency tests. As described before, since each test had different quantities of test items, the raw scores from the two tests could not be simply added in order to produce a compound score. Therefore, the raw scores of the VLT and the C-test were converted to *z*-scores to make a composite score. Then, using percentiles, three groups were constituted, with the same number in each group. The data of 102 participants was used for inferential data analysis, so each group was comprised of 34 participants. Next, the middle group was excluded to make a distinctive difference between the more and less proficient groups. As a result, the more proficient group consisted of the upper 33.3% of participants, while the less proficient group consisted of the lower 33.3% of participants in terms of overall L2 proficiency scores. The two groups' proficiency scores were examined for any significant difference. Table 4.8 below

shows the means and standard deviations of each proficiency group's VLT and C-test scores, and Figure 4.5 presents bar charts of the scores of each proficient test by the two groups.

Table 4.8 Scores on the VLT and the C-test for each proficiency group

		VLT	C-test
	N	Mean (SD)	Mean (SD)
More proficient	34	138.7 (4.8)	71.0 (6.1)
Less proficient	34	122.8 (5.2)	47.9 (11.6)

Maximum possible scores: VLT=150; C-test=100

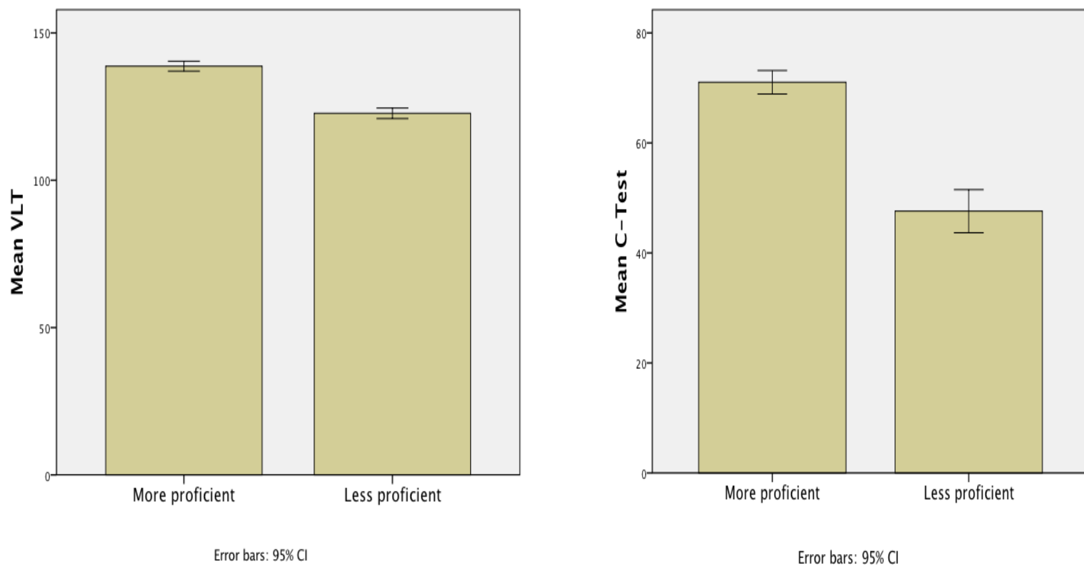


Figure 4.5 The VLT and the C-test scores for each proficiency group

More proficient participants obtained around 16 points and 23 points more than less proficient ones from the VLT and the C-test respectively. It can be seen that the standard deviations of the VLT for the two groups are similar (4.8 vs. 5.2); on the

other hand, the standard deviations for the C-test show a greater difference between the two groups (6.1 vs. 11.6). This indicates that the data of the C-test scores from the less proficient participants was more widely dispersed than those from the more proficient participants.

Independent samples *t*-tests were conducted to examine whether the difference between the proficiency test scores of the two groups was significant. The Kolmogorov-Smirnov tests were used to determine whether the VLT and the C-test scores were normally distributed for each proficiency group, and it was found that the assumption of normality was met for both proficiency tests ($p > .05$).

For the VLT, the homogeneity of variances was checked, and the variances in two groups were not significantly different ($p > .05$). The independent t-test showed that the more proficient group obtained higher scores (M = 138.7, SE = 0.8) than the less proficient group (M = 122.8, SE = 0.9), and the difference in the VLT scores between the two groups was significant $t(66) = 13.226$, $p < .001$. The effect was large, $r = .85$.

For the C-test, unlike the VLT, the assumption of homogeneity of variances was violated ($p < .05$). The independent *t*-test showed that the more proficient group gained statistically significant better scores (M = 71.0, SE = 1.1) than the less proficient group (M = 47.9, SE = 1.9) ($t(51.077) = 10.666$, $p < .001$). The effect was large, $r = .83$.

Table 4.9 presents the means and standard deviations of the VLT, C-test and overall L2 proficiency with the converted *z*-scores for each proficiency group.

Table 4.9 *Z*-scores on the VLT, C-test, and overall L2 proficiency for each group

		VLT	C-test	Overall
	N	Mean (SD)	Mean (SD)	Mean (SD)
More proficient	34	1.02 (0.62)	0.83 (0.48)	0.93 (0.34)
Less proficient	34	-1.01 (0.65)	-1.01 (0.88)	-1.01 (0.46)

The significance of the difference between the means for overall L2 proficiency of the two proficiency groups was also examined with an independent *t*-test. The assumption of normality was checked with the K-S test ($p > .05$). Levene's test was non-significant (i.e., $p > .05$), so the assumption of homogeneity of variances was not violated. The independent *t*-test showed that the difference in overall L2 proficiency between the more proficient (M = 0.93, SE = 0.6) and the less proficient group (M = -1.01, SE = 0.8) was statistically significant ($t(66) = 19.543$, $p < .001$). The effect was large, $r = .92$.

Next, the difference in frequencies of LREs between the two groups was compared to examine the effect of L2 proficiency on learners' noticing. The descriptive statistics for the frequency of LREs in each proficiency group is displayed in Table 4.10, and Figure 4.6 presents the bar chart for the frequency of LREs of the two groups.

Table 4.10 Frequency of LREs for more and less proficiency groups

Group	N	Mean	SD	Std. Error Mean
More proficient	34	3.7	2.8	0.5
Less proficient	34	7.7	3.0	0.5

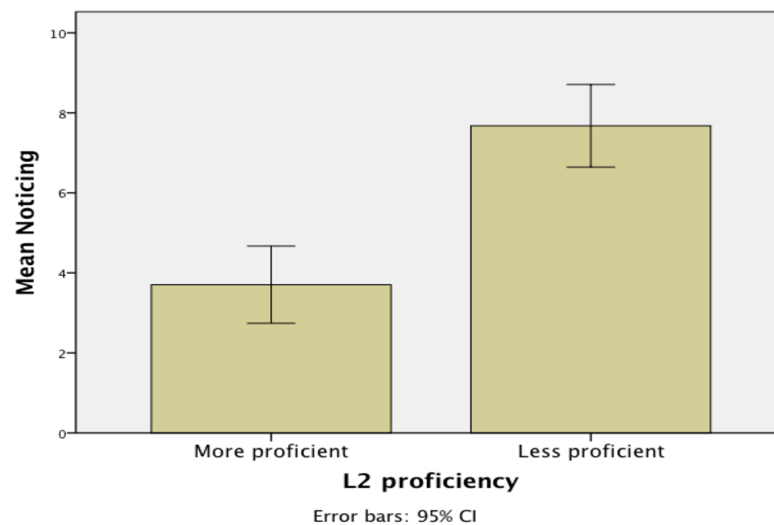


Figure 4.6 Frequency of LREs for each of the two proficiency groups

To explore whether the means of the frequency of LREs in each group was significantly different or not, an independent samples *t*-test was carried out. Beforehand, the assumption of normality was assessed using the K-S test, and it was found that the frequencies of LREs were normally distributed within the two groups ($p > .05$). The result of Levene's test showed that the variances in two groups were equal ($p > .05$). The independent *t*-test showed that less proficient participants noticed more language problems (M = 7.7, SE = 0.5) during the L2 writing process than more proficient participants (M = 4.7, SE = 0.5). This difference was significant $t(66) = -5.710$, $p < .001$. In addition, it represented a large effect $r = .58$.

To sum up, based on the results of the independent samples *t*-test, it was found that L2 proficiency has an effect on learners' noticing during the L2 writing process, and the effect is substantive. That is, less proficient learners tend to verbally express average four more lexical or grammatical problems than more proficient learners. In the next section, the effects of L1 and L2 working memory capacity on learners' noticing will be investigated.

4.3.4 Effects of L1 and L2 working memory capacity on noticing

As mentioned in Section 3.3.3, for each participant, a working memory measure was calculated on the basis of three elements: recall span, percentage of correct logicality judgments, and average reaction time (in milliseconds) taken to make the logicality judgment. Table 4.11 presents the means and standard deviations of these three elements in both languages (i.e., L1=Korean, L2=English).

Table 4.11 Scores on recall span and logicality judgment; and mean reaction times in milliseconds for correct answers in L1 and L2

N = 102	Language	Mean (SD)
Recall span	L1	4.0 (0.7)
	L2	3.4 (1.0)
Logicality judgment	L1	94.2 (3.7)
	L2	94.5 (4.8)
Reaction times	L1	4273 (1241)
	L2	6377 (1883)

Maximum possible scores: Recall span=5.0; Logicality judgment=100

In order to attribute statistical significance to the differences between the means of recall span, logicality judgment, and reaction times in L1 and L2, Wilcoxon signed-rank tests were conducted. Since the assumption of normality in the data was violated, on the basis of the results of the K-S test ($p < .05$), this nonparametric equivalent to the paired samples *t*-test was employed. The result is displayed in Table 4.12 below.

Table 4.12 Wilcoxon signed-rank test for L1 and L2 recall span, logicality judgment, and reaction time

	Recall L2 - Recall L1	Logicality L2 - Logicality L1	Reaction L2 - Reaction L1
Z	-4.936	-.968	-8.467
Asymp. Sig. (2-tailed)	.000	.333	.000

The table shows that participants correctly recalled the sentence-final words in three out of five sets at the higher level in L1 (4.0), compared to L2 (3.4), and this result is statistically significant. Furthermore, the mean reaction time taken to make the logicality judgment in L1 (4237ms) was significantly less than the reaction time in L2 (6377ms). It means that participants spent more time on the process of making decisions on sentences' logicality in English than in Korean. However, there was no significant difference in the percentage of correct logicality judgments between L1 and L2, which was near ceiling.

To investigate the effects of working memory capacity on learners' noticing, two groups were constituted, on the basis of overall working memory measure in L1 and L2. For this, as for L2 proficiency, *z*-scores were used, because each element was calculated with different metrics. After each element was converted to *z*-scores, the mean of the three *z*-scores was regarded as the working memory measure, and two values were calculated for each participant (i.e., L1 and L2 working memory measures). Two independent samples *t*-tests were conducted for the L1 and L2 working memory measures respectively.

Concerning L1 working memory, first, 102 participants were divided into three groups with the same number of participants, based on the L1 working memory measure expressed as *z*-scores (i.e., 34 participants in each of the upper, middle, and lower groups). Next, the middle group was excluded to elicit a distinctive difference between the higher and lower L1 working memory groups. Table 4.13 presents the means and standard deviations of recall span, logicality judgment, reaction time and overall L1 working memory with the converted *z*-scores for each L1 working memory group.

Table 4.13 *Z*-scores on recall span, logicality judgment, reaction time, and overall L1 working memory for each group

		Recall	Logicality	Reaction	Overall
	N	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Higher L1 WM	34	0.65 (0.89)	0.51 (0.67)	0.46 (0.78)	0.54 (0.21)
Lower L1 WM	34	-0.61 (1.01)	-0.58 (1.12)	-0.47 (1.15)	-0.56 (0.29)

An independent *t*-test was employed to examine the significance of the difference between the means for overall L1 working memory of the two groups. The assumption of normality was checked with the K-S test ($p > .05$), and the assumption of homogeneity of variances was checked with Levene's test ($p > .05$). The independent *t*-test showed that the difference between overall L1 working memory of the higher (M = 0.54, SE = 0.04) and the lower group (M = -0.56, SE = 0.05) was statistically significant ($t(66) = 17.901$, $p < .001$). The effect was large, $r = .91$.

Then, the number of LREs found in each group was compared. The descriptive statistics and the bar chart of the frequency of LREs in each group are displayed in Table 4.14 and in Figure 4.7 respectively.

Table 4.14 Frequency of LREs for higher and lower L1 working memory groups

Group	N	Mean	SD	Std. Error Mean
Higher L1 WM	34	6.2	3.1	0.5
Lower L1 WM	34	5.2	3.6	0.6

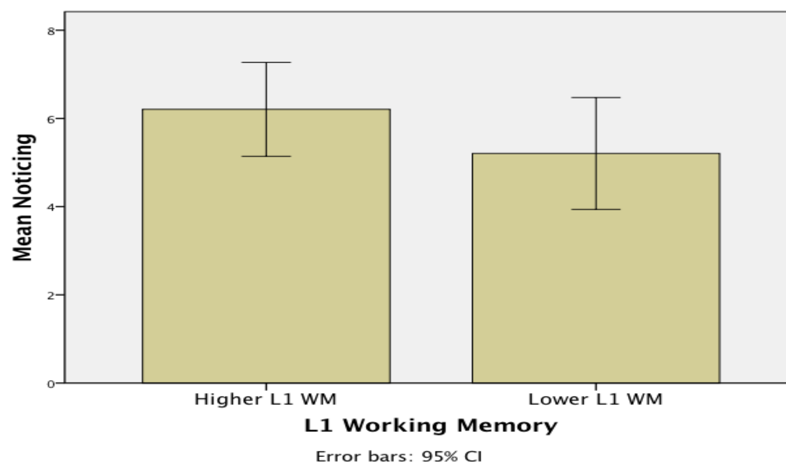


Figure 4.7 Frequency of LREs for each of the two L1 working memory groups

To compare the means between the two groups, an independent samples *t*-test was conducted. The assumption of normality was assessed by the K-S test ($p > .05$). The result of the *t*-test indicated that there was no statistically significant difference in the frequency of LREs between the groups ($p = .224$). That is, it seems that L1 working memory does not affect learners' noticing while they produce L2 texts.

Next, in order to explore the effects of L2 working memory on noticing, the same steps as undertaken in L1 working memory were carried out, obtaining the mean *z*-scores of the three elements for L2 working memory and creating higher and lower groups. Table 4.15 presents the means and standard deviations of recall span, logicality judgment, reaction time and overall L2 working memory with the converted *z*-scores for each proficiency group.

Table 4.15 *Z*-scores on recall span, logicality judgment, reaction time, and overall L2 working memory for each group

		Recall	Logicality	Reaction	Overall
	N	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Higher L2 WM	34	0.69 (0.67)	0.61 (0.57)	0.55 (0.73)	0.62 (0.37)
Lower L2 WM	34	-0.70 (0.91)	-0.59 (1.25)	-0.65 (1.04)	-0.65 (0.39)

The significance of the difference between the means for overall L2 working memory of the two groups was examined with an independent *t*-test. The assumption of normality was checked with the K-S test ($p > .05$). Levene's test was non-significant (i.e., $p > .05$), so the assumption of homogeneity of variances was not violated. The independent *t*-test showed that the difference between the overall L2 working

memory of the higher (M = 0.62, SE = 0.06) and the lower group (M = -0.65, SE = 0.07) was significant (t(66) = 13.798, $p < .001$). In addition, it represented a large effect, r = .86.

Table 4.16 below shows the descriptive statistics for the frequency of LREs in the higher and lower L2 working memory groups, and Figure 4.8 displays each group's frequency of LREs.

Table 4.16 Frequency of LREs for higher and lower L2 working memory groups

Group	N	Mean	SD	Std. Error Mean
Higher L2 WM	34	4.3	3.2	0.5
Lower L2 WM	34	6.9	3.1	0.5

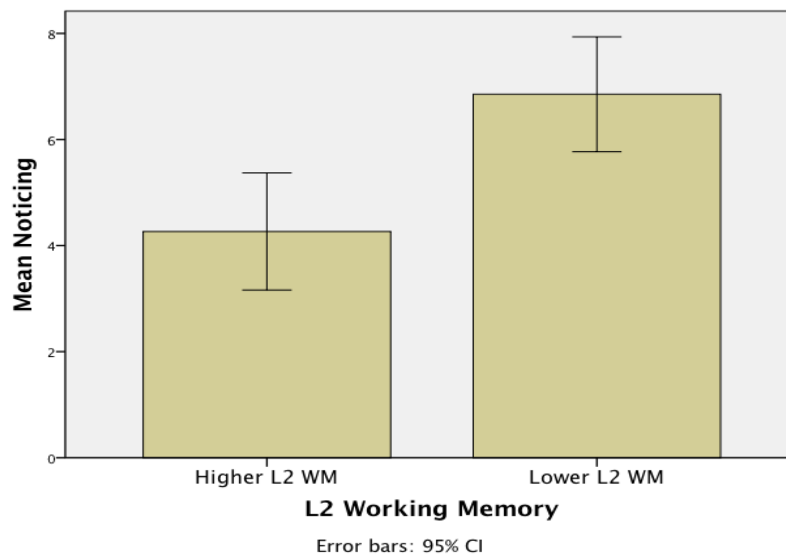


Figure 4.8 Frequency of LREs for each of the two L2 working memory groups

To examine whether the means of the frequency of LREs in each group were significantly different, an independent samples *t*-test was used. Before that, the K-S

test was conducted to check the assumption of normality. The result showed that the frequency of LREs was indeed normally distributed within the two groups ($p > .05$). The result of Levene's test shows that the assumption of the homogeneity of variances was met ($p > .05$). The *t*-test reveals that the difference between two groups' means of the frequency of LREs is significant ($t(66) = -3.403$, $p < .01$). In other words, participants having higher L2 working memory noticed fewer language problems ($M = 4.3$, $SE = 0.5$) during the L2 writing process than ones having lower L2 working memory ($M = 6.9$, $SE = 0.5$). The effect size was medium, $r = .39$.

Summarising the findings from this section, L1 working memory has no effect on learners' noticing; on the other hand, L2 working memory has an effect on whether learners notice language problems during the L2 writing process, and the effect is substantial.

Thus far, the effects of four learner-related variables: previous study abroad experience, L2 proficiency, and working memory capacity in L1 and in L2, have been examined, and it has been found that all but L1-based working memory capacity had effects on learners' noticing during the L2 problem-solving process. Following this, although it is not a main research aim, it was judged interesting to explore the relationship between the investigated variables and which variable is the best predictor of learners' noticing. This will be discussed in the next section.

4.3.5 An examination how the investigated variables predict noticing

Multiple regression was employed in order to learn more about the relationship between the investigated independent variables (*Study abroad experience, L2 proficiency, L1 and L2 working memory*) and the dependent variable (*Noticing*). Specifically, the variables investigated so far were explored to determine which could best predict learners' noticing. Before conducting the multiple regression, Pearson product-moment correlations were carried out to get a rough idea of the relationships between the predictor and the outcome variables. Correlation coefficients between all variables are reported below in Table 4.17.

Table 4.17 Pearson product-moment correlations between the frequency of LREs, study abroad experience, L2 proficiency, and L1 and L2 working memory

	Noticing	Study abroad exp.	L2 proficiency	L1 WM	L2 WM
Noticing	-				
Study abroad exp.	-.505*	-			
L2 proficiency	-.569*	.426*	-		
L1 WM	.181	-.183	.017	-	
L2 WM	-.304*	.355*	.259*	.356*	-

** p < .01, 2-tailed*

As can be seen, there were significant relationships between *Noticing* and all other independent variables except *L1 working memory*. *L2 proficiency* and *Study abroad experience* showed relatively stronger negative relationships with noticing than *L2 working memory*. Between independent variables, *L1 working memory* had only a moderate relationship with *L2 working memory* (r = .36). In addition, although *study*

abroad experience, L2 proficiency, and L2 working memory were significantly correlated with each other, the relationships between these variables were not strong. Furthermore, from the correlation matrix above, it was possible to identify multicollinearity, which is one of the assumptions for multiple regression. Multicollinearity increases the standard errors of the coefficients. Therefore, the standard errors could erroneously indicate that some variables are statistically insignificant, while they should be otherwise significant. According to Field (2009), if any correlations between the predictor variables are above .80 or .90, there may be a possible problem for multicollinearity. In the table above, there were no high correlations between predictor variables, so these variables could go into the regression model without taking multicollinearity into account. However, using this correlation matrix is not a subtle method to check multicollinearity, so more sensitive collinearity diagnostics for predictor variables will be presented later.

A *stepwise* linear regression analysis was performed with *Noticing* as the dependent variable and the four factors as the independent variables. Since there has been no previous research on the relationship between learner-related factors and learners' noticing during the L2 writing process, it was hard to find good theoretical reasons for any given order for entering the predictors in the model, and consequently, a *stepwise* method was selected for multiple regression in the current study. According to Punch (2005), *stepwise* regression is a useful technique in the case of looking for answers to questions about how well a regression model predicts the dependent variable or about the effects of different independent variables on the dependent

variable. In *stepwise* regression, each variable is entered in sequence, and models are tested with one more variable at a time. SPSS first tests a model with the most highly correlated independent variable, and then it tests a model with this most correlated variable plus the variable with the highest partial correlation with the dependent variable, controlling for the most correlated independent variable. Those variables that do not significantly contribute to the model are excluded from model building, and models with these variables are not considered.

Before testing the model, it was necessary to make dummy variables for *Study abroad experience*, because it is a not continuous but a categorical variable with only two categories. To use a categorical variable as a predictor, dummy coding should be carried out before performing multiple regression (Field, 2009). Therefore, two categories, namely, 'having experience' and 'no experience' were coded with the values of 1 and 0 respectively, and then the variable was entered into the regression model. Table 4.18 presents the result of the *stepwise* multiple regression.

Table 4.18 Model summary from stepwise multiple regression

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.569	.323	.317	2.682	.323	47.791	1	100	.000
2	.639	.408	.396	2.522	.084	14.103	1	99	.000

a. Predictors: (Constant), L2 proficiency

b. Predictors: (Constant), L2 proficiency, Study abroad experience

The model summary above shows that two variables, that is, *L2 proficiency* and *Study abroad experience*, contributed significantly to learners' noticing, with *L2 proficiency* being the best predictor, explaining approximately 32.3% of the variance, and *Study abroad experience* adding 8.4%. The other two variables, *L1* and *L2 working memory*, were excluded in the process of model building, indicating that these two variables did not have a sufficient impact on learners' noticing during the L2 writing process, while controlling for *L2 proficiency* and *Study abroad experience*. Table 4.19 below displays the coefficients of each of the independent variables having impact on noticing in each model.

Table 4.19 Coefficients from stepwise multiple regression

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	5.529	.266		20.819	.000		
	L2 proficiency	-2.111	.305	-.569	-6.913	.000	1.000	1.000
2	(Constant)	6.362	.334		19.052	.000		
	L2 proficiency	-1.604	.317	-.432	-5.055	.000	.819	1.221
	Study abroad exp.	-2.123	.565	-.321	-3.755	.000	.819	1.221

a. Dependent Variable: Noticing

According to the table, a comparison of the standardized coefficients shows that L2 proficiency has greater impact on *Noticing* (Beta = -.432) than *Study abroad experience* (Beta = -.321). The unstandardized coefficients provide the information for the regression equation as a whole. Thus, the equation for predicting noticing from the four variables with the measures used in this study is generated as follows:

Noticing = 6.362 – (1.604 x *L2 proficiency*) – (2.123 x *Study abroad experience*)

As a final stage in the multiple regression analysis, an important step is to check whether the assumptions are met for running the regression procedure, because if the assumptions were not satisfied, there would be risks of drawing unreliable and misleading results. First of all, the assumption of independence of observation (i.e., independence of residuals) was checked. According to Field (2009), for any two observations in regression, the residuals should be uncorrelated or independent. That is, the errors associated with one observation are not correlated with the errors of any other observation. This assumption can be tested with the Durbin-Watson test. The test statistic has a range from 0 to 4, and a midpoint value of 2 means that the residuals are uncorrelated (Field, 2009). For the data in this research, the Durbin-Watson statistic was 1.955, so it can be said that the assumption of the independence of observation was almost certainly met.

Next, as has been pointed out earlier, the problem of multicollinearity is a concern for multiple regression analysis. One of the common tests of multicollinearity is the *variance inflation factor* (VIF). Cohen, Cohen, West, and Aiken (2003:423) say, 'the VIF provides an index of the amount that the variance of each regression coefficient is increased relative to a situation in which all of the predictor variables are uncorrelated'. Field (2009) adds, the VIF indicates whether a predictor has a strong linear relationship with the other predictors. Related to the VIF, a *tolerance*, which is

1 - R^2 for each independent variable, is another important indicator of multicollinearity, and it is the reciprocal of the VIF (Allison, 1999). This figure shows how much the predictor variables are correlated with each other. According to de Vaus (2002), any variable that has the value of *tolerance* below 0.2 or the value of VIF of 5 or more could indicate serious problems with muticollinearity. For the current analysis, large tolerances and small VIFs (see the last two columns in Table 4.19) indicated that the multicollinearity should not be a concern for these independent variables.

Another important step is to examine the residuals in order to check the assumptions for normality and homoscedasticity (homogeneity of variance). For this, a histogram and normal probability plot of the residuals for assessing the normality, and a scatter plot of standardized predicted values (*ZPRED) versus standardized residuals (*ZRESID) for assessing homoscedasticity were produced by SPSS. Figure 4.9 displays the histogram and normal probability plot of the data for this study. These two graphs show that the residuals are normally distributed, on the basis of a bell-shaped curve on the histogram and the points lying along a 45 upward sloping line on the normal probability plot. Figure 4.10 presents the plot of standardized residuals against standardized predicted values. It indicates that the independent variables have equal variances (randomly scattered in a horizontal band around a residual value of zero), which means that the assumptions for homoscedasticity were met with this data set.

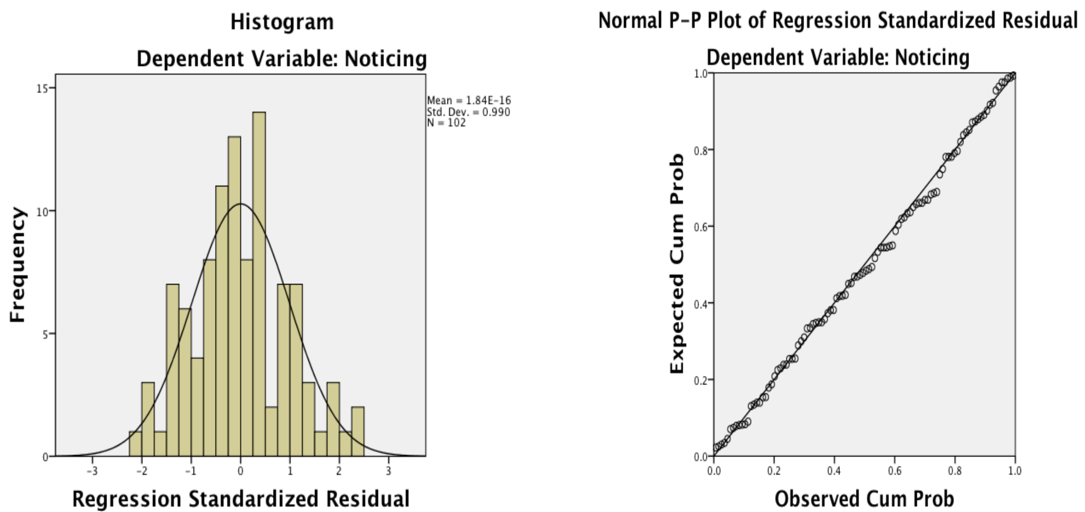


Figure 4.9 Histogram and normal probability plot of regression standardized residual

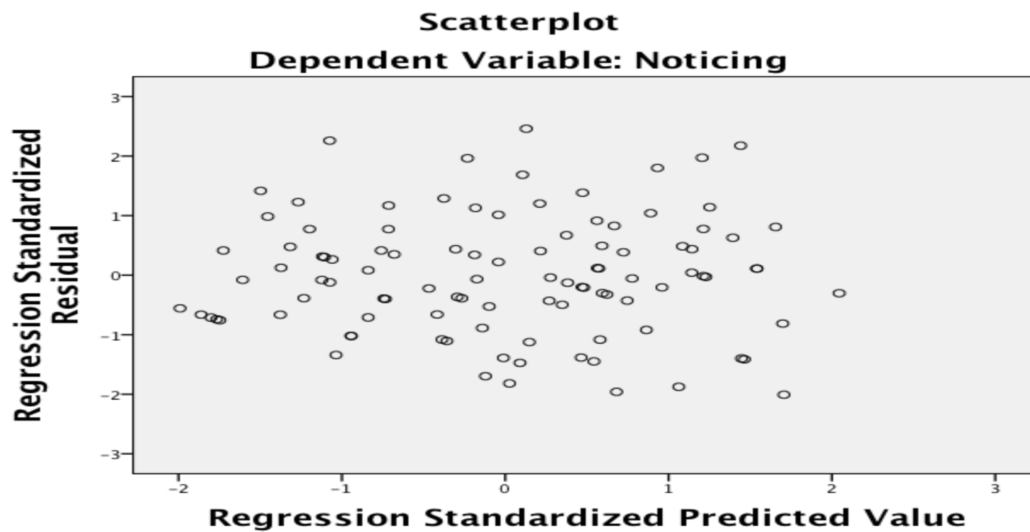


Figure 4.10 Scatter plot of residuals

In summary, among the investigated factors in this study, *L2 proficiency* and *Study abroad experience* explained about 40% of the variance in *Noticing*. Results from multiple regression analysis showed that *L2 proficiency* was the best predictor of noticing, explaining about 32.3% of the variance, and *Study abroad experience* added

8.4% of the variance in *Noticing*. Furthermore, both variables were negatively associated with *Noticing*. However, *L1* and *L2 working memory* did not have a significant impact on noticing while controlling for *L2 proficiency* and *Study abroad experience* in the regression model.

The next chapter will present the findings from qualitative data analysis in order to explore how Korean university learners resolve the language problems they face, which is a part involved in the L2 problem-solving process.

5. RESULTS 2: QUALITATIVE RESULTS

5.1 Introduction

This chapter sets out to present what knowledge sources learners employed in order to solve language-related problems when producing an L2 text. That is, the patterns of use of learners' internal sources related to language during the L2 problem-solving process are discussed in this chapter. For this, the interview data collected from all of the 108 participants were analysed, and all of the LREs found in each participant's interview transcript were examined. Since the aim of the interview data analysis is to develop a classification of knowledge sources learners used to resolve language problems during the writing process, it is reasonable to analyse all of the LREs rather than only some of them. As described in Section 4.2, LREs found in this study were divided into two main categories (lexical and grammatical), and there were three subcategories of lexical episodes (identification, selection, and orthography). It was hypothesised that knowledge sources used by participants during the L2 problem-solving process would be different according to the category of LRE. Knowledge sources for each category are discussed below, with examples from the interview data. The coding for knowledge sources was mainly based on the obtained interview data as well as the researcher's interpretation of the knowledge sources implied in the participants' statements. In addition, other taxonomies from previous studies (e.g., Nassajji, 2003; Storch; 1998a, 1998b) were also referred to in establishing the classification of knowledge sources.

5.2 Knowledge sources for lexical episodes

5.2.1 Identification

As described in Section 4.2.1, each occurrence of this type of lexical episode involved a single lexical item, and these episodes were characterised by participants asking themselves whether certain words existed, or trying to find an L2 translation equivalent in L1. A total of six knowledge sources were used in this type of LRE: previously acquired L1-L2 translationg word pairs, L1 lexical knowledge, semantic knowledge, morphological knowledge, episodic memory, and the writing task prompt; and some episodes were left unsolved in various ways. Table 5.1 summarises the *Identification* episodes in the data.

Table 5.1 Types of knowledge sodurces used in *Identification* lexical episodes

1) Previously acquired L1-L2 translation word pairs	Tip-of-the-tongue phenomenon
	Searching for synonyms for variety
	Searching for more sophisticated words
	Searching for more appropriate alternatives
	Coining new expressions through literal L1-L2 translation
2) L1 lexical knowledge	L1 word associations
	L1 paraphrasing
3) Semantic knowledge	Partially overlapping features of L1 & L2 words
	Sense relations: hypernymy and antonymy
4) Morphological knowledge	
5) Episodic memory	
6) The writing task prompt	
7) Unsolved	Leaving a blank
	Putting an L1 Korean word
	Abandoning ideas

5.2.1.1 Previously acquired L1-L2 translation word pairs

Many participants relied on previously acquired pairs of L1 word and L2 translation equivalents in their mind. Learners may have memorised the word pairs with conscious effort in previous learning, using various materials such as word lists, textbooks, or classroom instruction. However, learners struggled and hesitated to use these memorised lexical pairs for various reasons. Five different situations emerged, examples of which are presented below. In the following excerpts, unmarked text represents what participants said in L1 (Korean) and segments within single quotation marks are L2 (English) words.

Experiencing the tip-of-the-tongue phenomenon

In this case, participants failed to immediately retrieve a word from memory, but kept thinking to try and come up with the word they wanted to use. They tried to retrieve a desired word until it burst upon them.

Example 1

> I really wanted to use the word 'influenced' here, but I couldn't easily come up with the word immediately. I had learned it from textbooks. I was pretty sure that it was a suitable word in this sentence, so I kept trying to retrieve the word. I didn't think of any other word at that time. I was surprised that the word I thought I knew very well didn't straightforwardly come out

> when I was actually writing it. This frequently happens to me, and I think it may be because I have rarely used the word in speaking or writing. (P18)

Although learners seemed confident that a particular word they wanted to use was right, they struggled to retrieve it immediately during the task. There are several possible explanations for this. First, due to limited working memory capacity, the word might not be easily retrieved. As Unsworth and Engle (2007) point out, individual differences in working memory capacity have an impact on differences in the ability to retrieve information from long-term memory. Next, as can be seen in the example above, lack of experience of language use might prevent learners from retrieving words in the process of producing L2 sentences. For learners, the less frequently used words may not be easily recalled. Moreover, experiencing the tip-of-the-tongue phenomenon may be linked to the issues of bilingual lexical access. As de Bot (2004) points out, 'in all sorts of tasks bilinguals are slower in processing their weaker language'. It is likely that bilingual students are less able to recall words, in particular, in cases where the phonology of a word is distinctively different in both languages (Gollan & Acenas, 2004).

In addition, in the process of searching for an L2 translation equivalent in L1, some students seemed to get stuck on a specific L1-L2 word pair in their mind, and this blockage might have caused learners to spend too much time searching for a particular L2 word. In fact, a participant said:

> *Here, I thought I had to use this word. When I planned to present the word (concept) in Korean, I thought there should be an English equivalent for the*

> *Korean word. I had definitely learned it before, and I believed that I could retrieve it.* (P44)

<u>Searching for synonyms for variety</u>

Some students wanted to find English synonyms to avoid using the same word again; however, they sometimes failed to find a synonym, and finally used the original word that had come to mind.

Example 2

> At that time, I thought I had used the word 'area' too many times in my essay. Therefore, I wished I could write another word that has a similar meaning to the word 'area', but nothing popped into my mind. So I just used the word 'area' again. I really didn't want to repeat what I had written before in the essay. This happens very often whenever I do English writing assignments. (P3)

In fact, many participants reported difficulty in finding synonyms during the writing task, and they understood the importance of studying synonyms. For instance, a participant said:

> *I was told that I had to avoid repeatedly using the same words in English writing. My English teacher has always said that it is crucial to use a variety of words to make an English essay better. So, I know I need to study synonyms. However, it's not easy to find and use the desired synonyms when I make sentences in English. In fact, the biggest problem I have when*

writing in English is to find synonyms. In most cases, I fail to find synonyms and I just write the word I have already used before. (P87)

Searching for more sophisticated words

In some cases, learners kept trying to search for more sophisticated alternatives, but they failed to find them. As in the case of P87 above, after failing to search for more refined words, learners wrote the only word that came into their mind.

Example 3

> I wrote the word ‘mind’ in this sentence, but I wasn’t entirely satisfied with it. I thought it was not wrong, but it wasn’t the best choice either. I always have this kind of feeling whenever I write an essay in English. After I used this word, I was a bit embarrassed by my poor vocabulary knowledge. I wanted to write a more sophisticated English word for the word ‘mind’, but I couldn’t find any other word during the writing task. I wished I could use a dictionary to find higher level words that could be used instead of the word ‘mind’. If I have a chance to write this kind of sentence again, then I will use the word ‘awareness’ or ‘consciousness’ instead of ‘mind’. Those words look fancier. I don’t know why these kinds of words didn’t pop into my head during the last writing session. (P15)

As in this case, most students reported that they wanted to use more sophisticated words in English writing in order to make the essay impressive. For example, a participant said:

I know that I need to use more complex or sophisticated words to produce better writing. I have also heard that I can get a better score in the writing section of TOEFL if I complete the essay with as many high-level words as possible. I really want to express my idea using fancy or stylish words, but it's hard to actually use them in writing. It seems that I always use basic words in English writing, owing to lack of my vocabulary knowledge. For this reason, I'm often depressed when I perform English writing tasks. (P16)

Searching for more appropriate alternatives

When seeking an L2 translation equivalent in L1, many participants tried to search for other L2 alternatives, which they thought were more appropriate in the particular context. However, when they failed to find a more suitable alternative, there was no option except the word that they could come up with at the moment.

Example 4

> Here, I didn't want to use the word 'totally', because I thought it would be inappropriate in writing. In fact, I often use the word in conversation, but I don't think I've used it many times before, especially when doing English writing assignments. However, it was the only option I had at that time. If I had known another word that was more appropriate in the written text, I wouldn't have used the word 'totally'. (P29)

As in the example of P29 above, it was found that many participants doubted whether they had chosen the proper words for academic writing when constructing sentences in L2. They actually used some words or expressions that

are more appropriate in speaking than in writing (e.g., *today's society*, *surely*, or *have a total blank*). In addition, some participants thought about word collocations when looking for an L2 translation equivalent for the L1 word, as can be seen in Example 5.

Example 5

> Once I came up with and wrote the word 'severely' here, I spent so much time considering whether to use it with the word 'competitive'. I knew the meaning of the word 'severely', but I wasn't sure whether it could be used with the word 'competitive'. I've never seen the expression before. I was looking for other words instead of the adverb 'severely', but I couldn't come up with any other word. I really wanted to search for some other words using Google. (P61)

These two cases (Examples 4 and 5) show that learners seem to consider appropriacy as one of the criteria for word choice in writing. The first example is related to contextual appropriacy. That is, students try to search for and use formal written English words rather than informal spoken ones when producing an L2 text. Likewise, the second example is related to collocational appropriacy: learners think of words that often go together when searching for a lexical item.

<u>Coining new expressions through literal translation from L1 to L2</u>

In some cases, when solving the word-searching problem participants coined a new expression, directly translating from L1 Korean to L2 English words to express

the proposed meaning, on the basis of previously acquired L1-L2 translation word pairs.

Example 6

> In this sentence, I wanted to write several fields of psychology as examples for supporting my argument. However, I didn't know what to call those specific fields related to 'psychology'. I just tried to put the words I knew together. So, I wrote the term 'crime psychology' here. I haven't used this term in writing before, so I wasn't sure whether the term actually exists or not. I thought it might be wrong, but it was my best guess. Even though the expression might not be correct, I expected that its meaning would be comprehensible to the reader. (P79)

In relation to word coinages, many participants reported that they had not used the expression they coined in writing before, as seen in the example above. That is, learners attempted to coin a new expression, based on their existing vocabulary knowledge. The new lexical items participants made were mostly composed of two words. Among them, some expressions were standard terms (e.g., *self-satisfaction* or *human resources*); however, most of the new expressions were non-standard (e.g., *think monotonous*, *crime sociology*, *decided future*, *one knowledge*). Concerning the use of non-standard English expressions, it seems that learners tend to rely too much on previously acquired L1-L2 translation word pairs even though there is not always a one-to-one correspondence between words in Korean and in English. Consequently, it appears that the new combined expressions are likely to be incorrect.

So far, five situations have been discussed where learners use previously acquired L1-L2 translation word pairs as a knowledge source to resolve word-searching problems. A summary of the different cases is presented in Figure 5.1 below. In the figure, solid arrows indicate that an L2 word came to one's mind without long pause, and dashed arrows represent that a participant attempted to find an alternative lexical item, but failed to find it. A dash-dot line represents that an L2 word that did not come to one's mind straightforwardly, but emerged after some time.

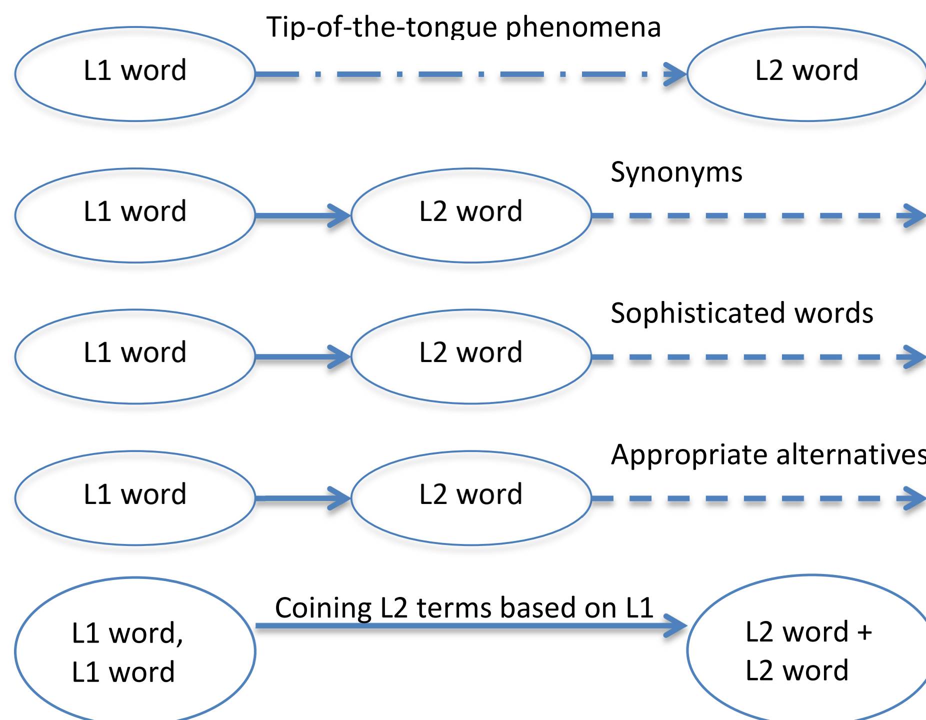


Figure 5.1 Cases where previously acquired L1-L2 translation word pairs are used

When searching for synonyms and more sophisticated or more appropriate words, it seemed that learners consistently tried to express their ideas in more exact and complex words instead of repeating the same basic words in L2 writing. These

kinds of word-searching processes may support Breeze's (2008) argument that 'student L2 writers' vocabulary is probably limited in both range (having a lack of synonyms or precise terms) and register (being informal rather than formal and academic)'. However, these data demonstrate that learners are aware of these limits. It can be said that these learners considered both the meaning and the usage of a word when searching for an L2 equivalent for an L1 word or expression in writing.

Interestingly, learners had different levels of satisfaction with word choices. For example, learners felt partially satisfied with their final word choice in situations where they failed to come up with synonyms or more sophisticated words, because they thought that the words were correctly used. On the other hand, when failing to find more appropriate alternatives, learners reported a very low level of satisfaction about the chosen words, since they believed that their final word choice was inaccurate.

5.2.1.2 L1 lexical knowledge

When participants failed to quickly find an L2 translation equivalent in L1 from previously learned L1-L2 word pairs, they employed L1 lexical knowledge to search for an L2 word that they wanted to express. That is, learners used L1 lexical knowledge to compensate for their lack of L2 lexical knowledge. Two types of knowledge sources were found in this category. Again, in the excerpts, unmarked text represents what learners said in L1 (Korean), and segments with single

quotation marks are L2 (English) words; italic segments represent L1 (Korean) concepts or words that participants wanted to express.

<u>L1 word associations</u>

Many participants tried to think about other L1 options and then found an L2 equivalent word after failing to retrieve an appropriate L2 word for the originally proposed L1 word.

Example 7

> I initially wanted to use the word *aptitude* in this sentence, but I couldn't come up with a word in English. So, I tried to think of a synonym for the word *aptitude*, and I guessed the word *ability* could be used instead of the word *aptitude*. Thus, I chose to write the word 'ability' here. If the word 'aptitude' came to mind at that moment, I would have used it instead of the word 'ability'. I wasn't sure whether 'ability' was a perfect replacement for the word 'aptitude'. (P100)

Quite a few students searched for L2 words using the process exemplified above (i.e., L1 concept or L1 word -> L1 alternative -> L2 word). However, it is worth noting that in this situation the outcome may be different according to an individual's ability to retrieve L1 alternatives. For instance, for the concept *aptitude* in Korean*,* while some participants used the word 'ability' in English, others used the word 'talent'. Interestingly, two students used the terms 'a real dream' and 'a future career' in English to express the concept *aptitude*. Some L2

words, as final choices, seemed to be only weakly associated with the initial L1 concepts (e.g., *pursuit* in L1 -> *find* in L2 (by 3 participants), *field* in L1 -> *topic* in L2 (by 4 participants), or *unexpected* in L1 -> *new* in L2 (by 1 participant)).

L1 paraphrasing

In some cases, instead of using L1 word associations, learners paraphrased the L1 word they initially wanted to express and then translated the paraphrased L1 expressions into L2.

Example 8

> I wanted to express *required subjects* in this sentence, but I couldn't find an adequate L2 word for that in English. So, I needed to express the word *required* in a different way. I thought that the word *required* had something in common with the word *avoidable*. Finally, I used the expression 'ones that students cannot avoid'. If the word 'necessary' or 'required' had come across in my mind, I would have used one of them. In fact, when I have difficulties translating Korean to English words, I often try to explain the Korean word in other simple Korean words at first, and translate the clarified words in English, based on my vocabulary knowledge. (P31)

It can be seen that learners employed knowledge of L1 word associations or L1 paraphrasing as compensatory devices to overcome lexical problems in their L2 writing. Unlike the cases where the target L2 words were straightforwardly retrieved described above, learners passed through another step (i.e., using L1 lexical knowledge) to search for an L2 word, as presented in Figure 5.2 below.

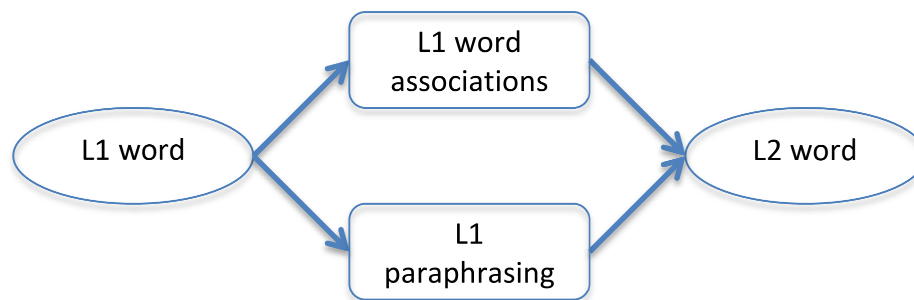


Figure 5.2 Cases where L1 lexical knowledge is used

5.2.1.3 Semantic knowledge

In many cases, learners used semantic knowledge to solve word-searching problems. When finding an L2 equivalent for the L1 word, participants compared semantic features of the L1 concept they wanted to express or the L1 word they wanted to use to those of the target L2 word.

<u>L1-L2 words' partially overlapping semantic features</u>

Many participants found an L2 word based on similarities between semantic features of L1 concepts (or words) and L2 words.

Example 9

> I tried to find an English word that means *in great quantity*, but I couldn't find anything. What I finally came up with was the word 'abundant'. It wasn't exactly what I was looking for, but I believed that it meant, at least, something similar to the idea that I wanted to express. I wasn't satisfied

> when I wrote it down, but I didn't have other choices. I really wanted to use a dictionary at that moment. (P3)

There were a few cases where the L1 concept was represented by multi-word units in L2.

Example 10

> In this sentence, I would like to use a word which means something like *interchange*. However, I couldn't come up with any adequate English words, so I just wrote 'meet and communicate'. This expression was the best option I could think of at that time. I knew that it was not exactly the same as the one I wanted to express, but I thought readers would understand what I meant. (P100)

<u>Sense relations: hypernymy and antonymy</u>

Several participants found an L2 alternative for the L1 word, on the basis of knowledge of the meaning relationship between L1 and L2 words.

Example 11

> At that time, no L2 words popped into my head. I now think I should have used the word 'knowledge'. Since I couldn't find an appropriate English word when composing this sentence, I just decided to use the word 'things'. If I had had access to a Korean-English dictionary, I would have looked up some other words. When doing English writing assignments, I often use the word 'things' when I cannot find a specific noun I want to use

> to express the meaning I want. I think that the word 'things' can generally be used as a substitute for any common noun. (P93)

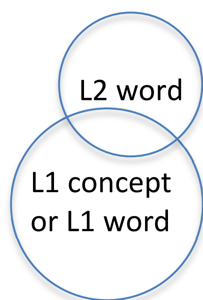
In particular, learners frequently used hypernyms in the process of searching for an L2 noun equivalent for the L1 word (e.g., *place* for institution, *things* for situations, and *a particular religion* for Christianity). Moreover, a few students used antonyms to solve word-searching problems.

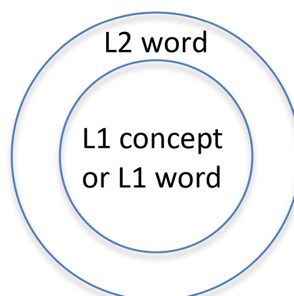
Example 12

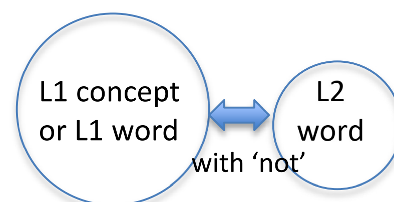
> Here, I initially wanted to write a sentence like 'I can gain shallow knowledge', but the word 'shallow' didn't come to mind. So, I wrote the sentence with the word 'deep', since I knew that the word 'deep' has the opposite meaning from 'shallow'. Finally, the sentence 'I cannot gain deep knowledge' was constructed. Although I couldn't use the word I originally planned, I thought the sentence conveyed the intended meaning. (P45)

Figure 5.3 below presents the cases where semantic knowledge is used when learners solved word-searching problems.

< Overlapping semantic features > < Sense relations >







[Hypernymy] [Antonymy]

Figure 5.3 Cases where semantic knowledge is used

Interestingly, the interview data shows that participants who found the L2 word based on hypernymy relations seemed to feel more satisfied than the ones who searched for the word on the basis of overlapping semantic features. This may be because the degree of overlapping sematic features between the L1 concept or word and L2 word is different in each case, as represented in the figure above.

5.2.1.4 Morphological knowledge

In the process of searching for an L2 translation equivalent in L1, some participants used knowledge of derivational morphology: word stems and affixes.

Example 13

> I wanted to write the word *philosopher* in this sentence, but the word in English didn't come to mind. Instead, I recalled the word 'philosophy'. In the end, I wrote the word 'philosophist'. I just put '-ist' after the word

> ‘philosophy’ because I knew that ‘-ist’ could be used for making nouns referring to people. I wasn’t sure if the word actually exists. (P12)

In most cases where derivational morphological knowledge was employed, participants combined a word stem and suffixes, and consequently, the word class of the base changed (e.g., variety -> variable, develop -> development, or whole -> wholly). On the other hand, as can be seen in the example below, there were a few cases where prefixes were added to the word stem, while the word class was retained.

Example 14

> I was trying to find an English word that has an opposite meaning to the word ‘specialised’, but I failed to recall any words. Although I wasn’t sure, I just used the word ‘non-specialised’ since I had learned that ‘non-’ indicates negation or absence. I haven’t used the word ‘non-specialised’ before, so I wasn’t satisfied with it. If I had had a dictionary, I would have checked whether such a word exists, or whether it can be used in this context. (P48)

Regarding this case, almost all of the participants reported that they had not used the target lexical items before. This process of making new expressions shows that, as Swain (1998) points out, learners use their output as a way of trying out new language forms or structures. That is to say, learner output can be an indication of the learners’ attempt to test how to something should be said or written, and this process of testing their own hypotheses related to word expressions may help them to develop their interlanguage.

5.2.1.5 Episodic memory

Several participants relied on their episodic memory when searching for an L2 equivalent for the L1 word. This knowledge source can be seen to be different from semantic or morphological knowledge, in that learners take an experiential approach instead of an analytical approach to the language. That is, students decided to write an L2 word, not explaining why they used the specific lexical items but recalling when or where they were exposed to the words. For example, some learners came up with a lexical item from the memory that they had gained while reading textbooks or newspapers.

Example 15

> What I wanted to express here was a word that is similar to *competitiveness.* There was no word that immediately popped up in my head, but the word 'competitive edge' came up later. I remembered that I saw this word when I had read an English newspaper at school earlier. Even though I wasn't sure whether it was perfectly correct in this sentence, I just used it because it was the only one that came to mind at that moment. (P25)

In addition, two students used lexical items that they picked up from class.

Example 16

> Although I used the word 'KSAT' (Korean Scholastic Ability Test) here, I wasn't sure whether it was correct or not. While composing this sentence, I actually remembered I had heard it in one of my classes. I had picked it up from someone's speech in class. When I heard the word, I understood what it meant. However, to be honest, I'm still wondering if the word is actually used by English native speakers. I've never used it in speaking or in writing before. (P41)

With regard to episodic memory, a noteworthy finding was that most (although not all) of the lexical items used by participants based on episodic memory were awkward or non-standard (e.g., *a generaliser* for a multi-player; *art liberal* for liberal arts; *wide range ideas* for a wide range of ideas; *everytime everyday* for all the time). These non-standard lexical items may emerge because 1) learners firstly picked up non-standard words and retained this information, or 2) they acquired the standard forms initially, but the information in their memory faded away as time went on. It is perhaps for these reasons that learners were less likely to be confident of using words on the basis of their episodic memory than on the basis of previously acquired L1-L2 translation word pairs. That is to say, L2 learners seemed to be more confident using words acquired through explicit learning processes than those acquired through implicit learning processes. Laufer and Hulstijn (2001:5) posit, 'the meaning of words is learned explicitly, requiring the conscious processing at the semantic and conceptual levels and paying attention to the form-meaning connections'. It appears that learning by a conscious and

deliberate focus on specific words leads L2 learners to use words more confidently than in instances where no or little attention is given to any specific words.

5.2.1.6 The writing task prompt

A few participants found an L2 equivalent for the L1 word from the writing prompt given for the task.

Example 17

> When writing this sentence, I wanted to use a word that means *area* or *field*, but no word came to mind. One of my English teachers always says that it is necessary to refer to any kinds of resources around me when I write in English. However, there were no sources I could use except the writing task prompt. So, I just read it again, and finally, I decided to use the word 'subject' from the prompt. Of course, it was not perfectly matched to the word I initially planned to write, so I wasn't totally satisfied with it. However, I had no other options, so I just used it. (P47)

It was interesting and unexpected that participants solved lexical problems by using the basis of the writing task prompt. This type of knowledge source is different from ones discussed before, in that the prompt is a learner-external resource instead of an internal source based on learners' own linguistic or experiential knowledge. As mentioned before, one of the aims of the present research is to examine learners' internal knowledge sources rather than external ones. That is why participants were not allowed to use any external aids, such as

dictionaries or the Internet, during the writing session. However, several students did use the prompt in order to resolve word-searching problems when searching for an appropriate English word; and furthermore, the writing task prompt was also used as a knowledge source in *Selection* episodes, as will be discussed later.

5.2.1.7 Unsolved

There were some lexical problems left unsolved when participants tried to find an L2 translation equivalent in L1; three different unsolved types were discovered.

<u>Leaving a blank</u>

When participants failed to find an L2 word they wanted to write, they left a blank in the sentence.

Example 18

> In this sentence, what I wanted to write was an English word that means *a place or an organisation for educational purposes*, but I couldn't find any appropriate English words. Now, I think the word 'institution' can be used here. Anyway, since no words came to mind at that moment, I just left it blank where I should have put a word like 'institution'. (P34)

Putting an L1 Korean word

Several participants wrote L1 words instead of L2 words in their essay, when confronting difficulty in finding an adequate L2 equivalent for the L1 word.

Example 19

> Here, I spent so much time thinking about the word *College Scholastic Ability Test*. I didn't know how to express it in English, so I put it in Korean in the sentence. I knew that in general, it is not acceptable to use Korean words in English writing, but there was nothing I could do. I really wanted to browse Google to find the equivalent word in English at that moment. (P33)

Abandoning ideas

In relation to unsolved cases, many learners abandoned the ideas they initially wanted to express due to failure in finding a proper L2 word.

Example 20

> Here, I wanted to use the word *range*, but no words in English came to mind when I was making this sentence. In the end, I gave up expressing the idea I originally thought of. (P11)

In some cases, interestingly, learners actually came up with an English word, but they finally made a decision not to use it, since they were not satisfied with it. This is different from the case where no word came to mind.

Example 21

> What I was searching for was the word *practical*, but I failed to find an appropriate word in English, except for the word 'useful'. However, I felt the word 'useful' was not quite right in this sentence, so I just gave up expressing my original idea. (P6)

In the same way as the use of the writing task prompt was unexpected, these unsolved cases, i.e., leaving blanks where appropriate English words would go, or using L1 instead of L2 words, were also unanticipated. In fact, of 385 *Identification* episodes, there were 82 unsolved cases. That is, about one-fifth of the total word-searching problems were unsolved. There may be several reasons for the occurrence of these unsolved cases. First, since the writing task given in this study was not an untimed essay but a timed essay, participants might have felt the need to proceed with the writing process as quickly as they could. Although the participants were informed that they did not need to finish a whole essay in the allotted time (20 minutes), many of them wanted to complete the writing task. For this reason, they might have left some problems unsolved, and avoided some word-searching difficulties they faced. In fact, a participant said:

> *While performing the task, I realised that 20 minutes wasn't enough to compose a complete essay. I knew that it wasn't necessary to compose an*

> *entire essay in 20 minutes, but I wanted to finish the essay, including the introduction, body, and conclusion. Therefore, when I failed to recall an English word, I quickly gave up the concept in Korean. I couldn't keep searching for English words I wanted to use, due to the time limit. I thought there was no time to lose and it was better to focus on what I could do at the time to complete the task. If I had had more time or if there had been no time limit, I would have spent more time searching for the word I wanted to express.* (P18)

Next, there is a possibility that a feature of the writing task affected the unsolved cases. Before the writing session, all of the participants were informed that the writing task was not a real test and their products would not be assessed. Therefore, they were able to perform the task with no pressure, and consequently, this might have affected how eager they were to do the task. For instance, a participant reported:

> *I just put a Korean word in this sentence because no appropriate English words came to mind. To be honest, since I was told that the essay would not be assessed, I thought using a Korean word in the essay was not a big deal. If it had been an important writing test such as TOEFL, then I would have spent more time searching for adequate English words. Or I might try to paraphrase the Korean word in any forms in English I could make.* (P77)

Furthermore, unsolved cases might have occurred because students thought that they might have chance of finding L2 equivalents for the L1 words at a later stage of writing process, that is, on revision. For example, a participant mentioned:

> *Here, I just wrote the sentence with a blank since I needed to keep moving on to the next sentence to finish the task. I thought that I could fill in the blank with an appropriate English word when I revised my essay later. In situations where I'm not allowed to use a dictionary during a writing task, I sometimes leave a blank in the sentence when I fail to recall words immediately in English. Then, when reviewing the essay later, I usually manage to put a word into the blank.* (P12)

In summary, as presented in Figure 5.4 below, learners employed six different knowledge sources (five internal and one external source), when asking themselves whether certain words existed, or when searching for an L2 translation equivalent in L1. When failing to find an L2 word in a previously memorised word list, learners tended to take another step to search for the L2 word, such as employing L1 lexical, semantic or morphological knowledge. In addition, learners tried to access experiential information (episodic memory) to solve word-searching problems.

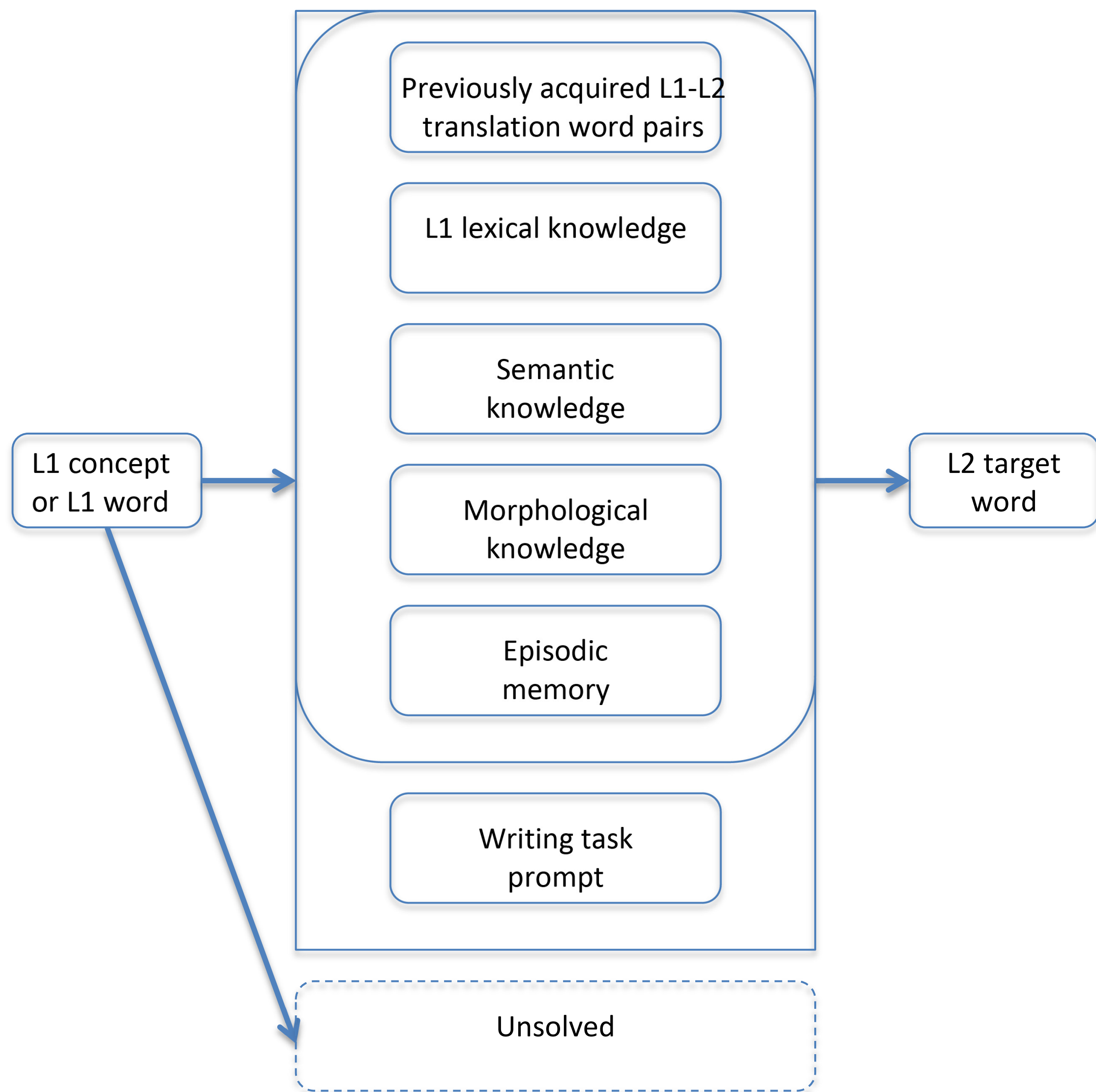


Figure 5.4 Knowledge sources in *Identification* episodes

5.2.2 Selection

Selection episodes occurred when a participant chose one between two or more lexical items. The processes activated to solve lexical problems in *Identification* episodes and those in *Selection* episodes appeared to be different. For *Identification*, it seemed that learners focused on searching for an L2 English equivalent for the L1 Korean word and that they frequently employed knowledge

sources related to L1 concepts or words, such as L1 associations or overlapping semantic features between L1 and L2 words. For *Selection*, on the other hand, learners seemed to concentrate on comparing several lexical options and choosing one of them, while considering some features of the L2 words that had been already retrieved. Therefore, it was hypothesised that not only similar types of knowledge sources but also different knowledge sources would be found in *Selection* episodes, compared to *Identification* episodes. Table 5.2 summarises the *Selection* episodes in the data.

Table 5.2 Types of knowledge sources used in *Selection* lexical episodes

1) Word meaning	Recalling L1 definitions
	Comparing L2 lexical options' semantic features with L1 concept
	Sense relations: hypernymy and antonymy
	Nuances
2) Word use	Collocations
	Register
	Grammatical features
	Frequency
3) Intuition	
4) The writing task prompt	
5) Unsolved (choosing both options)	

5.2.2.1 Word meaning

As in the cases where semantic knowledge was used to find an L2 translation equivalent in L1, many participants employed *word meaning* as a knowledge

source when choosing an L2 word among several options. Four different types of knowledge about word meaning emerged.

Recalling L1 definitions

When selecting one among two or more lexical options, some students recalled and compared the L1 definition of each L2 word.

Example 22

> When the words 'correlation' and 'interaction' came to mind, I was suddenly confused about what exactly each word means. As far as I know, the word 'correlation' means the connection between two things while the word 'interaction' refers to reciprocal action. I studied these words through the list of English-Korean word pairs provided by an English teacher when I was in a junior high school. Based on the meaning of each word, I decided to use the word 'correlation' in this sentence. (P77)

As can be seen in the example above, when comparing the definitions of L2 words, learners sometimes retrieve the words from the vocabulary lists they have learned before. It was also found that the words that share certain features such as spelling or sound were most often compared (e.g., *specific-special*, *lie-lay*, *identify-specify*, or *affect-effect*). This may be related to Korean learners' vocabulary learning method, that is, studying similar commonly confused word pairs through word lists.

Comparing L2 lexical options' semantic features with L1 concept

When participants needed to select an L2 equivalent from two or more words, they sometimes compared the lexical items on the basis of the degree of semantic similarity. In other words, word choice was determined according to how semantically close each L2 option was to the proposed L1 concept or word.

Example 23

> Here, the words 'beneficial' and 'economical' came into my mind at the same time. Although I thought neither of them was perfectly suitable for this sentence, I had to choose one of them at that moment. I wanted to write a word that meant *useful or helpful for someone as well as profitable*. I believed that the word 'beneficial' indicated something useful, while the word 'economical' didn't. Therefore, I chose to use the word 'beneficial'. It seemed to me that the word 'beneficial' shared more commonalities with the concept I initially thought of than the word 'economical'. I wasn't sure, though. I believed there was a more appropriate word than the word 'beneficial', but I didn't know what it was. (P1)

Many participants did indeed choose an L2 word by considering to what extent the planned L1 concept (or L1 word) and the L2 word overlapped semantically. In other words, among possible L2 lexical options, one that shared more semantic features with the L1 notion was selected, as represented in Figure 5.5 below.

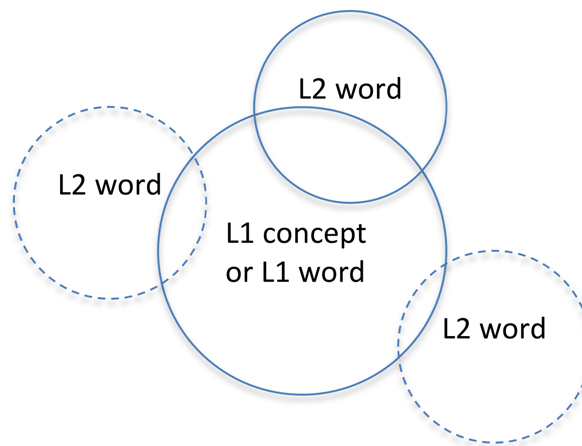


Figure 5.5 Cases where the L2 lexical options' semantic features are compared

Sense relations: hypernymy and antonymy

When considering semantic features between words in order to choose one of the lexical options, some learners based choices on sense relations between the words. Schmitt (2005:25) defines sense relations as 'the categories of meaning relationship between words'. Here, as found in *Identification* episodes, *hypernymy* and *antonymy* relations were used to solve word-selection problems. In the previous case (comparing L2 lexical options' semantic features with L1 concept), it seemed that learners concentrated on a certain semantic feature that they thought would be semantically close to the proposed L1 concept; on the other hand, when relying on sense relations, learners seemed to focus on semantic relationships between L2 words while making comparisons between them.

Example 24

> To me, it seemed fine to use the word 'entail' in this sentence, but I thought the word 'has' would be better, since it is a more generic word

than the word 'entail'. So, I finally chose to write the word 'has'. I often feel frustrated when I use basic and general words instead of specific words. It happens very often to me while writing in English. (P22)

As can be seen above, some participants tended to select a more generic term (a hypernym) among lexical options. After comparing the meanings of the words, learners chose one that had a more general meaning. It seemed that they selected the general terms instead of specific terms because they were not confident about using the specific terms. In fact, a participant reported:

> *I wrote the word 'things' instead of the word 'contents' here, since I assumed that using the word 'things' was less likely to be wrong. I mean I thought the word 'contents' couldn't be adequate here from English native speakers' point of view. However, there was little possibility that using the word 'things' would be wrong, because it can be used for any specific nouns in general. I know I need to express my argument with precise words in writing, but I don't want to show lack of my word knowledge. If I had been more confident about using the word 'contents', I would definitely have used it. However, I wasn't sure whether it was proper to use the word 'contents' in this sentence. I believed that a vague sentence would be better than an incorrect sentence.* (P90)

It seems that lack of word knowledge makes learners avoid using more precise and specific words and prefer using more common words even though they know that specificity makes better writing.

Nuances

When a lexical option needed to be chosen, nuances were considered as a basis for the learner's decision. The use of nuances may be distinguished from that of 'comparing L2 lexical options' semantic features with L1 concept' in that the participants seemed not to refer back to the L1 concept when they employed nuances as a ground for word choice. In addition, the participants seemed to think that the L2 lexical options could be used interchangeably when considering nuances, unlike when they determined how semantically close each L2 options was to the proposed L1 concept or word.

Example 25

> While writing this sentence, I came up with several verbs ('improve', 'broaden', 'stretch', and 'extend'). I thought these words could be used interchangeably, but the verb 'extend' was selected in the end. I believed there might be a slight difference between them in terms of meaning. The word 'improve' was firstly considered, but I thought it was usually used for increasing the quality of something, such as an English writing skill. Next, I thought the verb 'broaden' could be used when someone wanted to extend an existing road. On the other hand, the word 'stretch' may be used when something like rubber is made longer. Since I assumed that the verb 'extend' could be used when someone makes more personal connections, I chose to use it. However, I wasn't sure about my word choice. It's hard to differentiate the exact meaning of each word, but I knew these words should be used differently in writing, according to contexts. If I had been allowed to use a dictionary, I would have checked the definition of each word and some example sentences. (P28)

Many participants reported that as non-native English speakers, they had difficulty in understanding the subtle differences between L2 words. For example, a participant said:

> *When writing in English, I'm always puzzled when I have to pick one of the words out of the list of synonyms. Although I've learned that there are some words that have similar meanings and can be used interchangeably, I often get feedback from my English writing instructor, saying that my word choice is wrong. For example, as far as I know, the words 'circumstances' and 'situations' are synonyms, based on my previous learning with word lists. I think I can use either one of them in any sentence. However, I was told that the meaning of each word is slightly different and each word must be used in an appropriate context. How can I differentiate the meanings between the words which I learned as synonyms? I believe that for non-native English speakers, it's almost impossible to exactly distinguish the difference forever.* (P102)

In this section, the cases where learners employed semantic aspects of a word as knowledge sources to solve word-selection problems have been discussed. A summary of aspects of semantic word knowledge is presented in Figure 5.6 below.

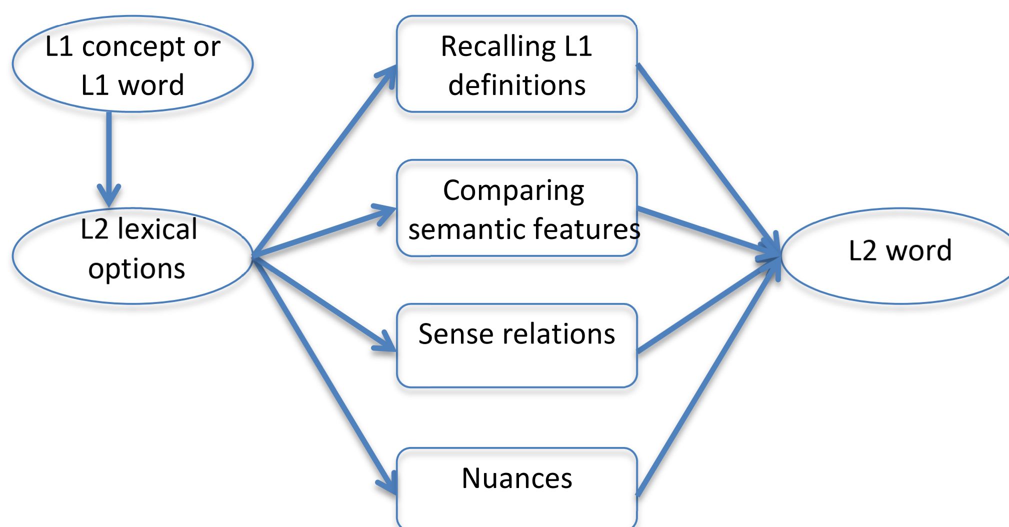


Figure 5.6 Aspects of word knowledge: cases where semantic knowledge is used for word choice

5.2.2.2 Word use

Instead of using semantic knowledge, in some cases, learners employed the knowledge of word use. That is, *word use* was a ground for word choice while participants performed the L2 writing task. Four different aspects of knowledge about word use were found through analysis of the interview data.

<u>Collocations</u>

When choosing one word from among several, some learners made a decision on the basis of collocational knowledge.

Example 26

> When making this sentence, I came up with four words, ‘enlarge’, ‘stretch’, ‘promote’, and ‘increase’. I thought all four words could be used in this sentence, since the meanings of the words seemed to be similar. However, I chose to use the word ‘increase’, due to the following noun ‘knowledge’. I felt these two words seemed to go together well. I wasn’t sure, but to me, ‘increase knowledge’ seemed to be more familiar than ‘enlarge knowledge’, ‘stretch knowledge’ or ‘promote knowledge’. (P96)

Collocational knowledge may be acquired through either explicit or implicit learning processes. However, at least for L2 students participating this study, it seemed that knowledge of collocations had been developed through exposure to input rather than explicit instruction. For example, a participant said:

> *When writing in English, I sometimes think about collocations when I have several options to choose from. I think I rarely learned collocations in class when I was in a junior-high or high school. In fact, I learned the term collocation at one of my major classes in university, and since then, I have begun to notice collocations while reading English journals or watching American TV shows. (P84)*

Register

In some cases, learners chose one of the lexical options by considering word features related to language situations or purposes. In particular, participants tended to use words that seemed to be appropriate in academic writing.

Example 27

> In this sentence, two words 'acquire' and 'get' popped into my head at that time. Although these two words are synonymous, I finally decided to use the word 'acquire', since I thought that while the word 'get' is usually used in speaking, the word 'acquire' seemed to be appropriate in writing. I've actually heard the word 'get' so many times from English native speakers' conversations via TV programs or movies, so I thought it was a more like spoken word, compared to the word 'acquire'. (P104)

Many participants indeed tended to avoid using informal/spoken language (e.g., *lots of, really, kids*, or *totally*) while composing their own essays. This case shows that as mentioned in Section 5.2.1.1, learners considered *contextual appropriacy* as one of the criteria for word choice in writing.

Grammatical features

Participants sometimes made a decision on word choice, based on their degree of grammatical knowledge about the lexical options. Learners selected a word that they could easily use without difficulties of syntactic structure when producing L2 sentences.

Example 28

> I thought that the word 'give' or 'provide' could be used in this sentence. Since I didn't feel confident when I used the word 'provide', I wrote the word 'give' in the end. I wasn't sure about the usage of the verb 'provide' in

terms of grammar. While I knew how to use the word 'give' with the following objects in a sentence, I wasn't sure how to place direct or indirect objects into a sentence when the word 'provide' was used. I've sometimes used the word 'provide' in writing before, but whenever I write it, I use a dictionary to find how to make sentences using it. On the other hand, I can make sentences including the word 'give' without using a dictionary. (P18)

Regarding this category, some participants commented that the words they can use in writing are limited due to lack of grammatical knowledge, and consequently, the low level of lexical diversity makes their essays tedious. For instance, a participant reported:

> *I definitely think that lack of my grammar knowledge hinders the development of my writing skills. When I'm not sure how to exactly use a word, I just give up using it. I'm really disappointed with myself whenever avoiding using some words due to lack of grammatical knowledge. I occasionally think my essays look terrible because I repeatedly use the same words. As a result, repetition of the same words makes my essay boring. Of course, I wish I could use a variety of words, but I don't want to write incorrect sentences with the words I'm not sure about. When I did the writing task last time, I felt frustrated because of the fact that there were fewer words I could use in writing than I expected.* (P97)

Frequency

When learners needed to choose one word between two or more, they sometimes based their decision on word frequency. As a result, they tended to use a word that they felt familiar with.

Example 29

> I thought the meanings of the two words (i.e., *think* and *consider*) were almost the same, but in the end, I chose to use the verb 'think' because it was much more familiar to me than the word 'consider'. The word 'think' is frequently used anywhere, isn't it? I don't think using the word 'consider' here would be wrong, but I felt more comfortable when I used the word 'think'. I just felt I wasn't confident about using the word 'consider'. It might be because although I understood what the word 'consider' means, I've rarely used it in speaking or in writing. (P10)

It seems that learners have different degrees of word familiarity, depending on how much they have previously been exposed to the words through reading or listening materials. In this sense, how familiar students feel with words may be related to word frequency. In fact, Huckin and Coady (1999:185) posit that 'incidental vocabulary learning depends on multiple exposures to a word in different contexts'. It can be reasonably assumed that more frequent words are more likely to be learned and retained in memory (Kweon & Kim, 2008; Waring & Takaki, 2003). In addition, the degree of word familiarity may vary according to how much learners have used the word before. In other words, previous learning

experience may cause different degrees of word familiarity, and being familiar with a given word may influence learners' word choice in writing.

Figure 5.7 below presents a summary of the cases where learners employed the knowledge of word use while choosing one of the lexical options.

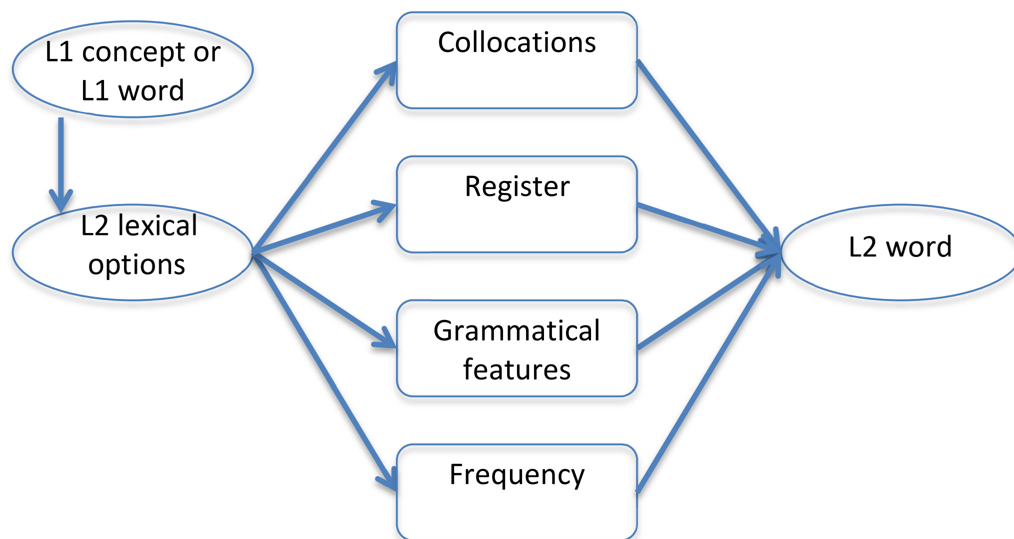


Figure 5.7 Aspects of word knowledge: cases where the knowledge of word use is employed for word choice

5.2.2.3 Intuition

In some instances, participants chose one of the several lexical options without clear ground or explanation. Learners made a decision using their intuition.

Example 30

> Here, three words, that is, 'certain', 'particular' and 'specific' popped into my head at the same time. I just thought the word 'certain' looked better than the others, so I used it. There was no particular reason why I decided to use the word 'certain' in this sentence. (P11)

This knowledge source is related to an individual's subjective feeling about the word. It can be argued that learners also based their decisions on personal feelings when they used collocations or frequency as grounds for word choice. However, in cases of the use of collocations or frequency, the participants expressed their individual feelings with more specific reasons to justify their word choice (e.g., 'These words seems to often go together' or 'I guess it is a more frequently used word'); on the other hand, in cases where intuition was used, the participants tended not to mention any particular reason. That is, learners choose a word, not because they have a specific reason but because they just believe it sounds right. An interesting finding was that each pair of lexical items cited by participants was fairly synonymous (e.g., proper-appropriate, proper-fit, big-large, certain-specific, university-college). It seemed that learners mainly used their intuitions to resolve problems related to the subtle difference in word meaning.

5.2.2.4 The writing task prompt

As noted in *Identification* episodes, several participants solved word choice problems based on the task prompt.

Example 31

> When I was writing this sentence, the word 'course' first came to mind. I also found the word 'subject' in the writing task prompt. I thought both words could be fine in this sentence. However, I chose to use the word 'subject', since I felt that the word in the task prompt looked better than one that I came up with by myself. I believed that the word that is used in the prompt for the writing task couldn't be wrong, so I felt that using the word 'subject' would be safer. On the other hand, I always doubt my vocabulary knowledge, because I'm not an English native speaker. So, I decided to trust the word in the prompt more than the one from my insufficient word knowledge. (P57)

As mentioned before, it was unexpected to find this kind of external source. An interesting finding, on the basis of comments like the one above, was that participants seemed to accept uncritically the word in the task prompt and also to feel insecure about their own word knowledge. It appears that word choice in L2 writing can be affected by an individual's low L2 self-confidence.

5.2.2.5 Unsolved (using both lexical options)

Interestingly, only one case was found for this category. When one participant tried to choose one of the two words that she thought of, she decided to use both words in the sentence.

Example 32

> It took so long to make this sentence. I believed that the meanings of the two words (*cautious* and *careful*) were similar, so it was hard to choose one of them. I finally made a decision to use both words instead of choosing one of them for several reasons. First of all, I couldn't easily select only one of them, since I wasn't sure which one was better than the other. Regarding the meanings, I couldn't find any distinctive differences between them. I also thought that using both words was less likely to be wrong than using one of them. I was trying to make the sentence okay using both words instead of making an incorrect sentence with wrong word choice. Next, I supposed that since the meanings of the two words were similar, using both words might emphasise the meaning I wanted to convey. (P52)

This case was interesting, because it could be categorised as both a solved and an unsolved case, depending on one's perspective. It might be regarded as a *solved* instance in that the participant expressed the meaning she wanted to convey. However, I categorised it as an *unsolved* case, because in the situation where one of the two words should be chosen, both words were used in the sentence. That is, it seemed that the participant avoided solving the problem by writing down both words.

Figure 5.8 below presents the summary of knowledge sources learners employed attempting to choose one between two or more lexical items.

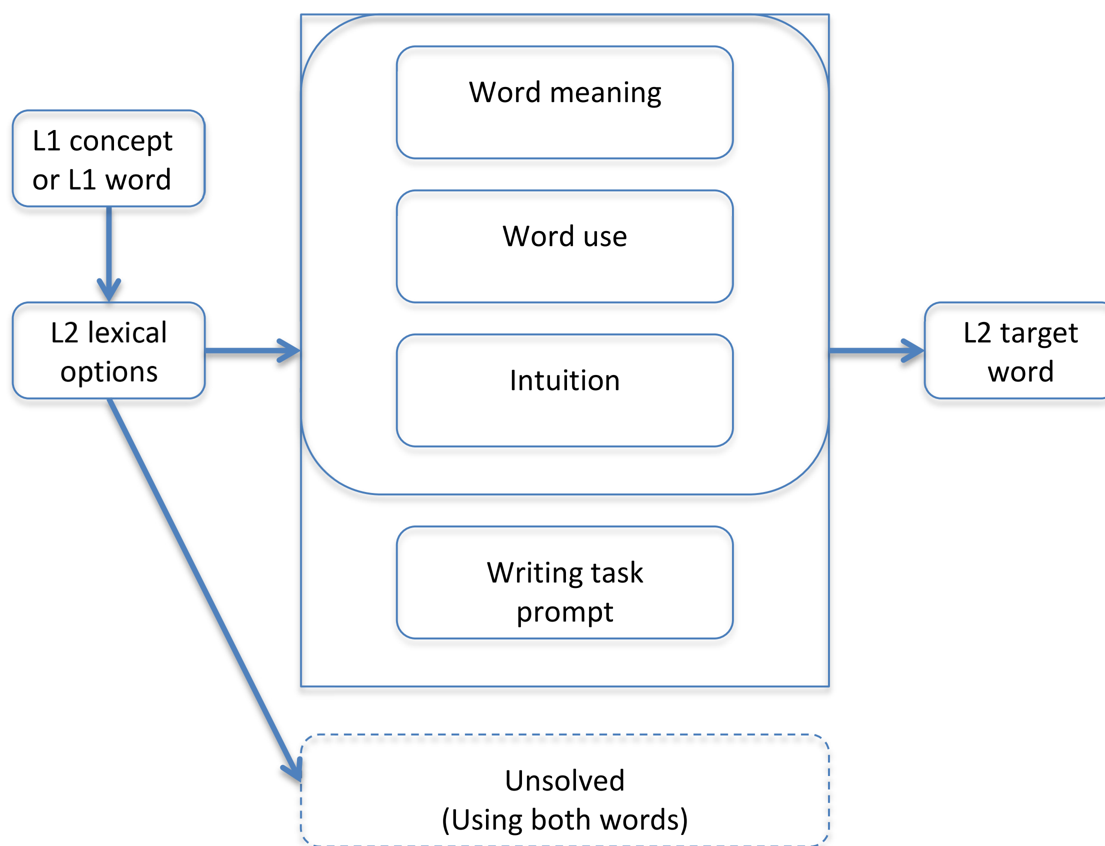


Figure 5.8 Knowledge sources in *Selection* episodes

An interesting finding was that intuition was employed in the process of solving word choice problems, while it was not used when learners faced word-searching problems (i.e., *identification* episodes). It seems that learners activate intuitive knowledge only in the process of lexical choice between several options.

5.2.3 Orthography

This kind of episode occurred when participants had difficulties with spelling words. Three sources of knowledge to solve spelling problems were found in the interview data: knowledge of sound-letter correspondence, analogy, and intuition.

Some episodes were left unsolved. Table 5.3 summarises the *Orthography* episodes in the data.

Table 5.3 Types of knowledge sources used in *Orthography* lexical episodes

<table>
<tr><td colspan="2">1) Knowledge of sound-letter correspondence</td></tr>
<tr><td colspan="2">2) Analogy</td></tr>
<tr><td colspan="2">3) Intuition</td></tr>
<tr><td rowspan="2">4) Unsolved</td><td>Attempting to search for alternative lexical items</td></tr>
<tr><td>Abandoning ideas</td></tr>
</table>

5.2.3.1 Knowledge of sound-letter correspondences

When the participants were faced with orthographic problems, they attempted to match the pronunciation to the spelling of the word, while repeatedly reading it several times.

Example 33

> I wasn’t sure about the spelling of the word ‘schema’ here. I’ve heard it several times before, and I know what it means. However, I had never actually written it down until I wrote it for the last writing task. At that time, I just wrote it down while thinking of its sound. Once I wrote it down on the paper sheet, I tried to match the sound to the letter, while slowly and repeatedly reading the word. To be honest, I still don’t know how to spell it correctly. (P2)

This kind of knowledge source was used in a situation where learners lacked information about graphemes in a word. The fact that learners have few chances to write in L2 may be one of the reasons why the discrepancy between phonemic and graphemic information happens. For instance, a participant said:

> *I definitely knew how this word ('deepth' [sic]) sounds, but I didn't know its spelling. I think it is a kind of basic word, and I've actually seen or heard it many times. That's why I was embarrassed when I was confused about its spelling last time. However, to be honest, I think there may be many words that I can understand when I see or hear them even though I can't use them in writing. I'm sometimes perplexed because I can't spell some of the basic words. It may be because I don't usually have enough opportunities to write in English. Come to think about it, I had never been asked to write in English until I entered university. And, since I entered university, I have written just two short English essays for assignments. I think at least for me, there are definitely not enough chances to actually use English in writing rather than to be exposed to English through a variety of media such as TV or the Internet.* (P31)

5.2.3.2 Analogy

There was one case where a word-spelling problem was solved on the basis of analogy. When facing the problem, a participant employed analogical reasoning, comparing the target word to other words that have similar pronunciation features.

Example 34

> Here, I was confused about the spelling of the word ‘synergy’. I wasn’t sure whether it should start with ‘S’ or ‘C’. Although I’ve sometimes used it in conversation, I don’t think I have actually written it down. I spent so much time dealing with this problem. I came to solve the problem while thinking about how other words are pronounced. Since I knew how to pronounce the word ‘synergy’, I tried to find other words that have similar pronunciation. I firstly came up with the word ‘cyber’, and I knew that ’Y in ‘CY’ is pronounced as /ai/. On the other hand, ’Y’ in ‘SY’ in such a word as ‘system’ is pronounced as /i/. Since the first syllable of the word ‘synergy’ is pronounced as /i/ instead of /ai/, I finally guessed that the word would start with ‘S’ instead of ‘C’. (P12)

5.2.3.3 Intuition

Participants sometimes relied on their intuition when they were confused about word spellings. Learners seemed to solve the problems based on their feeling.

Example 35

> When I decided to write the word ‘opportunities’, I wasn’t sure whether I should use ‘-OR-’ or ‘-ER-’. I think I’m always confused about the spelling of this type of word that has many syllables. After I tried writing both words (i.e., opportunities and oppertunities) on the paper sheet, I selected the one that I thought was more familiar to me. I just felt that the word ‘opportunities’ looked right, so I used it in this sentence. (P77)

5.2.3.4 Unsolved

As found in both *Identification* and *Selection* episodes, unsolved cases also occurred in *Orthographic* episodes, and two different situations emerged from the interview data.

<u>Attempting to search for alternative lexical items</u>

When facing word-spelling problems, some participants gave up using the initially planned L2 word and tried to find another word.

Example 36

> While writing this sentence, the word 'complement' firstly came up in my mind, and it was the word that I really wanted to use. However, I was suddenly confused about its spelling. I wasn't confident about using it correctly, so I tried to search for another word that has a similar meaning to the word 'complement'. Finally, I used the word 'supplement' in this sentence because I thought it could be used as an alternative instead of the word 'complement'. If I had known the correct spelling of the word 'complement', then I wouldn't have used the word 'supplement'. (P17)

This case is interesting in that it can be placed in either a *Solved* or an *Unsolved* category according to different perspectives, like the case where the participant decided to use both lexical items in *Selection* episodes. For instance, in the view of focusing on success of *conveying the planned message*, the problem was solved,

because the participants expressed the intended meaning in any case. In fact, the alternatives participants chose were synonyms or associated words with the target word (e.g., *chances* for opportunities, *known* for taught, or *concentrate* for immerse). However, it can be also regarded as an unsolved case, based on the view that learners failed to use the word, due to lack of orthographic knowledge. That is, learners gave up writing down the word that was originally proposed. Following the second view, this case was put into the *Unsolved* category for the present study.

<u>Abandoning ideas</u>

Two students abandoned the ideas they originally wanted to express because they failed to correctly spell the target word.

Example 37

> Here, I would have like to use the word *calligraphy*, but I didn't know how to spell it. I've seen it in a newspaper before, but I wasn't sure about its spelling. I had never actually used it before in writing. I wanted to look it up in a dictionary. I finally decided not to use it in my essay. (P25)

A similar case was also found in *Identification* episodes. In *Identification* episodes, learners chose not to express the proposed ideas, because the appropriate L2 word did not come to mind, or the meaning of the recalled word did not exactly match the planned idea. In *Orthography* episodes, on the other hand, students

decided to abandon the original ideas, since they were unsure about the correct form of the retrieved word instead of its meaning.

As presented in Section 4.2.1, a relatively small number of episodes were found in relation to orthography, compared to other types of lexical episodes (25 orthography, 123 selection, and 385 identification episodes); however, several interesting points related to *Orthography* episodes were observed in the interviews. Above all, certain types of words that puzzled learners were identified: 1) words having many syllables (e.g., *opportunities* or *circumstances*), 2) words including double letters (e.g., *professionally* or *curriculum*), and 3) words having a confusing letter order, such as *ie* or *ei* (e.g., *achieve*, *believe*, *belief* or *seize*). These words may cause writing problems due to their spelling, in particular for L2 learners whose native language is non-cognate with English.

Next, it was observed that participants rarely or never used problematic words in writing, even when they had heard or seen the words many times before. A participant reported that:

> *I was very frustrated when I found I couldn't correctly spell the word (efficient). I didn't think I had a problem using this word since it wasn't a difficult word and I've very often found it in textbooks, magazines, or Internet websites. When I met the word in various sentences, I understood what it meant. However, when I attempted to write it in the last writing session, I was confused about its spelling. I was so puzzled at that moment. I was also surprised that I had never used the word in my English essays before. I realised that there is a gap between what I can understand and*

> *what I can actually use. After the writing session, I thought I should study English vocabulary very hard.* (P54)

Furthermore, there were some interesting comments on how learners perceived orthography in English writing in the interviews. It seems that learners did not care much about spelling, since they thought that spelling errors could be checked by word-processing software.

> *I haven't thought that spelling would be a problem when I write in English. Honestly, I don't care about spelling, because I usually write an English essay using an MS Word program. If I wrote a word incorrectly, it would be automatically fixed by the software. So far, there have not been many cases where I have to write in English by hand.* (P29)

In addition, some students said that spelling errors would not be critical in writing.

> *When I fail to recall an L2 translation equivalent in L1, I usually try to find the word in a dictionary. However, if I have a problem with how to spell a word, I don't usually use a dictionary to check the spelling, because even if the spelling is wrong, the reader can understand the message I want to convey. I don't think spelling is a big deal. In fact, I don't think I have been given negative points when I misspelled a word in my essays* (P49)

In summary, regarding *Orthography* episodes, three knowledge sources were found, and these are presented in Figure 5.9 below.

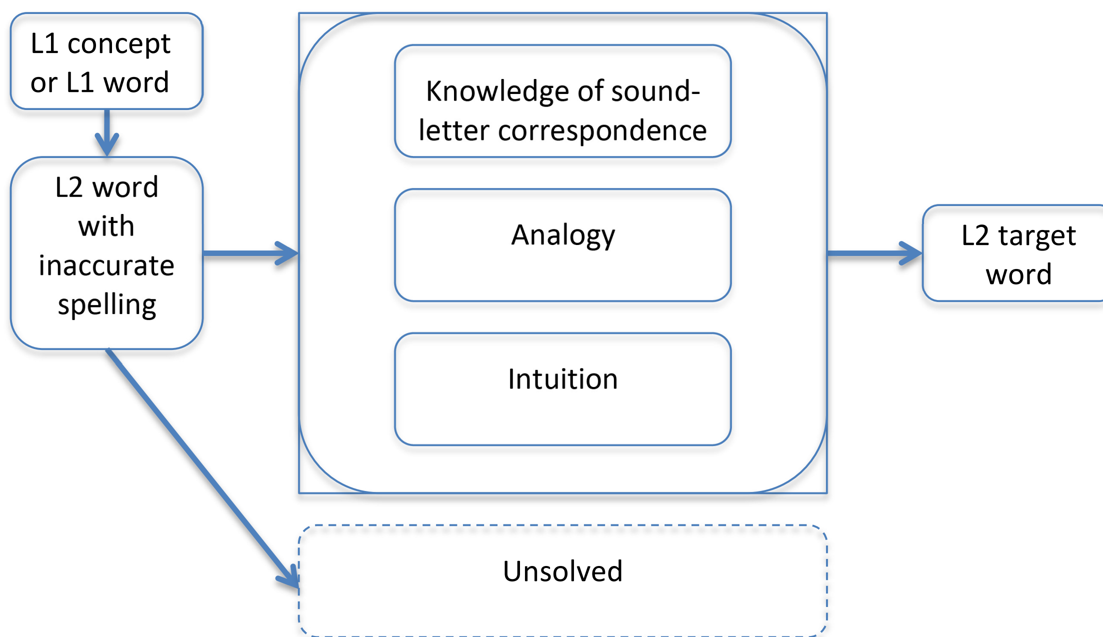


Figure 5.9 Knowledge sources in *Orthography* episodes

To this point, knowledge sources learners employed in lexical episodes have been discussed. Table 5.4 below presents the frequency of lexical episodes to call upon each knowledge source.

Table 5.4 Frequencies of the knowledge sources employed to solve lexical problems

	Identification	Selection	Orthography
Previously acquired L1-L2 translation word pairs	121		
L1 lexical knowledge	76		
Word form (morphological knowledge)	14		
Word meaning (semantic knowledge)	73	45	
Word use		40	
Knowledge of sound-letter correspondence			16
Episodic memory	16	6	
Analogy		2	1
Intuition		27	3
Writing task prompt	3	2	
Total	303	122	20

Of 533 lexical episodes, 88 unsolved episodes are excluded in the table

It can be said that all of the knowledge sources but *Intuition* are explicit linguistic knowledge sources, in that the participants were consciously aware of and articulated how they solved the lexical problems. On the other hand, intuition may be categorised as an implicit linguistic knowledge source, since the problem-solving processes were not articulated by the participants. In the next section, knowledge sources learners employed to solve grammatical problems will be discussed.

5.3 Knowledge sources for grammatical episodes

Based on analysis of the interview data, a total of four knowledge sources were found as the reasons for a decision on grammatical episodes: 1) grammatical rules, 2) analogy, 3) episodic memory, and 4) intuition. In addition, some episodes were left unsolved.

5.3.1 Grammatical rules

Many participants gave an explanation of grammatical rules, while justifying what they chose.

Example 38

> Actually, I'm not confident about using articles correctly in English writing. It is easy for me to differentiate where to use the definite article 'the' and the indefinite article 'a' or 'an'. However, It's always challenging for me to

> decide whether to use the article 'the' in front of a plural noun. In this sentence, the noun 'students' were not specifically designated, so I didn't think I need to put the article 'the' in front of this noun. I know that the definite article 'the' is used with a noun that has been mentioned before. (P1)

All of the students who employed this type of knowledge source used a variety of grammatical terms (e.g., *relative pronoun, passive voice, indirect object*, or *present participle*), explaining what rules are applied to a certain grammar problem.

5.3.2 Analogy

Several learners made their decision on grammatical items on the basis of similarities between the target items and the items they already knew.

Example 39

> I've seen this verb 'contemplate' several times while reading books, but I don't know its usage since I haven't used it before. I was wondering if this verb is an intransitive verb or a transitive verb. I thought it would be used as a transitive verb because other verbs that have a similar meaning, such as the verb 'think' or 'consider' are transitive verbs. So I used the verb 'contemplate' with a direct object in this sentence. (P2)

5.3.3 Episodic memory

As found in *Identification* episodes, participants solved some grammatical problems by retrieving information from memory related to previous situations such as taking a class, reading a textbook or searching the Internet. In this case, learners didn't know what grammatical rules should be applied to solve the grammatical problems they were faced with. Instead, they relied on their memory of previous learning experiences for solving those problems.

Example 40

> I was wondering if the expression 'as many things as' was correct. I was confused about the word order. Actually, I've seen this English expression very many times before, but I've rarely used it in speaking or in writing. In particular, I wasn't sure where the noun 'things' should be placed in the sentence. I guessed either 'things as many as' or 'as many things as' would be correct at that time. In the end, I remembered that I had seen this kind of English expression in a textbook when I was in high school, so I decided to use the expression 'as many things as'. Since the choice was totally based on my memory, I wasn't quite sure about it. I really wanted to check which one was correct, using the Internet. (P7)

In addition, some participants made decisions based on their memory even though they had some knowledge of grammatical rules. That is, in some cases where *episodic memory* and *grammatical rules* contradicted each other as knowledge sources, learners relied on their memory of previous learning experience.

Example 41

> I was really confused about the form of this noun ‘knowledge’. I knew that the noun ‘knowledge’ is an abstract and uncountable noun, so the suffix ‘-S’ should not be added. However, the reason why I hesitated to write the word ‘knowledge’ in this sentence was that I actually saw a sentence including the word ‘knowledges’ while googling a few days ago. When I found the word ‘knowledges’ on the website, I was a bit surprised that the word ‘knowledge’ could be used as a countable noun. Finally, although I learned that abstract nouns are not generally used in plural forms, I decided to use the noun ‘knowledges’ based on my recent experience. (P38)

5.3.4 Intuition

Some learners used intuition as a knowledge source when they solved L2 grammatical problems. They made a decision on grammatical items on the basis of what seems to be right.

Example 42

> I’m always confused about articles in English. Here, too, I wasn’t sure whether I should put the definite article ‘the’ in front of the noun ‘university’ or not. I thought I needed to put the article ‘the’ because when I read ‘at university’, it didn’t seem to sound right at that time. So, I placed the article ‘the’ between the preposition ‘at’ and the word ‘university’. To me, ‘at the university’ looked better than ‘at university’. There was no grammatical rule I could explain for my choice. I just felt it was right. (P107)

5.3.5 Unsolved

In a few cases, participants gave up using the grammatical items that they were considering, due to lack of grammatical knowledge.

Example 43

> I was stuck on this problem for a while. I wanted to use the expression *most of the students*. I wasn't sure which one was right between 'most of students' and 'most of the students'. I was confused whether to put the article 'the' in front of the word 'students'. In the end, I gave up using the expression. Instead, I used the word 'many'. I thought my original idea slightly changed here, but there was no way to figure out the solution to this problem at that time. While writing in English, I often face a situation where the intended meaning is changed due to lack of my grammatical knowledge. (P46)

Figure 5.10 below presents the summary of knowledge sources employed to solve grammatical problems.

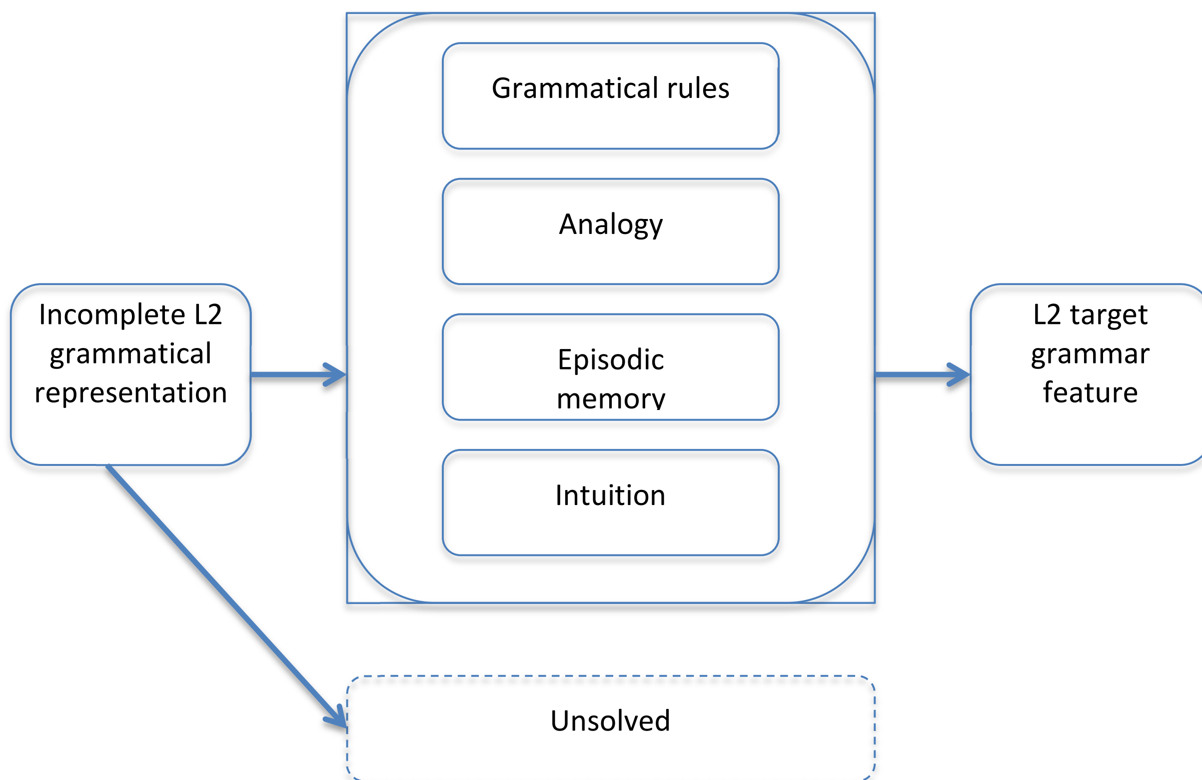


Figure 5.10 Knowledge sources in *Grammatical* episodes

Table 5.5 below shows the frequency of each type of knowledge source applied to each subcategory of grammatical episode.

Table 5.5 Frequencies of the knowledge sources used to solve each subcategory of grammatical problems

	Grammatical rules	Analogy	Episodic memory	Intuition
Inflectional & derivational morphology	3		4	7
Pronouns	1		1	
Articles	5			7
Verb	1	2	1	6
Word order			2	5
Subject-verb agreement	1			
Other	1		2	1
Total	12	2	10	26

Of 53 grammatical episodes, 3 unsolved episodes are excluded from the table

In summary, when facing grammatical problems in the process of L2 writing, learners employed four different types of knowledge sources, including both explicit and implicit knowledge sources, in order to solve the problems.

In this chapter, knowledge sources Korean university learners employed in order to solve lexical or grammatical problems when producing an L2 text have been discussed. Based on analysis of the stimulated recall interview data about a total of 586 LREs with 108 participants, it has been found that both explicit and implicit knowledge sources were used as learner-internal resources for the L2 problem-solving process in L2 writing, and that the writing task prompt was also employed as an external resource. In addition, there were some language-related problems that the participants left unsolved. Figure 5.11 summarises the types of knowledge sources found in the present study.

In Chapter 6, the quantitative and the qualitative findings of the study will be critically discussed in relation to the theoretical and empirical literature that has previously been examined in Chapter 2.

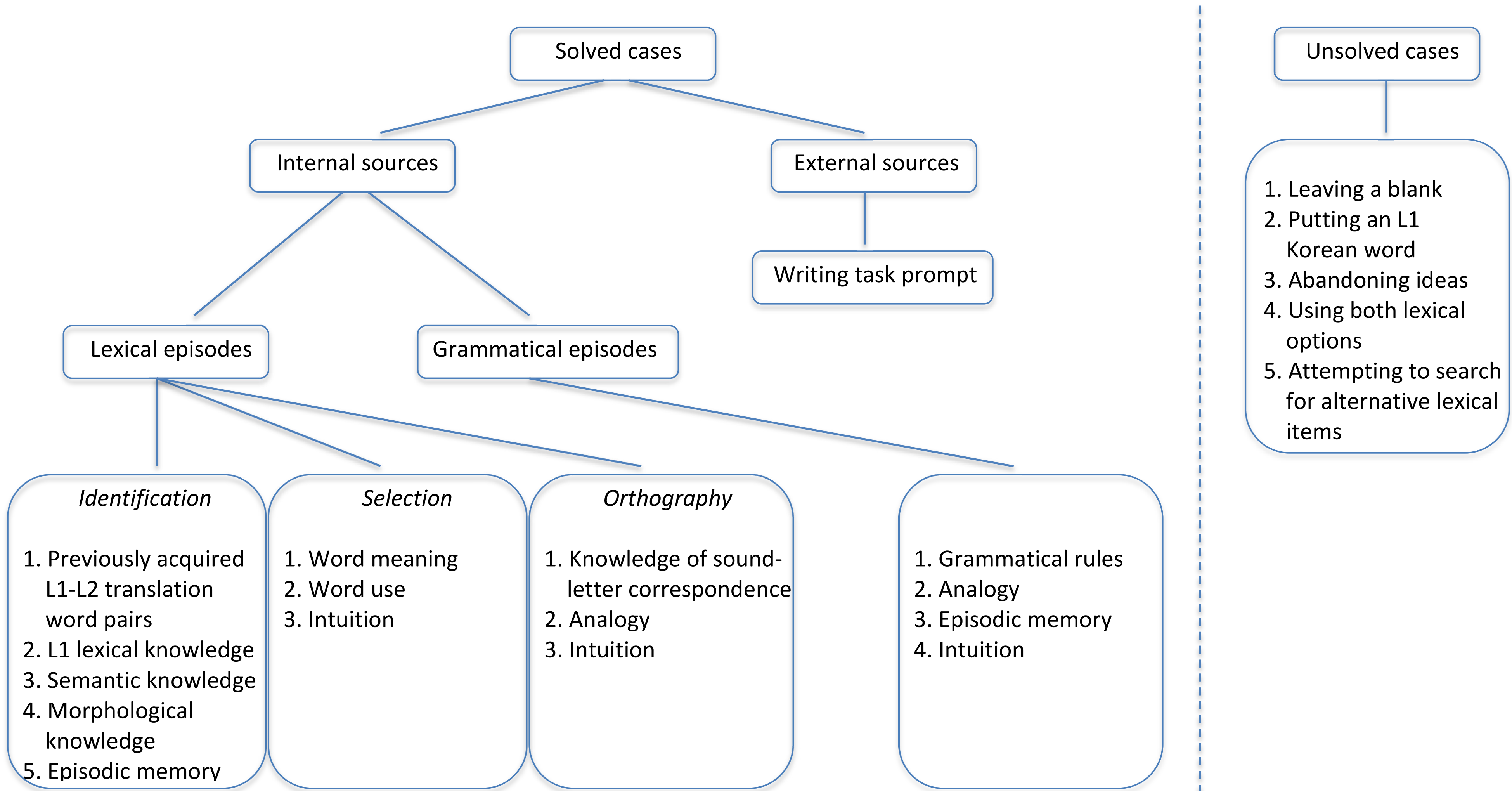


Figure 5.11 Summary of knowledge sources employed for the language problem solving process in L2 writing

6. DISCUSSION

6.1 Introduction

This chapter sets out to critically examine the findings of the study with regards to the major issues in the L2 problem-solving process in L2 writing of Korean university students who are proficient L2 users of English. All five research questions have been answered in Chapters 4 and 5. On the basis of the results, three main points have emerged, and these are discussed in detail in this chapter: 1) patterns of noticing language problems during the L2 writing process, 2) learner-related variables influencing learners' noticing, and 3) knowledge sources employed to solve L2 linguistic problems. These will be examined in turn in the sections below.

6.2 Tendencies in noticing language-related problems in L2 writing

6.2.1 Noticing more lexical problems than grammatical problems

The results showed that the 108 participants in this study noticed approximately five language problems each while working on an L2 text for 20 minutes, and noticed many more lexical problems than grammatical problems (totals of 533 and 53 respectively). Many previous studies have shown a similar tendency in LREs during the L2 writing process (e.g., Abe, 2008; Martínez Esteban & Roca de Larios, 2010; Hanaoka, 2007; Yazdi Amirkhiz, Bakar, Samad, Baki & Mahmoudi, 2013), indicating that learners notice substantially more lexical problems than grammatical problems when producing L2 texts.

On the other hand, several studies have produced different results from that of the present study. For instance, in Fortune and Thorp's study (2001), with students of various L1s in a British EFL context, a total of 413 LREs were identified in the collaborative output from grammar dictation tasks (Dictogloss), and more grammatical episodes (57%) occurred than either lexical (32%) or orthographic episodes (11%). Similarly, Haneda (1996) conducted a study in which eight adult learners of Japanese, each with a different L1 (i.e. English, Chinese, Hebrew and Perisan), completed a Dictogloss task in pairs. Haneda found that grammatical episodes (59%) occurred more than the other two categories: lexical (22%) and orthographic episodes (19%). Likewise, in Leeser's (2004) study with 42 Spanish students completing a Dictogloss task, learners noticed more grammatical than lexical problems (about 60% and 40%, respectively).

These disparities may be linked to the researchers' use of different writing tasks to elicit learners' noticing. In the studies where participants showed a tendency to notice more lexical than grammatical problems, somewhat less controlled writing tasks were employed (e.g., an IELTS writing task (Abe; Yazdi Amirkhiz et al.), a narrative task (Hanaoka; Martínez Esteban & Roca de Larios)), and an argumentative task (the present study)); on the other hand, a more controlled writing task (i.e., a Dictogloss task) was used in the studies where learners noticed more grammatical than lexical episodes. Because Dictogloss activities encourage learners to focus on form and to reconstruct the original text, it is not surprising that more grammatical than lexical problems are noticed by learners during a Dictogloss task. In fact, Storch (1998b) argues that more structured

tasks (i.e., grammar-focused tasks) such as multiple choice or text reconstruction elicit more learner attention to grammar than less structured tasks such as composition.

There are several possible reasons why the participants noticed more lexical episodes than grammatical episodes in the present study. First, when composing an L2 text, learners may focus more on content than on form, in order to convey the intended meaning. It is a fact that vocabulary is essential to communicate the intended meaning (Minett, 2009). Although both lexical and grammatical knowledge should be acquired to clearly express ideas, lexical knowledge may be more critical, since lack of adequate vocabulary knowledge appears to be more likely to impede learners in expressing the planned meaning than lack of grammatical knowledge. As Matsuda and Cox (2009) point out, wrong word choice can impact the meaning of the writing. For this reason, the participants in the present study might have paid more attention to words while paying less attention to the form of L2 English.

Next, the tendency to notice more lexical than grammatical episodes may be related to the nature of the formulating process in L2 writing. The current study was designed so that all of the LREs would be collected during the process of formulation, while the text was being produced. Learners are more likely to focus on vocabulary than on the processes of generating ideas or revising the produced text in the process of converting their ideas into a language form. Of course, it can be said that L2 learners tend to concentrate on either vocabulary (Porte, 1996; Stevenson, Schoonen & De Gloper, 2006; Whalen & Ménard, 1995) or grammatical correction (Silva, 1993). However, at least in

the present study, the comments of many participants indicated that they were more concerned with using appropriate words than with using appropriate language forms while performing the task, because they thought they could correct grammatical errors at later stages of revision. In this sense, the tendency to notice language-related problems can be affected by the type of L2 writing processes that are involved in the study. If time for revision was given to the participants in the present study, the frequencies of LREs noticed by learners might have been different.

From the findings regarding the tendencies in learners' noticing, it can be inferred that even highly proficient learners may have inadequate L2 vocabulary knowledge, and especially the productive vocabulary knowledge that is needed for L2 writing may be absent or difficult to access. In fact, the results of the VLT showed that the level of the participants' receptive vocabulary knowledge was fairly high (average about 130 of 150 points), but most reported that they had difficulty retrieving or using appropriate words while performing the writing task. There may be a big gap between learners' receptive and productive vocabulary knowledge, and in general, the receptive vocabulary size is larger than the productive vocabulary size (Fan, 2000; Waring, 1997; Webb, 2008). The gap between receptive and productive vocabulary sizes may lead them to notice far more vocabulary problems during the L2 writing process. However, this study did not attempt to test learners' productive vocabulary knowledge systematically, so further research is required in order to support this argument.

6.2.2 More identification episodes than other types of lexical episodes

With regard to lexical episodes, the result showed that meaning-based episodes (*Identification* and *Selection*) accounted for about 95 percent of all lexical episodes (533 instances) while only 5 percent were form-based episodes (*Orthography*). This result is consistent with that of other studies (e.g., Baleghizadeh & Arab, 2011; Fortune & Thorp, 2001; Martínez Esteban & Roca de Larios, 2010; Yazdi Amirkhiz et al., 2013), which have found that learners tend to notice more lexical problems related to the meaning of a word than to the form of a word while composing in L2. It may also be the case that the participants in this study did not have as many problems with the word spelling as with word meaning. These Korean university students with a high level of L2 proficiency (average TOEIC score: 916) did not seem to have much difficulty with mechanical problems during the L2 writing process. Furthermore, as pointed out in Section 5.2.3.4, while writing the essay, the participants tended to disregard word spelling, since they thought spelling could be automatically corrected by word-processing software, or it might not crucially affect the quality of the essay. However, there are sometimes institutional requirements for correct spelling, so there may be an argument for drawing L2 writers' attention to this aspect of word knowledge in some contexts.

The results showed that *Identification* episodes occurred more than *Selection* episodes (385 and 123 instances, respectively). That is, when learners attempted to find a proper L2 equivalent, there were more cases where only one L2 lexical item came to mind than ones where two or more items did. This result is different from that of Fortune and

Thorp's (2001) study, which revealed more occurrences of *Selection* than *Identification* (97 and 34 instances, respectively). It may be because different task implementation conditions were employed to elicit LREs. While the writing task was collaboratively conducted in Fortune and Thorp's study, the participants in the present study performed the task individually. There is a distinct difference between the two task conditions in terms of the use of knowledge resources. With a partner, learners can employ an external knowledge source (i.e., linguistic alternatives through peer interactions) in pair work; on the other hand, in the individual writing environment, the participants could only rely on their own linguistic knowledge (with the exception of the use of the writing task prompt). Therefore, presumably, the individual writer is more likely to have fewer opportunities to consider numerous lexical options than will pairs.

From the findings, which show a substantial discrepancy between *Identification* and *Selection* episodes, it can be inferred that lexical retrieval, an essential process in written L2 production, is a very effortful process, even for advanced L2 learners. As Dörnyei and Kormos (1998) point out, L2 learners may struggle to retrieve lexical items from their incomplete L2 lexicon because the items in the lexicon are not sufficiently specified. Therefore, it may be difficult to find L2 words appropriate to the context, and it may be difficult for learners to retrieve multiple lexical options. In addition to the difficulty of retrieving L2 words during the process of written production, the use of a timed essay may have contributed to the likelihood that the participants spent less time attempting to retrieve multiple L2 words once a word occurred to them. In fact, many participants reported that they had used the word that first came to mind during the writing task,

because they had wanted to complete the writing task within the allotted time (i.e., 20 minutes). If they had been given more time to accomplish the task, the frequencies of the two types of meaning-based lexical episodes might have been different from the ones found in the present study.

6.2.3 More problems related to morphology and articles than the other types of grammatical episodes

In grammatical episodes, the participants generally reported more problems related to *morphology,* especially *inflectional morphology,* and *articles* (14 and 13 instances respectively = 27 out of 53 instances) than other types of categories in this study. It seems that Korean students consciously struggle to use these specific grammatical features in L2 writing. This may be linked to the difficulty in the acquisition of these grammatical components for EFL learners or to specific difficulties to do with the differences between the English and Korean languages. As regards morphology (14 instances), it was found that the participants had more difficulties with inflectional morphology (13 instances) than with derivational morphology (1 instance); and notably, all of the 13 LREs related to inflectional morphology involved noun countability. DeCapua (2008) posits that the distinction between countable and non-countable nouns is a problematic area for non-native speakers whose native languages have different ways of looking at nouns. In fact, some words that are countable in English are uncountable in Korean. For instance, in English, *information* and *knowledge* are

generally considered as non-countable nouns; on the other hand, in Korean, these nouns can be used as countable nouns, and they do have plural forms.

Next, many Korean learners have difficulty using English articles, and this is because Korean does not contain articles. Korean students have to learn the English article system without reference to comparable linguistic items in their own language, so it is difficult for them to acquire the rules for the use of articles in English (White, 2009). Moreover, since many of the difficulties related to the use of articles involve determining the countability of nouns (Amuzie & Spinner, 2013), Korean learners who have difficulties with countability in English nouns are likely to find it difficult to use articles. In other words, a mismatch exists between Korean and English, so Korean learners face obstacles when acquiring these English grammatical features (plural morphology and articles). As a result, Korean university students may have more difficulty using these than other grammatical features (e.g., *pronouns*, *verb tense*, or *word order*) when producing written text in English.

In addition, the method of teaching English in Korean classrooms contributes to difficulty in acquiring these grammatical features. In Korea, the dominant form of English grammar teaching is still a traditional grammar translation method (Bae, 2011; Nam, Benedetti & Kim, 2008). Learners are taught discrete grammar points and asked to practice the elements of grammar in isolation from context or communicative activity. Moreover, students are generally trained in skills for reading; consequently, this way of teaching probably does not greatly facilitate the acquisition of the productive aspects of

English. In order to acquire grammatical knowledge, learners may need not only to understand grammatical rules but also to have opportunities to apply the rules in the process of L2 production. In this sense, limited opportunity to study and practice grammar features in situations and a lack of attention to context may cause Korean students to consciously struggle to use certain grammatical elements such as morphology or articles in L2 writing.

6.3 Effects of learner-related variables on noticing in L2 writing

6.3.1 Study abroad experience

This study found that previous study abroad experience has an effect on learners' noticing during the L2 writing process. Students with study abroad experience tended to verbally express fewer lexical or grammatical problems while producing an L2 text than those with no experience. This finding may be attributed to the greater degree of exposure to L2 experienced by students with study abroad experience. That is, there is a positive impact of study abroad experience on learners' vocabulary development (Ife, Vives Boix & Meara, 2000; Milton & Meara, 1995), and previous immersive exposure to L2 may explain the difference in learners' vocabulary size. Kinginger (2009:79) says that 'study abroad participants develop more expansive lexical repertoires than do purely instructed learners, and their lexicons tend to be organised in a more native-like way'. Consequently, it can be assumed that learners with larger vocabulary size may encounter fewer lexical problems in the process of L2 writing, since they have more available lexical knowledge than individuals with smaller vocabulary size. Those who

have studied abroad in English-speaking countries may know more words than those who have no study abroad experience, because presumably, the former have been provided with greater exposure to L2 words than the latter. As described before, the participants in the 'no experience' group had engaged in four hours of English class per week before entering university. There should exist a difference between these students and the students who have spent time learning with English as a medium of instruction, and being exposed to English outside classrooms, in terms of vocabulary learning.

Furthermore, the study abroad experience may affect the speed of learners' language processing as well as the difference in their vocabulary size. Learners who have studied in a classroom where English is the medium of instruction have ample opportunities to write in English, and this may have led to automatisation of the process of written language production. In contrast, it is common that Korean students have few opportunities to receive formal L2 writing instruction until the university level, with the exception of a minority of individuals who gain experience in L2 writing at language institutes (Nam, Benedetti & Kim, 2008). As a result, the difference in the amount of previous writing practice in L2 may influence speed in accessing L2 knowledge (in particular, L2 vocabulary knowledge) from long-term memory. That is, automaticity of language processing is likely to be affected by the study abroad experience. Taguchi (2013) claims that study abroad experience might help learners to move from idiosyncratic, interlanguage usage of routines to more conventional, target-like usage, and a study abroad context that provides abundant opportunities to practise routines in daily interaction is considered advantageous for automatisation.

In other words, it seems that study abroad experience may have an effect the speed and automaticity of learners' lexical or structural access, and for this reason, those who have experienced English immersion program may experience fewer language-related problems in the process of L2 written production. This argument may be supported to some extent by the results of Yazdi Amirkhiz et al.'s (2013) study comparing EFL and ESL learners' LREs during writing tasks. In this study, two EFL (Iranian) dyads and two ESL (Malaysian) dyads were asked to do fifteen writing tasks collaboratively, and the verbal interactions were recorded by analysing three types of LREs (Grammar, Lexis, and Mechanics). It was found that the two EFL pairs noticed more LREs (176 and 212 episodes) than their ESL counterparts (123 and 102 episodes). The discrepancies may come from the different L2 learning environments, that is, from how much learners are exposed to English and how many chances to produce English they have. The researchers concluded that different English learning backgrounds might affect the pattern of learners' noticing during writing tasks.

6.3.2 L2 proficiency

The results indicate that L2 proficiency also has an effect on learners' noticing during the L2 writing process, showing that less proficient learners tend to verbally express on average four more lexical or grammatical problems than more proficient learners. This difference in noticing between two proficiency groups was a surprising finding, since it is different from the results of previous studies. Various studies that have examined the

relationship between noticing in L2 writing and learners' L2 proficiency suggest that learners with higher L2 proficiency tend to notice more linguistic items than those with lower L2 proficiency (e.g., Abe, 2008; Hanaoka, 2007; Qi & Lapkin, 2001; Swain & Lapkin, 1995). However, it should be noted that no inferential statistics were conducted in these studies, due to the small sample sizes. For example, in Abe's study, the data from five students in each proficiency group was analysed, and Swain and Lapkin compared two differently proficient groups consisting of only two participants each. Likewise, the data from only two learners of different L2 proficiency levels was analysed in Qi and Lapkin's study.

The disparity in the results may be attributed to the different measures of L2 proficiency employed in each study. While IELTS scores were used in Abe's study, the participants in Hanaoka's study were asked to do a cloze test. Qi and Lapkin assigned the participants' L2 proficiency on the basis of their oral and written work, and teachers' ranking was the basis for assigning to proficiency groups in Swain and Lapkin's study. For the present study, the VLT and a C-test were used to measure learners' L2 proficiency. As mentioned before, the construct of L2 proficiency can be operationalised differently by different researchers, and this may lead different results in terms of LREs. Interestingly, however, a similar finding to that of the present study was found in Iwanaka and Takatsuka's (2007) study, which employed a C-test as a L2 proficiency measure. In this study, 39 Japanese college students were divided into three proficiency groups (elementary, intermediate, and advanced) on the basis of a C-test in which every 11th word had been deleted. Although the number of language problems each group experienced was not

described in detail, it was reported that the elementary group noticed more language-related problems than the other groups. However, a cautious interpretation is also required since statistical evidence was not provided.

One plausible explanation for the tendency of noticing in relation to L2 proficiency is that more proficient learners may access L2 linguistic knowledge, in particular, lexical knowledge, more easily than their less proficient counterparts. Aliakbari and Karimi Allvar (2009) claim that learners with sufficient language proficiency may produce lexical items more easily and fluently during the process of written language production. Similarly, Iwanaka and Takatsuka (2007) contend that low proficient learners notice more language problems because of their limited linguistic resources. In other words, as the students with study abroad experience, the learners with high L2 proficiency may have greater availability of L2 lexical or grammatical knowledge than learners with low proficiency; consequently, the former are likely to notice fewer language problems during the L2 writing process.

6.3.3 Working memory capacity

There are some interesting issues for discussion in relation to the results about the impact of working memory capacities in L1 and in L2 on noticing. First, as described in Section 4.3.5, it was found that there is a positive correlation between L1- and L2-based working memory capacities. This result is consistent with that of other studies. For example, in the study with 30 Japanese university students performing reading span

tests in L1 Japanese and in L2 English, Osaka and Osaka (1992) found a significantly high correlation between two working memory capacities (r = .84). Osaka, Osaka and Groner (1993) also conducted a similar study with fifteen students and staff members at a university in Switzerland. All of the participants were native speakers of Swiss German and had learning experience of French for 7-9 years. Reading span tests both in German and in French were given to measure working memory capacity. The results showed a high correlation between the German and French versions of the reading span test (r = .85). However, some studies have found only a moderate relationship between working memory capacities in L1 and in L2, which is similar to the results found by the present study (r = .36). For instance, in a study with 34 Japanese EFL university students completing three working memory tests for both L1 Japanese and L2 English (digit span, word span, and reading span), Harrington and Sawyer (1992) found moderate (r = .39 - .47) correlations between the L1 and L2 working memory measures. Roehr and Gánem-Gutiérrez (2008) also found a moderate (r = .41) correlation between L1 (English) and L2 (German and Spanish) reading span tests. In other words, these studies demonstrate that one's working memory capacity in L1 and in L2 may share a substantial amount of resources, presenting the moderate-to-strong relationships between L1 and L2 working memory capacities.

However, given that several studies, including the present study, have found a moderate relation between working memory tests conducted in different languages, it can be argued that an individual's working memory system can be differently activated to some degree, according to the language that is involved in a task, and this may be linked to a

function of the phonological loop, which stores verbal information temporarily. For instance, while learners perform reading span tests in L1 and in L2, they are required to remember the last word of each sentence in order to measure their storage of information. It is possible that L1 words may be recalled or remembered more easily than L2 words, because L1 words are likely to be more familiar and more frequently dealt with than L2 words. That is, learners may encode and store information in L1 more easily than that in L2. The degree of automaticity in language knowledge may influence the encoding and retrieval of information within the phonological loop (Baddeley, 2007). In other words, it can be said that the language in which a person is working can affect the operation of the phonological loop and thus, there may exist differences when one's working memory capacities are measured in L1 and in L2.

Next, concerning the effect of L1 and L2 working memory on learners' noticing, it was found that while working memory measured in L1 had no effect on learners' noticing, working memory measured in L2 affected learners' abilities to notice language problems during the L2 writing process. The result is not surprising, since the noticing data was obtained when the participants wrote an essay not in L1 Korean, but in L2 English. That is, the ability to store and to manipulate information in L1 may not be related to learners' noticing of language problems during the L2 writing task. Interestingly, some studies have found that working memory capacity in L1 has no or only a weak relation to L2 performance. For example, in Tsuchihira's (2007) study, 22 Japanese college students were asked to complete L1 Japanese and L2 English listening span tests and an L2 listening comprehension test with twenty multiple choice questions. The results showed

that while working memory span both in L1 and in L2 were significantly correlated to L2 listening comprehension, L1-based working memory operation had a weaker relation (r = .58) than L2-based working memory (r = .72) to L2 listening comprehension. Likewise, in Satori's (2012) study with 150 Japanese college students performing L1 Japanese and L2 English listening span tests and the TOEIC test (only listening section), working memory capacity in L1 showed a weaker relationship with L2 listening comprehension (r = .22) than working memory capacity in L2 (r = .46).

Ikeno (2006) examined the relationship between working memory capacity and L2 reading comprehension. In the study, 52 Japanese university students were required to complete the reading section of the TOEFL test and L1 and L2 reading span tests. The findings demonstrated that while working memory capacity in L2 was significantly correlated to L2 reading comprehension (r = .33), working memory capacity in L1 had no relation to L2 reading comprehension. Similarly, in a study with 43 Turkish university students taking L1 Turkish and L2 English reading span tests and a reading comprehension test with twenty questions, Alptekin and Erçetin (2010) found that while L2 working memory capacity had a significant positive relation to L2 reading comprehension (r = .45), there was no significant relation between L1 working memory capacity and L2 reading comprehension.

The four studies above demonstrate no or a weak correlation between working memory capacity in L1 and L2 language skills. This is consistent with the finding of the present study. However, it should be noted that the result of the present study was drawn in the

context of L2 production performance (writing) while other studies were conducted in the context of L2 comprehension performance (reading and listening). Therefore, further research is needed to examine the relationship between L1-based working memory operations and L2 production skills.

In addition, it was found that learners whose working memory capacity as measured in L2 is larger tend to verbalise fewer language-related problems during the formulating process than those having less working memory capacity. One possible explanation of this result regards recall of lexical or grammatical information from long-term memory that is conducted during the process of formulation. During the process of formulating, leaners may need to deal with diverse cognitive processes. In particular, retrieving relevant linguistic information from long-term memory is an essential process for producing sentences, and according to Rosen and Engle (1997), working memory indeed plays a crucial role in retrieval. Working memory capacity has an impact on the writer's ability to allot attention to what information related to words or grammar structures is needed. It can be said that individuals with higher working memory capacity tend to retrieve information more effectively during the performance of complex cognitive tasks. As Olive (2003) points out, high span learners may better access syntactic (grammatical encoding) and morphological word categories (mental lexicon) at the moment of retrieval during task performance than low span learners.

As pointed out in Section 2.3.2.3, working memory capacity is limited, and attentional resources are constrained by working memory. Cantor and Engle (1993) argued that

individual differences in working memory capacity exist because people differ in the amount of activation available to long-term memory. Learners with higher working memory capacity have greater attentional resources and efficiently allocate their resources; consequently, they can process the information they need between long-term memory and output more quickly and fluently. In contrast, lower working memory students cannot process well, and they are less efficient at focusing their attention on the relevant information they need. As a result, L2 learners' individual differences in working memory capacity may lead them to encounter different quantities of linguistic problems during the formulation process in L2 writing.

6.4 Knowledge sources for language-related problems in L2 writing

6.4.1 Knowledge sources for solving L2 lexical problems

Regarding *Identification* episodes, the participants very frequently used previously acquired L1-L2 translation word pairs, and in these cases, they recalled L2 translation equivalents somewhat quickly. This may be related to the traditional way of learning English vocabulary in Korea. In order to study as many English words as possible more quickly in a limited time, learners were and still are asked to memorise the words using word lists. That is, Korean learners have relied heavily on list of paired L1-L2 associates. This conventional method might be efficient for expanding vocabulary size and for improving comprehension skills; however, for language production, the effect may be limited, since literal translation from a Korean to an English word is not always correct. Although there is seldom a one-to-one correspondence between different languages,

Korean learners are generally required to study English-Korean word pairs by rote learning; consequently, they may have limited word knowledge for language production and may experience some difficulty using appropriate L2 words according to context when producing L2 texts.

In addition, when failing in their search for an English equivalent through the memorised word list, the participants often used their L1 knowledge. The native language was used as a knowledge source when learners tried to find alternative lexical items or to paraphrase the originally planned target L1 word. In fact, the use of L1 knowledge was identified in some previous studies that investigated strategies L2 learners employ to solve lexical problems during the L2 writing process (e.g., Manchón, Murphy & Roca de Larios, 2007; Murphy & Roca de Larios, 2010; Santos 2006; Woodall, 2002). In particular, Manchón, Murphy and Roca de Larios (2007) emphasise that learners' L1 is commonly used to search for appropriate words or phrases, or assess and verify their lexical choices. Similarly, Mohanraj and Chimirala (2013) acknowledge that learners use their L1 as a problem-solving tool in L2 writing, and one of the main purposes of the use of L1 is to search for words.

As for *Selection* episodes, as in *Identification* episodes, students used *word meaning* as a knowledge source, considering some aspects of word knowledge such as L1 definition, L2 words' semantic features, sense relations or nuance in order to compare two or more lexical items. Furthermore, it is noticeable that when deciding to write one of L2 lexical options, learners employed *word use,* which did not occur in *Identification* or

Orthography episodes. When they compared two or more lexical items and tried to select the better one, they considered several features linked to word use such as collocation, register, grammatical features or frequency. It seems that more aspects of vocabulary knowledge are examined when learners need to compare and choose between lexical items than when they try to find an L2 translation equivalent for the L1 word.

Another interesting finding is that *intuition* was used in *Selection* episodes. Instead of giving an explicit reason, learners employed their own feelings or personal preferences when comparing two or more lexical items and choosing one of them. From the fact that the participants often used intuition when comparing fairly synonymous pairs of lexical items (e.g., proper-appropriate, proper-fit, big-large, certain-specific, university-college), it can be inferred that a learner's intuition is activated when he or she attempts to grasp the subtle differences of the meanings between words. However, it can be said that the use of intuition in language production for L2 learners may be different from that of L1 native speakers in terms of accuracy and certainty. While L1 English native speakers are highly likely to acquire intuition through naturalistic exposure, EFL learners, and in the current context Korean students, have limited opportunities to be exposed to L2 English, and they generally learn English words through explicit instruction. As a result, L2 learners may be uncertain in using intuition, and the use of intuition may make their word choice in L2 writing wrong.

With regard to *Orthography* episodes, learners mostly used knowledge of sound-letter correspondence, which unsurprisingly was not found in either *Identification* or *Selection* episodes. Since this type of episode is related to the form of a word instead of its meaning, it can be assumed that the patterns of knowledge source use are different from the meaning-based lexical episode types. Learners who have only phonemic information or who have partial information about a word's orthography seem to face this kind of lexical problem. In order to overcome spelling problems, learners retrieved the spoken form of the word, trying to connect the information about the word's phonemes and its graphemes from long-term memory. This may demonstrate that even highly proficient learners such as those in the present study still encounter spelling difficulties when writing in L2, and that they may have still not internalised the spelling patterns of certain words.

Several lexical knowledge sources that students used in the current study were found in previous studies that investigated learners' communicative strategies in L2 writing (e.g., Aliakbari & Karimi Allvar, 2009; Chimbganda, 2000). For example, learners used semantic knowledge, in particular, L1 and L2 words' partially overlapping semantic features, in order to convey a part of the intended meaning (*approximation*), or they sometimes considered a word's sense relations and used hypernyms (*generalisation*). In addition, words were replaced (*lexical substitution*) or restated in other words (*paraphrase*) by using L1 lexical knowledge. Furthermore, some learners made new expressions through direct translation from L1 to L2 by combining items from previously acquired L1-L2 translation word pairs (*word coinage*), or used morphological knowledge to express the

initially planned word (*morphological creativity*). While learners used the achievement strategies described above, they also employed reduction strategies such as message abandonment, and these cases were represented as *unsolved* in the present study.

The findings showed that the knowledge sources used by participants in the current study were different from the types of lexical knowledge sources used to infer word meaning in reading or listening in other studies. The difference may be due to the features of the tasks that learners undertook. When attempting to guess and understand the meaning of a word in a reading or listening text, learners seem to frequently employ contextual information or background knowledge about the target word (Nassaji, 2003). On the other hand, to write in L2 learners tend to use intralingual knowledge sources (e.g., morphology, collocations, or semantics). This may indicate that the types of knowledge sources employed in language production are different from those used in language comprehension. Namely, when solving L2 lexical problems, learners tend to take more analytical approaches to a word itself in the process of language production than in the process of language comprehension.

6.4.2 knowledge sources for solving L2 grammatical problems

With regard to grammatical episodes, four categories of knowledge sources (i.e., grammatical rules, analogy, episodic memory and intuition) were identified, and these were similar to the types of sources found in previous studies (e.g., García Mayo, 2002; Storch, 1998a, 1998b), with some exceptions such as ‘no explanation’, which was found

in earlier studies but not in the present one. This category was found in other studies because no follow-up interviews were conducted after the think-aloud sessions. However, this category did not appear in the present study since the stimulated recall interviews were conducted to examine knowledge sources employed for each LRE.

Both *grammatical rules* and *episodic memory* were used to some degree across the subcategories of grammatical episodes. In addition, interestingly, the participants used their *intuition* more frequently than the other kinds of knowledge sources. As described in Section 2.4.2.1, it was assumed that learners rely on their explicit knowledge more than implicit knowledge as L2 problem-solving resources because explicit knowledge is usually accessed through a controlled process such as a problem-solving activity. Moreover, given that Korean learners have learned knowledge related to the grammar items more explicitly than implicitly, without contextualised grammar exercises, this finding is surprising. Of course, L2 learners can have intuitive knowledge about the target language (Schmidt, 2010), but there is a possibility that L2 intuition is different from L1 intuition because the learning processes of L1 and L2 are likely to be different. This issue will be discussed in more depth in the next section.

6.4.3 Explicit and implicit linguistic knowledge sources employed in L2 writing

It can be said that in general, learners reported relying more on explicit L2 knowledge sources than implicit ones when they faced linguistic difficulties during the L2 writing process. In order to solve lexical or grammatical problems, they mostly reported using

explicit/declarative linguistic information, presenting the use of metalinguistic knowledge (using either technical terms or not); on the other hand, implicit/procedural linguistic information was not likely to be reported frequently when resolving lexical or grammatical problems. At the moment when learners experience some kind of linguistic difficulty while producing L2 texts, they may be required to consciously pay attention and focus on retrieving relevant L2 information. Explicit knowledge is primarily used when learners are involved in problem-solving activities that call for learners to pay focal attention to linguistic form, while implicit knowledge can be generally accessed during rapid and fluent performance, and retrieved by means of automatic processes (Graaff & Housen, 2011). In other words, the L2 problem-solving activity makes use of explicit knowledge; on the other hand, it may be hard to find the use of implicit knowledge during think-aloud accounts of the L2 problem-solving process.

Another plausible explanation of more explicit than implicit knowledge sources is related to how English is taught in Korea. It may be impossible to measure the amount of explicit or implicit knowledge learners have; however, it can be inferred that they are more likely to have explicit than implicit English learning experience. For most Korean EFL learners who have few chances to produce L2 English outside classrooms, teachers' instructions using textbooks in the classroom are the main sources of L2 learning, and traditional teacher-centred methods focusing on rote memorisation and grammar-translation are still pervasive in class (Guilloteaux, 2007). Although the opportunity to learn English at language institutes has increased, as Kim and Uhm (2010) note, Korean students, in particular, until the university level, are still more likely to build vocabulary

and grammar knowledge explicitly than implicitly. For this reason, it may be hard to accumulate implicit knowledge about English; consequently, it is difficult to develop linguistic intuition equivalent to that of English native-speakers. Therefore, more explicit knowledge sources are likely to be used in the L2 problem-solving process than implicit sources.

In the present study, it was found that learners' intuition was employed when they selected between two or more lexical items, decided the appropriate spelling for a word, or judged the correct grammar features during the L2 problem-solving process. Like L1 learners, L2 learners can develop linguistic intuitions about the target language, either through consistent practice of explicitly acquired knowledge, or through natural experience, although this may well be limited in the case of Korean students without study abroad experience. However, as mentioned before, the quality of intuition may be different between L1 and L2 learners. While L1 learners use their intuition without particular difficulty, L2 learners may be uncertain about when they should rely on their linguistic intuition, because they have not internalised the same linguistic competence as L1 learners.

The existence of a gap between L1 and L2 learners' intuition may be discussed using Anderson's (1980, 1983) Adaptive Control of Thought (ACT) Model, explaining the distinction between declarative and procedural knowledge. In his model, the transition from declarative to procedural knowledge takes places in three stages: 1) the declarative stage where information is assembled and stored, 2) the associative stage where

declarative information is gradually converted to a procedural form, and 3) the autonomous stage where procedures become increasingly rapid and automatic. Following Anderson's ACT model, in the context of L2 learning, learners acquire certain L2 linguistic information, and then, they may try to sort the information into more efficient production sets by means of proceduralisation. Finally, the procedures become automated through persistent practice.

While explaining the nature of procedural knowledge, Anderson (1980:224) postulates that L2 knowledge learned in a classroom situation is different from L1 knowledge, saying that:

> We speak the learned language by using general rule-following procedures applied to the rules we have learned, rather than speaking directly, as we do in our native language. Not surprisingly, applying this knowledge is a much slower and more painful processs than applying the procedurally encoded knowledge of our own language.

This argument indicates that L1 knowledge is primarily acquired procedurally whereas L2 knowledge is normally learned in a situation where L2 rules are mainly taught in a declarative way, and that there may be a difference in the use of linguistic knowledge between L1 and L2 learners. In fact, applying Anderson's ACT model, R. Ellis (2008a:428) argues that whereas L1 learners almost invariably reach the autonomous stage, L2 learners usually only reach the associative stage. Thus, although L2 learners achieve a fair degree of proceduralisation through practice and they can use L2 rules with little attention to the underlying structures of the rules, unlike L1 native speakers, L2 learners'

language processing is not fully proceduralised (i.e., automatised). García Mayo (2002) posits that L2 learners' intuition is likely to be formed during the process of proceduralisation and can be regarded as a type of implicit/procedural knowledge. However, there exist differences between L1 and L2 learners' intuition, and this may result from a difference in the stage of knowledge about language L1 (the autonomous stage) and L2 learners (the associative stage) can reach.

7. CONCLUSION

7.1 Summary of the major findings and contribution of the study

This study set out to explore the features of the L2 problem-solving process in L2 writing. In order to achieve this aim, 1) what Korean university learners of English notice while they are writing in L2, 2) what variables have an impact on learners' noticing during the L2 problem-solving process, and 3) what internal knowledge sources are employed by learners when they face language problems were examined with 108 English major students recruited from three high ranked universities in Korea, using think-aloud protocols and stimulated-recall interviews.

By generating more refined categorisation of lexical and grammatical episodes, compared to previous studies, this study may help to further examine 1) how learners access and retrieve lexical items when converting ideas into texts and 2) what grammatical features prevent learners from expressing their intended meaning fluently in the process of L2 written production. The results of quantitative data analysis showed that the participants noticed approximately five language problems while producing an L2 text for 20 minutes, and noticed many more lexical episodes than grammatical problems. More specifically, the findings demonstrated that learners tended to pay more attention when they attempted to find an L2 translation equivalent for an L1 word than when they try to choose between two more lexical items or to spell words

correctly. Additionally, learners seem to have difficulty using certain grammatical items, notably articles and plural nouns, during the L2 writing process.

Furthermore, regarding the relations between learner-related variables and noticing during the L2 writing process, it was found that previous study abroad experience and L2 proficiency had effects on learners' noticing. The findings also showed that L2-based working memory had an effect on when learners notice language problems in L2 text production, while L1-based working memory had no effect. These findings may contribute to further investigations of variables affecting noticing in the process of language production. In fact, whereas factors influencing noticing in input such as frequency, expectations, skill level or task demands have been examined (Schmidt, 1990; Skehan, 1998), there have been few studies on the features that impact learners' noticing in output. It can be hypothesised that the factors that may affect noticing in language comprehension and language production are different, since the patterns of paying attention to linguistic items and allocating attentional resources are different between the two processes. Therefore, the current study may offer a foundation for future research that examines the factors affecting learners' noticing, not only with regards to input but also output.

Moreover, the findings of qualitative data analysis indicate that the participants employed various types of knowledge sources in order to solve lexical and grammatical problems. It was demonstrated that both explicit linguistic knowledge sources, such as previously acquired L1-L2 translation word pairs; aspects of word knowledge (form,

meaning, or use); episodic memory or analogy; and implicit knowledge sources, such as intuition, were used during the L2 problem-solving process. By scrutinising what knowledge sources learners use during the L2 writing process, it may be possible to ascertain the current stage of their L2 abilities. As mentioned earlier, while numerous studies have been conducted to interrogate L2 writing strategies, research that straightforwardly inspects the knowledge sources used for the L2 problem-solving process is scant. In this sense, the present study may provide a new approach to exploring L2 learners' interlanguage.

7.2 Limitations

While this study has made several contributions to knowledge in the field of L2 writing, it has some limitations, stemming from the study design and requiring that the results of the study be interpreted with caution. First, in general, the college students participating in this study had a high level of proficiency in L2 English. For practical reasons, the participants were recruited from high-ranking universities, and they were all majoring in English Studies (see Section 3.1). As described before, all of the participants had a relatively advanced level of English language proficiency (average TOEIC score: 916). This apparently affected the number of LREs verbalised during the writing task and the patterns of the use of knowledge sources. Therefore, scrutinising noticing in more disparate L2 proficiency groups may help to shed further light on learners' L2 problem-solving processes in L2 writing.

Secondly, this study examined only one genre, namely, an argumentative essay. Therefore, this research was limited in its scope. Although this type of writing task is pervasive in Korean colleges, and may indeed be fairly common globally, it is difficult to generalise the findings across genres. Learners may encounter different types of linguistic difficulties when performing other types of writing tasks. As Wang (2003:353) notes, 'each different task may place varying demands on learners' writing abilities in terms of sources of information, relation to personal experience, intended readers, and rhetorical forms'. Therefore, different types of writing activities may influence L2 learners' noticing and use of knowledge sources during the L2 writing process in different ways. In order to investigate this issue, future research should incorporate a variety of task types.

Thirdly, this study was limited with regards to the time allocated for the writing tasks. The participants were given a time limit in which to conduct the writing task, because it would have been impossible for one researcher to transcribe lengthier audio-recordings. The selection of the time-constrained writing task might have affected the patterns of learners' noticing, and particularly the frequency of LREs. Kroll (1990) points out that writing under time pressure is an unnatural situation, and time constraints can affect some aspects of writing, including organisation and text production. For instance, if a participant had more time to complete the writing task, he or she might spend more time retrieving L2 lexical items from long-term memory, and probably, experience more episodes of comparing lexical items (i.e., *Selection* episodes). Furthermore, the timed writing task might have made the participants focus their attentional resources more on

words than on syntactic structures. In order to complete the task in a given time, learners might have concentrated more on the content than the correct form. Thus, the time constraint imposed on participants seemingly influenced the management of the formulation processes, including the L2 problem-solving process.

Finally, although the effect of study abroad experience on learners' noticing has been confirmed, there may be a potential confounding variable between two of the independent variables, *Study abroad experience* and *L2 proficiency*. This is because learners having previous study abroad experience are likely to have better L2 proficiency than those who have no experience, based on the fact that the former achieved higher scores in both the receptive vocabulary size test (VLT) and the C-test that the latter counterparts. As pointed out Section 4.3.2, the 'having experience' group had had many more opportunities to speak and write in English than ones in the 'no experience' group, so the levels of L2 proficiency in the two groups were highly likely to be different. It cannot therefore be excluded that *Study abroad experience* and *Proficiency* are tapping into the same underlying construct. It may be possible in future studies to separate these two variables.

7.3 Pedagogical implications for L2 teachers

There are several pedagogical implications that can be drawn from the results of the present study. Firstly, L2 teachers need to provide learners with plentiful opportunities to write in L2 in and out of classrooms. As found in the interview data, the participants

seemed to have difficulties retrieving lexical or grammatical information during the L2 writing process. That is, they recognized a lack in their own linguistic knowledge while performing the writing task. Some participants failed to retrieve the words they wanted to use from their long-term memory. Other pariticpants seemed to spend time trying to retrieve words. As a result, they were not satisfied with their lexical choice, or they gave up their attempts to use the words they wanted to write. This finding may be attributed to the participants' lack of opportunities to practice writing in L2. Therefore, for L2 teachers, it is necessary to provide students with ample chances to practice writing in L2. The findings of this study suggest that this approach encourages learners to pay attention to aspects of productive vocabulary and grammar knowledge and makes the process of written language production more automatic.

Secondly, teachers may need to support learners in studying various aspects of vocabulary knowledge. For language production, learners are required to develop not only the breadth but also the depth of vocabulary knowledge. For this, more meaningful input is needed. Instead of only giving a list of L1-L2 word pairs, teachers might provide learners with chances to study other aspects of word knowledge such as nuances or collocations. For instance, related to nuances, there is a possibility that words that have very distinct meanings to L1 users may be treated by L2 learners as synonyms. It seems that even high proficiency L2 students have difficulties distinguishing subtle differences of meanings between some words, or developing collocational knowledge in L2. To correctly express the intended meaning, learners need to use a word in an appropriate situation, and for this, it is necessary for them to study the contextual features of a word

as well as its definition. In classrooms, for example, it may be helpful to show how a word can be differently interpreted according to context by providing a variety of example sentences.

Lastly, concerning grammar instruction for L2 writing, it may necessary for teachers to give Korean learners instruction on certain grammatical elements that present difficulties during the process of formulating. Although each of the participants in the current study reported on average only 0.5 grammatical problems during 20 minutes of writing, it was obvious that they seemed to have more difficulties with certain grammatical items. In particular, the participants had greater difficulty using articles and plural nouns during the L2 writing process than with other subcategories in grammatical episodes. Since this kind of difficulty arises from the difference between Korean and English, teachers may need to provide learners with more opportunties to practice these categories. For example, by providing numerous sentences including grammatical errors related to noun countability or articles, or purposely asking learners to write sentences including these grammatical features, teachers may help learners internalise those specific grammatical concepts and use them successfully in L2 writing.

7.4 Suggestions for future research

There remains room for exploration and improvement related to the L2 problem-solving process. With regard to noticing, first of all, a number of different variables other than those that were discussed in the present study (i.e., study abroad experience, L2

proficiency, and working memory) can be investigated as factors influencing learners' noticing in the process of L2 writing. For example, there may be other learner-related variables, such as grammatical sensitivity or motivation, that have an impact on noticing. In addition, as mentioned before, different task designs may impact learners' noticing. Types of writing tasks or difficulty of the tasks may influence the pattern of learners' noticing in L2 writing. In addition, since noticing as a cognitive process in L2 writing cannot be studied separately from the social context in which it occurs, social-cultural factors may be another interesting topic to research in noticing. Examining all of these factors related to noticing in output may allow comparison with the factors that have been identified in input, as noted by Schmidt (1990) and Skehan (1998).

In addition, for the current study, the participants' written essays have not been fully investigated, because it was not part of the research questions. However, it may be also worth examining other aspects of writing performance such as accuracy and complexity in order to shed light on the relationship between L2 learners' noticing in writing and L2 writing performance in future studies. It may be interesting to explore whether learners who notice fewer language problems during the L2 writing process actually produce better quality written essays. This area of study in turn may provide useful knowledge for L2 writing teachers.

Investigating the patterns of noticing and the use of knowledge sources with the students in fields of study other than English studies would be also interesting. In the present study, only students majoring in English were recruited, and this might have

affected the noticing and knowledge source data, because these students are presumably better at English writing than other students who are not studying English as a main subject. In contrast, non-English major students might show more linguistic difficulties in the process of L2 written production, since they may have less exposure to English and less opportunity to practice writing in English than the English major counterparts. Studying with college learners across various subject fields may offer new insights into how Korean learners deal with the L2 problem-solving process while producing an L2 text.

Lastly, one of the stimulating and motivating avenues for future research is L2 learners' implicit linguistic knowledge, that is, intuition. As discussed before, learners can develop linguistic intuition on L2 and employ it in the process of L2 written production. However, L2 learners' intuition may be different from L1 native speakers' intuition. This may be attributed to the process of acquiring intuition. For instance, English native speakers form their linguistic intuition through natural exposure to English input. On the other hand, Korean students generally may develop their intuition on English through very limited exposure to English, and constantly test their working hypotheses about vocabulary use and grammatical rules. This different learning situation may make a different level of intuition about language between English native speakers (autonomous level) and Korean EFL learners (associative level). Therefore, in-depth studies of L2 learners' linguistic intuition might examine what conditions produce linguistic intuition for L2 learners and how their intuition works during the L2 problem-solving process in L2 writing.

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APPENDIX 1: Information letter for the universities

Dear head of department,

My name is Jonggab Choi, and I am a DPhil student at the Department of Education at Oxford University. I would like to ask your permission to invite students from your department to participate in a study entitled 'A protocol-based study of the L2 writing process'. This research will be interesting in that it is about what language problems Korean learners face and how they resolve the problems while they are writing in English. I would like to invite 35 students from your department to participate in this research. If you agree for your students to take part in this study, the information they provide may help researchers to better understand second language learners' writing process.

For this study, participants will be asked to do a writing task in English. At the same time, they will be asked to verbalize everything that goes through their minds while doing the task. In fact, verbalizing everything in mind is difficult for people, so there will be a training session before the task. The training session will be conducted for one and a half hours, and participants will be taught how to think aloud through several activities. Participants will then be given 20 minutes with no interruptions for the writing task. The main writing task will be audio-recorded. In addition, after the writing task, some participants will be interviewed on how they resolved the language problems during the writing process, and recordings and writing samples will be used as stimuli. All interviews will be also audio-recorded.

Participants may withdraw at any point from the research without giving me a reason for withdrawal. All information will be treated highly confidentially, and will be kept securely. Only the two primary investigators (I and my supervisor Dr. Catherine Walter) will have access to the data. The data will be used only for the purposes of writing the DPhil dissertation. I will not use students' real names in anything I write, and nor will your university be named.

This project has been viewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.

I would really appreciate your permission for me to invite your students to participate in my study. One thing I have to inform you of in advance is that your department might not be chosen once you show me the intention of participation. This is because only three universities will take part in this study. If you have a query or concern, please feel free to contact me (jonggab.choi@kellogg.ox.ac.uk). You can also contact my supervisor, Dr Catherine Walter (catherine.walter@education.ox.ac.uk).

Yours sincerely,

Jonggab Choi

< Information letter translated in Korean >

존경하는 학과장님께,

안녕하십니까? 저는 옥스퍼드 대학교 교육학과 대학원생 최종갑입니다. 이번에 제가 진행중인 'A protocol-based study of the L2 writing process'연구에 학생들의 참여에 대한 허락을 얻고자 이렇게 편지를 드립니다. 이 연구는 학생들이 영어로 글쓰기를 하는 동안 언어와 관련해 어떤 문제들에 직면하고 그 문제들을 어떻게 해결하는지에 대한 것으로, 굉장히 흥미로운 연구가 될 것입니다. 이 연구를 위해 35 명의 학생들이 참여할 수 있고, 얻어진 결과들은 제 2 언어 글쓰기 과정을 이해하는데 큰 도움이 될 것입니다.

이 연구를 위해, 학생들은 영어 글쓰기 과제 하나를 하게 될 것이며, 동시에, 그들은 글을 쓰는 동안 머리 속에서 생각하는 것을 이야기하게끔 요구 받을 것입니다. 하지만, 글을 쓰면서 자신의 생각을 말하는 것이 학생들에게 생소하고, 또 쉬운 것이 아니기에 본 자료수집 이전에 그 과정을 미리 연습하는 시간이 제공될 것입니다. 약한 시간 반 동안, 학생들은 몇몇 활동들을 통해 생각하는 것을 말하는 연습을 하게 될 것입니다. 본 자료수집은 20 분 동안 이루어질 것이며, 모든 자료 수집 과정은 녹음될 것입니다. 또한, 글쓰기 과제가 끝난 후 몇몇 학생들은 과제를 하는 동안 직면했던 문제들을 어떻게 해결했는지에 대해 녹음된 자료와 학생들이 쓴 글을 바탕으로 인터뷰를 하게 될 것입니다. 이 인터뷰 과정 또한 모두 녹음될 것입니다.

연구에 참여하는 동안, 학생들은 어느 때나 실험 중간에 그만둘 수 있으며, 모든 정보들은 외부에 유출 없이 안전하게 보관될 것입니다. 오로지 두 명의 연구자(저와 저의 지도교수 Dr. Catherine Walter)만이 연구 자료를 볼 수 있으며, 이 모든 자료는 오로지 저의 박사논문을 위해서만 쓰여질 것입니다. 학생들의 이름 등의 개인 신상에 대한 정보는 알려지지 않을 것입니다.

이 연구 과정은 진행 전에 University of Oxford Central University Research Ethics Committee 에 미리 보고되고 검토를 마쳤습니다.

저의 연구에 학생들의 참여를 허락해 주시면 정말 감사하겠습니다. 그 전에 하나 제가 꼭 미리 말씀드려야할 것은, 혹시 저의 연구에 관심을 가져주시고 참여를 허락해 주신다고 하시더라도 후에 실제로 학생들의 참여가 이루어지지 않을 가능성도 있는데, 이유는 제 연구에는 세 학교의 참여만이 필요하기 때문입니다. 혹시 연구 참여를 결정하는 데 있어서 더 필요한 정보가 있거나 제가 도와드릴 일이 있으면, 언제든지 저에게 연락 주시거나 (jonggab.choi@kellogg.ox.ac.uk), 저의 지도 교수인 Dr. Catherine Walter 에게 연락하실 수 있습니다. (catherine.walter@education.ox.ac.uk).

읽어주셔서 감사합니다.

최종갑

APPENDIX 2: CUREC application

University of Oxford
CENTRAL UNIVERSITY RESEARCH ETHICS COMMITTEE (CUREC)
IDREC Checklist

Principal investigator/supervisor/student researcher (title and name):	Jonggab Choi
FOR STUDENT RESEARCH PROJECTS ONLY ***Name of Supervisor:***	Dr. Catherine Walter
Department or institute:	Department of Education
Address for correspondence:	15 NorhamGardens
E-mail and telephone contact:	Jonggab.choi@kellogg.ox.ac.uk 07581 075383

FAQ 12

Before completing this checklist, please ensure you have consulted the following CUREC guidance documents available on the CUREC website at http://www.admin.ox.ac.uk/curec/resrchapp/index.shtml:

Guidance on approval process
Glossary
FAQs

This checklist is the first stage of the University of Oxford's scrutiny procedure for *research involving *human participants. (Definitions of terms marked with an asterisk are to be found in CUREC's glossary and guidance).

The University aims to ensure that all research is subject to *appropriate* ethical scrutiny. This form is designed to identify those projects which fall outside CUREC's remit; those which fall within CUREC's remit but which pose low risks to participants and so need scrutiny only through this checklist; and those which fall within CUREC's remit and which pose greater risk to participants and so need more scrutiny. If you need further advice or if you have comments about this form, please consult the relevant IDREC officer (please see: http://www.admin.ox.ac.uk/curec/oxonly/contact.shtml).

FAQ 26

The checklist should be completed by the *principal investigator/supervisor/student researcher (under the guidance of his/her supervisor) undertaking or supervising research which comes under CUREC's responsibility. Please carry out a risk assessment of the project, in consultation with all researchers involved, using the checklist and CUREC's other documentation.

This form does not cover research governance, satisfactory methodology, or the health and safety of employees and students. As principal investigator, it is your responsibility to ensure that requirements in these areas are met.

Office use only:

IDREC Ref. No. ___________________
Date of confirmation that checklist accepted on behalf of IDREC: // //

Section A

Title and brief lay description of *research (about 150 words), plus description (about 200 words) of the nature of participants (including the criteria for inclusion/exclusion, method of recruitment, attaching samples of participant information and consent forms), purpose of the research, methods to be used, how professional guidelines are being applied (if applicable) and use to which the results/data will be put.

Learners' noticing in the L2 writing process: An exploratory study of Korean university learners With the prevalence of the Communicative Language Teaching approach, communicative competence has been focused upon, and productive skills have been stressed more than they were before in English as a foreign language (EFL) classrooms. Korea is no exception to this trend, and in particular, writing has recently been regarded as an important aspect of foreign language learning. The aim of this research is to investigate what learners notice while they are writing in L2, what variables are related to noticing during the L2 writing process and what knowledge sources they use when they face language problems. This research will focus on the following research questions: 1) what aspects of language do Korean learners notice while writing in L2? 2) does the learners' L2 proficiency have effects on noticing during the L2 writing process? 3) is noticing while writing in L2 related to learners' working memory capacity? 4) is noticing while writing in L2 related to learners' L2 writing performance? 5) what sources of knowledge do they employ to resolve language problems they face? For this research, 100 English major students who are over 18 years old will be recruited from three high ranked universities in Korea. There are several steps for gaining samples. First of all, among top 10 universities in Korea, three universities will be excluded because one is a women's university, and there is no English department in the other two universities. Therefore, a letter for permission for the study will be sent to seven universities, and three universities will be selected among universities that show me the intention of participation. Then, once permission from the head of the English department from three universities is obtained, all English major undergraduate students in each university will be contacted via email or through their instructors. In addition, with the help of the department's staff, I will be able to give explanation of my research aims and procedures to students in class. Through this process, about 35 students from each university will be recruited. In addition, piloting will be conducted with several students in one of the seven universities, before the main data collection. Ten students will be recruited for piloting, and the data of the pilot study will be analyzed and reported to my supervisor. Therefore, I will be able to revise the instruments on the basis of the pilot results, and the main data collection will be conducted with the revised instruments. As the main means of collecting data, think-aloud protocols and stimulated-recall interviews will be employed. First, all participants will be asked to do a writing task in L2 and to verbalize everything that goes through their minds while producing written texts. Before the main data collection, participants will be taught how to think aloud through a training session. For the main writing task, they will be given 20 minutes with no interruption. In addition, after the writing task, 30 of 100 participants will be interviewed on the sources of knowledge (i.e. how to resolve language problems during the writing process), and recordings and writing samples will be used as stimuli. The writing task and all interviews will be audio-recorded. Participants' audio-recordings will be transcribed, and all data will be anonymised and confidential. It will be held securely (locked or passworded), and all identifying details will be destroyed one year after the end of the project, with only anonymised data sets made available to other researchers. Moreover, the results of this study will only be used for this dissertation and for any other publications or presentations arising from it.	
List all *sites where project will be conducted:	***Three or more of the following: Seoul National University; Yonsei University; Korea University; Sungkyunkwan University; Kyunghee University; Sogang University; Hanyang University, Korea***
Anticipated duration of project:	**18** months

Anticipated start and end dates:	From 10 / 3 / 2011 until 30 / 9 / 2012		
Name and status (e.g. 3rd year undergraduate; post-doctoral research assistant) of others taking part in the project:	N/A		
External organisation funding the research (if applicable - see also Section D):	N/A		
	Does the funding body require some form of monitoring of the conduct of the research until completion (eg. annual ethical re-approval of the study)?	**YES**	**NO**
Please indicate what training on research ethics you have received, e.g. online training in ethics/human subject protection etc.			

Section B

(Please put a tick in the yes/no column as appropriate to indicate your response).

	YES	NO
1). Does your study primarily aim to monitor and/or improve the performance of a particular service provider?		X
2) Will your conclusions be applicable wholly or primarily to that service provider?		X
3) Are you conducting your study on behalf of or at the request of a service provider?		X

If you have answered 'yes' to any question in section B it is likely that your study is *audit, not *research. Please check the CUREC glossary and if your study is audit you need not submit your proposal for ethical scrutiny. If you have answered 'no' to all questions please proceed to section C.

Section C

(Please put a tick in the yes/no column as appropriate to indicate your response).

	YES	NO
*1) Will the research involve *human participants recruited by means of their status as present or past NHS *patients or their relatives or carers or present or past NHS staff?*		X
*2) Will the research involve *personal data of any of the people listed in question C 1 above ?*		X

3) *Will the research in whole or part be carried out on NHS premises or using NHS facilities?*	**YES**	**NO**
		X
4) *Does the research involve administering any drug, placebo, or other substances to participants in the European Union (EU)?*	**YES**	**NO**
		X
5) *Does the research involve ionising radiation in the EU?*	**YES**	**NO**
		X
6) *Does the research involve human genetic research in the EU?*	**YES**	**NO**
		X
7) *Does the research involve magnetic resonance imaging in the EU?*	**YES**	**NO**
		X
8) *Does the research involve use of organs or other bodily material of past and present NHS patients?*	**YES**	**NO**
		X
9) *Does the research involve any other *invasive procedure (Class A) not described above?*	**YES**	**NO**
		X
10) *Does the research involve *human participants aged 16 and over who do not have *capacity to consent for themselves?* *[Please note that the definition of *capacity has been altered by the Mental Capacity Act 2005; see the Glossary on the CUREC website for further information]*	**YES**	**NO**
		X

If you have answered 'yes' to any question in section C please stop work on this checklist as you will need to submit your proposal to the appropriate NHS ethics committee. Further details may be obtained from the website http://www.nres.npsa.nhs.uk. Please submit the NHS Ethics Committee approval to the relevant IDREC officer for information when received.
If your research involves any of the above procedures but will be carried out by University of Oxford staff wholly outside the EU, your research will be reviewed by OXTREC (http://www.tropicalmedicine.ox.ac.uk/oxtrecframeset.htm). **If you have answered 'no' to all questions so far, please proceed to section D.**

Section D

(Please put a tick in the yes/no column as appropriate to indicate your response).

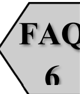
1) *Is the study to be funded by the US National Institutes of Health or another US federal funding agency?*	**YES**	**NO**
		X

If you have answered 'yes' to the question in section D please stop work on this checklist as you will need to submit your proposal to OXTREC which uses separate documentation (http://www.tropicalmedicine.ox.ac.uk/oxtrecframeset.htm)**.**
If you have answered 'no' to all questions so far, please proceed to section E.

Section E

(Please put a tick in the yes/no column as appropriate to indicate your response).

1) Are all the data about people to be used in your study previously collected anonymised data which neither you nor anyone else involved in your study can trace back to the individuals who provided them (e.g. census data, administrative data, secondary analysis)? Please refer to the definition of *personal data in the glossary and FAQ no. 6 for further guidance.	**YES**	**NO**
		X



If you have answered 'yes' to the question in section E please stop work on this checklist as you do not need to secure ethical approval for your study. There is no need to submit any details to IDREC as such research does not constitute research involving human participants for review purposes.
If you have answered 'no' to all questions so far, please proceed to section F.

Section F

Methods to be used in the study (**tick** as many as apply: this information will help the committee understand the nature of your research and may be used for audit).

METHOD USED	PLEASE TICK
Unstructured interview	
Semi-structured interview	X
Structured interview	
Questionnaire	
Analysis of existing records	
Participant performs verbal/paper and pencil/computer based task	X
Measurement/recording of motor behaviour	
Audio recording of participant	X
Video recording or phtotography of participant	
Physiological recording from participant	
Participant observation	
Systematic observation	
Observation of specific organisational practices	
Other (please specify) ***Think-aloud protocol***	X

Section G

See protocols

(Please put a tick in the yes/no column as appropriate to indicate your response).

	YES	NO
1). Have you made arrangements to obtain written *informed consent from participants?	X	
2) Have you made arrangements to ensure that *personal data collected from participants will be held in compliance with the requirements of the Data Protection Act?	X	

3) If your research involves any use of *personal data obtained from a *third party, have you checked to ensure that the *third party has arrangements in place to permit disclosure?	**YES**	**N/A**	**NO**
		X	
4) Does the research involve as participants *people whose ability to give free and informed consent is in question?	**YES**		**NO**
			X
5) Does the research involve any alteration of participants' normal patterns of sleeping, eating, or drinking?	**YES**		**NO**
			X
6) Is there a significant risk that the research will expose participants to visual, auditory, or other environmental stimuli of a level or type that could have short- or long-term harmful physical effects?	**YES**		**NO**
			X
7) Is there a significant risk that the research will induce anxiety, stress or other harmful psychological states in participants that might persist beyond the duration of the test/interview?	**YES**		**NO**
			X
8) Does the research involve exposing participants to any physical or psychological hazard, beyond those of their usual everyday life, not covered by questions 6 and 7?	**YES**		**NO**
			X
9) Does the research involve any *invasive procedure (Class B)?	**YES**		**NO**
			X
10) Will the research elicit information from participants that might render them liable to criminal proceedings (e.g. information on drug abuse or child abuse)?	**YES**		**NO**
			X
11) Does the research involve the *deception of participants?	**YES**		**NO**
			X
12) Will the research require a participant to spend more than 2 hours in any single session on activities designed by the researcher (NB this time restriction does not refer to situations where participants are observed going about activities not devised by the researchers e.g. observation of lessons in schools)?	**YES**		**NO**
			X

13) *Will the research involve a significant risk of any harm of any kind to any participant not covered above?*	YES	NO
		X

If any of your answers in section G are in a shaded box, please complete section H. If all your answers in section G are in the unshaded boxes, please complete section I.

Section H

One or more aspect(s) of your research project suggest(s) that it may pose risks to participants (see shaded box(es) ticked in section G).

FAQ 19-2

Are all the aspects of your project which caused you to tick a shaded box in section G fully covered by research protocol(s) which has/ve received IDREC/CUREC approval?	YES	NO
	Please give IDREC protocol number (s). Please proceed to section I.	Please complete this form AND form CUREC/2 and submit both to the relevant Inter Divisional Research Ethics Committee.
If you answered NO to question 1) in Section G concerning informed consent but a section of the Code of Practice governing your research activity is relevant, are you going to apply the standard set out in the Code of Practice?	Name of Code of Practice and section number: Please ensure that the description in section A indicates how the Code is applied and proceed to section I.	Please complete this form AND form CUREC/2 and submit both to the relevant Inter Divisional Research Ethics Committee.

FAQ 26

Section I

FAQ 19&2

Complete this section only if you do not need to submit form CUREC/2.

I understand my responsibilities as principal researcher/supervisor/student researcher as outlined on p.1 of this form and in the CUREC glossary and guidance.

I declare that the answers above accurately describe my research as presently designed and that I will submit a new checklist should the design of my research change in a way which would alter any of the above responses so as to require completion of CUREC 2/full scrutiny by an IDREC. I will inform the relevant IDREC if I cease to be the principal researcher on this project and supply the name and contact details of my successor if appropriate.

FAQs 28&3

Signed by principal researcher/supervisor/student researcher:…………………… ………………
Date:…………………
Print name (block capitals)…………………………………………………………………………
Signed by supervisor:……………………………………………………………(for student projects)
Date:…………………
Print name (block capitals)…………………………………………………………………………
I understand the questions and answers that have been entered above describing the research, and I will ensure that my practice in this research complies with these answers.

Signed by associate/other researcher: ………………………………………………………………

Print name (block capitals)………………………………………………………………………………
Date ………………

I have read the research project application named above. On the basis of the information available to me, I:

(i) consider the principal researcher/supervisor/student researcher to be aware of her/his ethical responsibilities in regard to this research;

(ii) consider that any ethical issues raised have been satisfactorily resolved or are covered by CUREC approved protocols, and that it is appropriate for the research to proceed without further formal ethical scrutiny at this stage (noting the principal researcher's obligation to report should the design of the research change in a way which would alter any of the above responses);

(iii) am satisfied that the proposed project has been/will be subject to appropriate *peer review and is likely to contribute something useful to existing knowledge and/or to the education and training of the researcher(s) and that it is in the *public interest.

(iv) [FOR DEPARTMENTS/FACULTIES WITH A DEPARTMENTAL RESEARCH ETHICS COMMITTEE (DREC) OR EQUIVALENT BODY - PLEASE DELETE IF NOT APPLICABLE] confirm that this checklist (and associated research outline) has been reviewed by the Department's Research Ethics Committee (DREC)/equivalent body, and attach the associated report from that body.

Signed:……………………………………….**(Head of department or nominee e.g Chair of DREC, Director of Graduate Studies for student projects)**
Print name (block capitals)………………………………………………………………………………
Date:……………………

Please send an electronic copy and a paper copy of this completed checklist to whichever of the IDRECs is more suitable (Social Sciences or Medical Sciences), keeping a copy for yourself.

Forms may be sent by email (without signature), where both the note of submission from the researcher and the note of endorsement from the supervisor/Head of Department are sent from a University of Oxford email address.

IDRECs and/or CUREC will review a sample of completed checklists and may ask for further details of any project.

FINAL CHECK

To prevent delay please check each of the following before submitting the application.

Have you completed Section A and answered all relevant questions in Sections B-H? ☐

Have you defined all technical terms and abbreviations used? ☐

Have you included all questionnaires and participant information, consent forms, advertisements, and surveys to be used? ☐

Have you included all relevant approvals and supporting letters? ☐

Have you declared all potential conflicts of interest? ☐

Are all pages (including appendices and attachments) numbered? ☐

Are all relevant declarations in Section I complete and any necessary authorisations obtained (by email or by signing the form)? ☐

Revised May 2009

APPENDIX 3: Letter of CUREC consent

UNIVERSITY OF OXFORD
DEPARTMENT OF EDUCATION

15 Norham Gardens, Oxford OX2 6PY
Tel: +44(0)1865 274024 Fax: +44(0)1865 274027
general.enquiries@education.ox.ac.uk www.education.ox.ac.uk

Director Professor Anne Edwards

23/02/2011

Dear Jonggab Choi,

Application Approval

Title: Learners' Noticing in the L2 Writing Process: An Exploratory Study of Korean University Learners

The above application has been considered on behalf of the Departmental Research Ethics Committee (DREC) in accordance with the procedures laid down by the University for ethical approval of all research involving human participants.

I am pleased to inform you that, on the basis of the information provided to DREC, the proposed research has been judged as meeting appropriate ethical standards, and accordingly approval has been granted.

Should there be any subsequent changes to the project, which raise ethical issues not covered in the original application, you should submit details to DREC for consideration.

Yours sincerely,

Justina Kurkova
Research Office Assistant

APPENDIX 4: Participant Information Sheet

Dear head of department,

My name is Jonggab Choi, and I am a DPhil student at the Department of Education at Oxford University. I would like to ask your permission to invite students from your department to participate in a study entitled 'A protocol-based study of the L2 writing process'. This research will be interesting in that it is about what language problems Korean learners face and how they resolve the problems while they are writing in English. I would like to invite 35 students from your department to participate in this research. If you agree for your students to take part in this study, the information they provide may help researchers to better understand second language learners' writing process.

For this study, participants will be asked to do a writing task in English. At the same time, they will be asked to verbalize everything that goes through their minds while doing the task. In fact, verbalizing everything in mind is difficult for people, so there will be a training session before the task. The training session will be conducted for one and a half hours, and participants will be taught how to think aloud through several activities. Participants will then be given 20 minutes with no interruptions for the writing task. The main writing task will be audio-recorded. In addition, after the writing task, some participants will be interviewed on how they resolved the language problems during the writing process, and recordings and writing samples will be used as stimuli. All interviews will be also audio-recorded.

Participants may withdraw at any point from the research without giving me a reason for withdrawal. All information will be treated highly confidentially, and will be kept securely. Only the two primary investigators (I and my supervisor Dr. Catherine Walter) will have access to the data. The data will be used only for the purposes of writing the DPhil dissertation. I will not use students' real names in anything I write, and nor will your course and university be named.

This project has been viewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.

I would really appreciate your permission for me to invite your students to participate in my study. One thing I have to inform you of in advance is that your department might not be chosen once you show me the intention of participation. This is because only three universities will take part in this study. If you have a query or concern, please feel free to contact me (jonggab.choi@kellogg.ox.ac.uk). You can also contact my supervisor, Dr Catherine Walter (catherine.walter@education.ox.ac.uk).

Yours sincerely,

Jonggab Choi

< Information sheet translated in Korean >

학생들에게,

안녕하십니까? 저는 옥스퍼드 대학교 교육학과 대학원생 최종갑입니다. 이번에 제가 진행중인 연구에 여러분들의 참여를 부탁드리고자 합니다. 연구에 대한 세부 정보는 아래에 있으니, 참여를 결정하기 전에 주의깊게 읽어주시면 감사하겠습니다.

이 연구는 한국 학생들이 영어로 글쓰기를 하는 동안 언어와 관련해 어떤 문제들에 직면하는지, 그리고 어떻게 그 문제들을 해결하는 지에 대해 알아보고자 하는 것입니다. 이 연구를 통해 얻게 되는 정보들은 외국어 교육, 특히 영어 글쓰기 교육에 많은 도움이 될 것입니다. 이 연구에 참여하신다면, 여러분들은 영어 글쓰기 과제 하나를 받게 될 것이며, 그 과제를 하는 동안, 여러분이 생각하시는 모든 것을 말하도록 요구받을 것입니다. 이 과정이 매우 어렵게 보이기는 하지만, 본 자료 수집에 앞서 어떻게 하는 것인지 미리 연습할 수 있는 시간이 제공될 것입니다. 약 한 시간 반 동안 설명을 듣고 연습을 하면서, 본인의 생각을 어떻게 말로 표현하는지 제가 알려드릴 것입니다. 본 자료 수집은 20 분동안 이루어질 것이고, 여러분이 말하는 것은 녹음될 것입니다. 또한, 글쓰기 과제 후에, 원하는 사람들에 한해 글을 쓰는 동안 직면했던 문제들을 어떻게 해결했는지에 대하여 인터뷰를 할 수도 있습니다. 이 인터뷰 과정 또한 모두 녹음될 것입니다.

이 연구는 여러분의 자발적인 참여를 바탕으로 진행될 것입니다. 따라서 실험 도중 어느 때나 여러분이 원할 때 그만 둘 수 있고, 원치 않는 대답은 안 하셔도 됩니다. 여러분들로부터 제가 얻게 될 정보들은 외부에 유출없이 안전하게 보관될 것이며, 여러분의 신분이 다른 사람들에게 드러날 일은 전혀 없을 것입니다. 이 연구가 끝나고 일년 후에는, 여러분의 신상에 관한 정보는 모두 파기될 것이며, 오로지 익명으로 된 자료만이 다른 연구를 위해 쓰여질 수 있습니다.

이 연구의 결과들은 저의 박사논문을 위해서 쓰일 것이며, 저널이나 학술 보고서를 위해 쓰일 수도 있습니다. 다시 한 번 말씀드리지만, 모든 자료는 익명으로 처리될 것이며, 여러분의 신상이 공개될 가능성은 전혀 없습니다. 혹시 이 연구의 결과가 궁금하시다면, 그 결과에 대한 요약본을 저의 이메일을 통해 받아보실 수 있습니다. 이 연구에 대한 질문이 있으시면, 주저 없이 저에게 (jonggab.choi@kellogg.ox.ac.uk) 연락해 주시거나, 저의 지도교수이신 Dr. Catherine Walter 에게 이메일 (catherine.walter@education.ox.ac.uk)을 통해 연락하시면 됩니다.

읽어주셔서 감사합니다.

최종갑

APPENDIX 5: Demographic information of participants

Characteristics of the participants

		Univ. A	Univ. B	Univ. C	Total
Age	Mean (SD)	21.8 (1.8)	22.0 (1.7)	20.8 (1.1)	21.5 (1.6)
	Range	20 - 26	21 - 28	20 - 25	20 - 28
Gender	Male	10	8	7	25
	Female	22	30	31	83
	Total	32	38	38	108
Year of study	Freshman	9	0	20	29
	Sophomore	9	24	12	45
	Junior	7	9	6	22
	Senior	7	5	0	12
TOEIC score	Mean (SD)	905 (65)	935 (48)	906 (73)	916 (63)
	Range	750 - 985	750 - 990	740 - 990	740 - 990

APPENDIX 6: Interview protocol for participants' information

Protocol: Interview for collecting data of participants' demographic information and previous study abroad experience

1. Participant background

1) What is your name?
____

2) How old are you?
____

3) What is your current year of study?
A: Freshmen B: Sophomore C: Junior D: Senior

4) Have you taken any English writing classes so far after entering university?
A: Yes B: No
4-1) If Yes, briefly describe the classes you have taken.

5) Have you ever taken any type of English language proficiency test?
A: Yes B: No
5-1) If Yes, which test have you taken?
5-2) Could you tell me your test score you have had within two years?

2. Previous study abroad experience

1) Have you had any previous study abroad experience?
A: Yes B: No
1-1) If Yes, which countries?
1-2) How long?
1-3) When?
1-4) Could you describe the class (including assignment) you had taken?

APPENDIX 7: Vocabulary Levels Test-Version 2

Name: ____________________________ Date: _______________________________

The 2000 word level

1 copy
2 event ______ end or highest point
3 motor ______ this moves a car
4 pity ______ thing made to be like
5 profit another
6 tip

1 admire
2 complain ______ make wider or longer
3 fix ______ bring in for the first time
4 hire ______ have a high opinion of
5 introduce someone
6 stretch

1 accident
2 debt ______ loud deep sound
3 fortune ______ something you must pay
4 pride ______ having a high opinion of
5 roar yourself
6 thread

1 arrange
2 develop ______ grow
3 lean ______ put in order
4 owe ______ like more than something
5 prefer else
6 seize

1 coffee
2 disease ______ money for work
3 justice ______ a piece of clothing
4 skirt ______ using the law in the right
5 stage way
6 wage

1 blame
2 elect ______ make
3 jump ______ choose by voting
4 manufacture ______ become like water
5 melt
6 threaten

1 clerk
2 frame ______ a drink
3 noise ______ office worker
4 respect ______ unwanted sound
5 theater
6 wine

1 ancient
2 curious ______ not easy
3 difficult ______ very old
4 entire ______ related to God
5 holy
6 social

1 dozen
2 empire ______ chance
3 gift ______ twelve
4 opportunity ______money paid to the
5 relief government
6 tax

1 bitter
2 independent ______ beautiful
3 lovely ______ small
4 merry ______ liked by many people
5 popular
6 slight

The 3000 word level

1 bull
2 champion _____ formal and serious manner
3 dignity _____ winner of a sporting event
4 hell _____ building where valuable objects are shown
5 museum
6 solution

1 abandon
2 dwell _____ live in a place
3 oblige _____ follow in order to catch
4 pursue _____ leave something permanently
5 quote
6 resolve

1 blanket
2 contest _____ holiday
3 generation _____ good quality
4 merit _____ wool covering used on beds
5 plot
6 vacation

1 assemble
2 attach _____ look closely
3 peer _____ stop doing something
4 quit _____ cry out loudly in fear
5 scream
6 toss

1 comment
2 gown _____ long formal dress
3 import _____ goods from a foreign
4 nerve _____ par of the body which carries feeling
5 pasture
6 tradition

1 drift
2 endure _____ suffer patiently
3 grasp _____ join wool threads together
4 knit _____ hold firmly with your hands
5 register
6 tumble

1 administration
2 angel _____ group of animals
3 frost _____ spirit who serves God
4 herd _____ managing business and affairs
5 fort
6 pond

1 brilliant
2 distinct _____ thin
3 magic _____ steady
4 naked _____ without clothes
5 slender
6 stable

1 atmosphere
2 counsel _____ advice
3 factor _____ a place covered with grass
4 hen _____ female chicken
5 lawn
6 muscle

1 aware
2 blank _____ usual
3 desperate _____ best or most important
4 normal _____ knowing what is happening
5 striking
6 supreme

Academic Vocabulary

1 area	
2 contract	_____ written agreement
3 definition	_____ way of doing something
4 evidence	_____ reason for believing
5 method	something is or is not true
6 role	

1 alter	
2 coincide	_____ change
3 deny	_____ say something is not true
4 devote	_____ describe clearly and exactly
5 release	
6 specify	

1 debate	
2 exposure	_____ plan
3 integration	_____ choice
4 option	_____ joining something into a
5 scheme	whole
6 stability	

1 correspond	
2 diminish	_____ keep
3 emerge	_____ match or be in agreement
4 highlight	with
5 prefer	_____ give special attention to
6 seize	something

1 access	
2 gender	_____ male or female
3 implementation	_____ study of the mind
4 license	_____ entrance or way in
5 orientation	
6 psychology	

1 bond	
2 channel	_____ make smaller
3 estimate	_____ guess the number or size
4 identify	or something
5 mediate	_____ recognizing and naming
6 minimize	a person or thing

1 accumulation	
2 edition	_____ collecting things over time
3 guarantee	_____ promise to repair
4 media	a broken product
5 motivation	_____ feeling a strong reason
6 phenomenon	or need to do something

1 explicit	
2 final	_____ last
3 negative	_____ stiff
4 professional	_____ meaning ‘no’ or ‘not’
5 rigid	
6 sole	

1 adult	
2 exploitation	_____ end
3 infrastructure	_____ machine used to move
4 schedule	people or goods
5 termination	_____ list of things to do at
6 vehicle	certain times

1 abstract	
2 adjacent	_____ next to
3 controversial	_____ added to
4 global	_____ concerning the whole
5 neutral	world
6 supplementary	

The 5000 word level

1 analysis		
2 curb	______	eagerness
3 gravel	______	loan to buy a house
4 mortgage	______	small stones mixed with sand
5 scar		
6 zeal		

1 contemplate		
2 extract	______	think about deeply
3 gamble	______	bring back to health
4 launch	______	make someone angry
5 provoke		
6 revive		

1 cavalry		
2 eve	______	small hill
3 ham	______	day or night before a holiday
4 mound	______	soldiers who fight from horses
5 steak		
6 switch		

1 demonstrate		
2 embarrass	______	have a rest
3 heave	______	break suddenly into small pieces
4 obscure	______	make someone feel shy or nervous
5 relax		
6 shatter		

1 circus		
2 jungle	______	musical instrument
3 nomination	______	set without a back or arms
4 sermon	______	speech given by a priest in a church
5 stool		
6 trumpet		

1 correspond		
2 embroider	______	exchange letters
3 lurk	______	hide and wait for someone
4 penetrate	______	feel angry about something
5 prescribe		
6 resent		

1 artillery		
2 creed	______	a kind of tree
3 hydrogen	______	system of belief
4 maple	______	large gun on wheels
5 pork		
6 streak		

1 decent		
2 frail	______	weak
3 harsh	______	concerning a city
4 incredible	______	difficult to believe
5 municipal		
6 specific		

1 chart		
2 forge	______	map
3 mansion	______	large beautiful house
4 outfit	______	place where metals are made and shaped
5 sample		
6 volunteer		

1 adequate		
2 internal	______	enough
3 mature	______	fully grown
4 profound	______	alone away from other things
5 solitary		
6 tragic		

The 10000 word level

1 alabaster	
2 chandelier	______ small barrel
3 dogma	______ soft white stone
4 keg	______ tool for shaping wood
5 rasp	
6 tentacle	

1 dissipate	
2 flaunt	______ steal
3 impede	______ scatter or vanish
4 loot	______ twist the body about
5 squirm	uncomfortably
6 vie	

1 benevolence	
2 convoy	______ kindness
3 lien	______ set of musical notes
4 octave	______ speed control for an
5 stint	engine
6 throttle	

1 contaminate	
2 cringe	______ write carelessly
3 immerse	______ move back because of
4 peek	fear
5 relay	______ put something under
6 scrawl	water

1 bourgeois	
2 brocade	______ middle class people
3 consonant	______ row or level of something
4 prelude	______ cloth with a pattern or gold
5 stupor	or silver threads
6 tier	

1 blurt	
2 dabble	______ walk in a proud way
3 dent	______ kill by squeezing
4 pacify	someone's throat
5 strangle	______ say suddenly without
6 swagger	thinking

1 alcove	
2 impetus	______ priest
3 maggot	______ release from prison early
4 parole	______ medicine to put on wounds
5 salve	
6 vicar	

1 illicit	
2 lewd	______ immense
3 mammoth	______ against the law
4 slick	______ wanting revenge
5 temporal	
6 vindictive	

1 alkali	
2 banter	______ light joking talk
3 coop	______ a rank of British nobility
4 mosaic	______ picture made of small
5 stealth	pieces of glass or stone
6 viscount	

1 indolent	
2 nocturnal	______ lazy
3 obsolete	______ no longer used
4 torrid	______ clever and tricky
5 translucent	
6 wily	

APPENDIX 8: Texts selected from ESL textbooks for the C-test development

1.
The germs that make people sick are everywhere. You cannot see them, but they're there. They're sitting on your desk. They're hiding on your computer's keyboard. They're even in the air that you are breathing. There are two types of germs: viruses and bacteria. Viruses are germs that can only live inside animals or plants. Viruses cause illnesses such as the flue and measles. Bacteria are tiny creatures. Some bacteria are good. They can help your stomach break down food. Other bacteria aren't so good. They can make you sick.

2.
In the huge, open lands of the American west, herding cattle is one way to make a living. The image of the cowboy on his horse is a familiar one, but in reality, women also participate in ranch work. This reality can be seen in the rodeo, where cowboys and cowgirls compete in roping young steer, and riding adult bulls. Throwing a rope around a steer is something ranchers must do in order to give the young animals medicine or to mark the steers as their property. On the other hand, riding on the back of a large and angry bull is purely for sport-a brutal and dangerous sport. But that danger doesn't stop the men and women who love rodeo.

3.
For every mystery, there is someone trying to figure out what happened. Scientists, detectives, and ordinary people search for evidence that will help to reveal the truth. They investigate prehistoric sites trying to understand how and why ancient people constructed pyramids or created strange artwork. They study the remains of long-extinct animals and they speculate about how the animals might have looked when they were alive. Anything that is unexplained is fascinating to people who love a mystery.

4.
Using less energy to begin with may be the easiest way for most of us to decrease carbon emissions. Switching from old-fashioned incandescent light bulbs to high-efficiency fluorescent lights dramatically decreases out electrical consumption. Lifestyle changes are also important, for example, turning off computer monitors when we're not using them and riding bicycles or using public transportation. Finally, if all new buildings, appliances, and vehicles were designed with energy efficiency in mind, we could stabilize or even decrease the amount of carbon entering the atmosphere.

5.
There was once a town in the heart of America where all life seemed to live in harmony with its surroundings. The town lay in the midst of a checkerboard of prosperous farms, with fields of grain and hillsides of orchards where, in spring,

white clouds of bloom drifted above the green fields. In autumn, oak and maple and birch trees set up a blaze of color that flamed and flickered across a backdrop of pines. Then foxes barked in the hills and deer silently crossed the fields, half hidden in the mists of the fall morning.

6.
The development of resistant populations of pathogens can be averted in at least four ways. First, sufficiently high concentrations of the drug can be maintained in a patient's body for a long enough time to kill all sensitive cells and inhibit others long enough for the body's defenses to defeat them. Discounting a drug before all of the pathogens have been neutralized promotes the development of resist strains. For this reason, it is important that patients finish their entire antimicrobial prescription and resist the temptation to "save some for another day."

7.
Despite crime statistics that indicate urban crime is falling, fear of crime is as prevalent as ever. When neighbors come together to discuss what they can do to help reduce crime, there are certain measures they can take. The "hardening" of targets, controlling access, and offender deflection are a few approaches home owners and communities can use to reduce criminal activity. Hopefully, urban planners will keep these methods in mind as they plan the communities of the future.

8.
Car sharing programs have environmental and financial advantages that should make them even more popular in the future. Currently, diffusion of information about this innovation related to traditional car ownership has been limited to the Internet. This means that access to this information has been restricted to countries that have easy access to the Internet. Furthermore, without a cosmopolitan or local opinion leader to promote car sharing programs, diffusion of information about this innovation will continue to be slow.

APPENDIX 9: C-test

Name: ______________________________ Date: _________________________

Please complete the missing parts of the words.

1. For every mystery, there is someone trying to figure out what happened. Scientists, detec________, and ordi________ people sea________ for evid________ that wi________ help t________ reveal t________ truth. Th________ investigate prehi________ sites try________ to under________ how a________ why anc________ people const________ pyramids o________ created beau________ artwork. Th________ study t________ remains o________ long-ext________ animals a________ they spec________ about h________ the ani________ might ha________ looked when they were alive. Anything that is unexplained is fascinating to people who love a mystery.

2. Despite crime statistics that indicate urban crime is falling, fear of crime is as prevalent as ever. When neig________ come toge________ to dis________ what th________ can d________ to he________ reduce cr________, there a________ certain meas________ they c________ take. T________ "hardening" o________ targets, contr________ access, a________ offender defle________ are a f________ approaches ho________ owners a________ communities c________ use t________ reduce crim________ activity. Hope________, urban plan________ will ke________ these met________ in mind as they plan the communities of the future.

3. Using less energy to begin with may be the easiest way for most of us to decrease carbon emissions. Switching fr________ old-fash________ incandescent li________ bulbs t________ high-effic________ fluorescent lig________ dramatically decr________ our elect________ consumption. Lifes________ changes a________ also impo________, for exa________, turning o________ computer moni________ when we'________ not us________ them a________ riding bicy________ or tak________ public transpo________. Finally, i________ all n________ buildings, appli________, and vehi________ were desi________ with energy efficiency in mind, we could stabilize or even decrease the amount of carbon entering the atmosphere.

4. Car sharing programs have environmental and financial advantages that should make them even more popular in the future. Currently, diff________ of infor________ about th________ innovation rel________ to tradi________ car owne________ has be________ limited t________ the Inte________. This me________ that acc________ to th________ information h________ been restr________ to coun________where connec________ is go________ and comp________ use wides________. Furthermore, wit________ a cosmop________ or lo________ opinion lea________ to pro________ car sha________ programs, distribution of information about this innovation will continue to be slow.

Appendix 10: Working memory test items

Working memory test items with a condition starting in English with the original list

The soldiers showed how severely the picture was punished.
This strategy could cause more problems than it solves.

We don't know when he is arriving.
This sentence doesn't understand what I mean.

I thoroughly approve of what the government is doing.
The film doesn't know if I have started.

If you are fake, these paintings will be punished.
While his car was paying for fuel, he was stolen.

The dishwasher didn't know that Jane wasn't working.
Consumers usually buy fewer goods when prices rise.

버스가 떠난 후에 그녀는 자신의 지갑이 없어졌다는 사실을 알았다.
누구나 앞으로 어떤 일이 일어날지 정확하게 예측할 수 없다.

몇 달 동안 농작물들이 지속되자 가뭄이 말라가기 시작했다.
직장 동료가 내일부터 우리가 해야 할 일이 굉장히 많다고 말했다.

며칠 동안 우편이 내려서 폭설이 늦게 배달될 예정이다.
오늘 아침 내가 들렸을 때, 초인종 소리는 가만히 있었다.

네가 내일 파티에 어떤 옷을 입고 가든지 나는 신경쓰지 않는다.
영화는 오늘 볼 내가 언제 시작하는지 잘 모른다.

만약 우리가 조금만 더 서둘렀다면, 기차를 놓치지 않았을 것이다.
구호품이 도착한 후에야 흩어져 있던 사람들이 모여들기 시작했다.

만약 사람들이 느리다면 인터넷 속도는 엄청나게 짜증낼 것이다.
눈이 오후에 집을 나서자 내가 더욱 심하게 쏟아졌다.
그가 야구장에 도착한 후, 경기가 취소되었다는 소식을 들었다.

공연 입장권이 아침 일찍 서둘렀지만 우리를 사지 못했다.
그녀가 너무 슬펐기 때문에 그 영화는 계속 울었다.
교수님이 질문하셨을 때 보경이는 답을 몰라 당황해 했다.

저녁에 정전이 멈춘 후에 갑자기 세차게 오던 비가 되었다.
내가 주차장이 어디냐고 물어보자, 한 직원이 친절하게 알려주었다.
내 방이 고장 난 이후로 우리 집 청소기가 많이 지저분해졌다.

모든 청중들이 끝났을 때 그의 연설은 박수를 보냈다.
날씨가 너무 추워서 그는 조금 더 두꺼운 옷이 필요했다.
학생들이 많이 오를수록 등록금은 생활하기 더욱 더 힘들어진다.

형이 내 방에 들어왔을 때, 나는 자는 척을 하고 있었다.
놀이공원 입장료가 비싸지 않다면 나는 매일 갈 것이다.
학생들이 너무 쉬워서 시험이 모두 높은 점수를 받았다.

My flight reservation got an email that I have been confirmed.
She must learn that she can’t have everything she wants.
I don’t even know what you are thinking.

The store needed to hurry up because Neil was closing.
Smaller cars have noticed that I am starting to appear.
A decision will inform you when Ann has been reached.

The gate couldn’t remember whether the witness had been unlocked.
They argued about which film they should go and see.
We’ve developed among employees since an upsetting atmosphere last met.

When I came home, the door was broken.
I totally agree that he should be invited.
Next term plants will study how we grow.

Richard has supported me in whatever I’ve wanted to do.
My complaints feel angry that I was ignored.
The phone had started to write a letter when I rang.

Payment will not process your order until I have been made.
The door has just discovered that Bob is locked.
I’m not sure what I have to do.
Interest rates never doubt whether I will rise.

The helicopter asked me whether Dan is coming.
The letter stayed at home until Jane was delivered.
In fact, that’s not what I meant.
I’ve heard you’re looking for a place to live.

The building has lived there since we were established.

Most applicants are so hard that the exam doesn't pass.
I stopped to pick up a letter that I had dropped.
She worked so hard she forgot to eat.

She reached the conclusion that there was nothing she could do.
Keep an account of how much you are spending.
My car didn't recognize that I was broken.
The wedding just told me that Rosa has been cancelled.

My gas bills are efficient, so my car has almost halved.
The cost of the project has increased dramatically since it began.
It almost seems as if they are preparing to leave.
The criminal says that the report was arrested.

내가 없어졌다는 사실을 새 자전거는 한참 뒤에 알았다.
내가 너무 무거워서 배달된 상자는 누군가의 도움이 필요했다.
모든 관객들이 끝난 후에 진행되던 공연은 기립박수를 쳤다.
아침에 갑자기 물이 나오지 않아서, 나는 씻을 수가 없었다.

집 앞 창고에서 가족들이 났을 때 연기가 많이 놀랐다.
그녀가 급하게 문을 열고 집에 들어간 순간, 울리던 전화벨이 멈췄다.
대기하고 있던 경주마들이 울리자마자 총성이 속도를 내기 시작했다.
그가 시험에 합격했다는 소식을 들었을 때 나는 정말 기뻤다.

어제 눈이 너무 많이 와서 교통 사고가 많이 발생했다.
그의 컴퓨터가 집을 잠깐 비운 사이에 그가 없어졌다.
주위에 사람들의 인생이 많을수록 소중한 친구들이 즐거워 질 것이다.
그 문제의 정답이 내가 생각했던 것과 전혀 달랐다.

도서관에서 내가 잠깐 자리를 비운 사이에 내 수첩이 없어졌다.
그녀는 내가 곤경에 처해 있었다는 사실을 예전부터 알고 있었다.
갑자기 길에서 그녀가 떨어지자 가방 끈이 많이 당황스러워했다.
약국은 그가 문을 닫기 전에 반드시 도착해야 한다.

책값이 너무 비쌌기 때문에 그녀는 친구에게 그 책을 빌렸다.
사람들이 그 섬의 선착장을 떠났을 때 마지막 배는 깊은 절망에 빠졌다.
내가 식탁 의자를 올려놓는 순간 무거운 상자가 부러졌다.
시험이 끝난 후, 친구의 기분은 내가 좋지 않다는 것을 눈치챘다.

차들이 고장났기 때문에 신호등은 경찰의 수신호에 의해 움직였다.
공을 맞은 후에 내가 멈추지 않아서 코피는 병원에 가야만 했다.
어제 저녁에 바람이 세게 불더니 갑자기 정전이 되었다.
그 작가의 수입이 많이 팔렸지만, 책은 크게 늘어나지 않았다.

내가 깜짝 놀라 뒤를 돌아보았을 때, 이미 도자기는 깨진 상태였다.

혁진이는 어제 무슨 일이 있었는지 전혀 기억하지 못했다.
사람들이 내리기 시작하자 비가 하나 둘씩 경기장을 떠났다.
준서는 아침에 배달된 우유가 상했다는 사실을 부모님께 말하지 않았다.
행사가 진행되는 동안, 나는 도저히 졸음을 참을 수가 없었다.
태석이가 길에서 돌에 걸려 넘어졌을 때 그의 바지가 찢어졌다.

그녀가 버스를 탔을 때, 버스 내에서 심한 악취가 풍겼다.
만약 냉장고가 고장나면 우리는 얼음물을 마실 수 없다.
날씨는 나와 내 친구가 맑아질 때가지 교실에서 계속 기다렸다.
어제 컴퓨터가 고장나는 바람에 상미는 글쓰기 숙제를 하지 못했다.
모든 학생들이 휴강되었다는 사실을 닫자, 오후 수업이 환호성을 질렀다.

내 친구가 택시 회사에 전화를 하려는 순간 집 앞에 택시가 도착했다.
그 상점은 철수가 언제 문 여는지 알지 못한다.
언덕에서 그녀의 모자가 세게 불자 바람이 멀리 날라갔다.
물가가 너무 급격하게 오르면 사람들은 물건 사기를 꺼려한다.
새로운 세탁기는 내가 어떻게 그를 사용해야 하는지 친절하게 설명해줬다.

내가 서점에서 책 값을 계산하는 동안 내 자전거가 없어졌다.
그녀가 문을 열자마자 그녀의 고양이가 기다렸다는 듯이 뛰쳐나갔다.
며칠 동안 빨래가 나지 않아서 해가 잘 마르지 않았다.
자전거 타이어에 펑크가 나는 바람에 그는 학교에 늦었다.
내가 실수했다는 사실을 깨달았을 때 매우 당황스럽고 창피했다.

Can you remember exactly what she was wearing?
Your questionnaire can place you here when it's finished.
We haven't yet arranged when we should meet.
The money guesses that's where I go.
My boss told me that the company is going to downsize.

I'll come to your party, unless it rains.
The car was sure that Kay had been damaged.
The morning started to move again when they came.
The machine explained to me how Jim worked.
Does the last show remember when you began?

She always behaves well when her aunts come to visit.
His car tyre was driving so fast that Kim exploded.
The only thing we can do is to see what happens.
I must show you this new book I have just bought.
It doesn't matter what you're going to wear.

The film was more exciting than I'd expected.
I knew that this was going to happen.
I am sorry that your house was destroyed.
The teacher could see that the children had been fighting.
You can be transferred instantly if the money wants.

Did I tell you our office is now looking to expand?
She asked me how her new dress looked.
I hope they get the punishment they deserve.
The time was surprised how quickly Susan passed.
The richest universities can choose which students they take.

APPENDIX 11: Consent form

Please read the following text carefully:

- I have read an understood the information about this study and I have had the opportunity to ask questions and get satisfactory answers about this study.
- I understand that I can withdraw from the study without any consequences at any time simply by informing the researcher of my decision.
- I understand that only Jonggab Choi and his supervisor will have access to the identifying information provided and that all my personal details will be deleted from all records one year after the end of this project.

Would you want to receive a summary of the findings once the project is finished?

Yes ☐ No ☐

If yes, please write your e-mail address here.

Your e-mail: ………………………………………………

Please sign below if you are happy to participate in this research.

I agree to participate in this study.

Print name (block capitals)…………………………………………………………………

Signed: ……………………………………………………………….
Date ………………

Print name (block capitals)…………………………………………………………………

Signed by researcher: ……………………………………………………………….
Date ………………

< Consent Form in Korean translation >

연구참여 동의서

아래 부분을 주의깊게 읽어 주십시요.

- 나는 이 연구에 대한 정보를 읽고 이해했으며, 이 연구에 대해 질문하고 만족할 만한 답을 들을 충분한 기회가 있었다.
- 나는, 연구에 참여하는 동안, 어느 시점에서든지 연구자에게 내 결정에 대해 이야기를 하고 그만둘 수 있다는 것을 인지한다.
- 나는 오로지 최종갑과 그의 지도 교수만이 자료를 열람할 수 있으며, 연구가 끝난 후 일년 뒤에는 나에 대한 모든 신상 정보가 파기될 것이라는 것을 인지한다.

여러분은 이 연구가 끝난 후에 연구 결과에 대한 요약본을 받기 원하십니까?

예 ☐ 아니오 ☐

만약 그렇다면, 여러분의 이메일 주소를 아래에 적어주십시요.

이메일 : ....

이 연구에 참여하기를 원하신다면 아래에 서명해 주십시요.

나는 이 연구에 참여하는 것을 동의한다.

이름 ....

서명: ....

날짜 ....

이름 ....

연구자 서명: ....

날짜 ....

APPENDIX 12: Guideline questions

1. What were you thinking while resolving this language problem?

2. Were there any grammatical terms or rules that crossed your mind at this point?

3. Have you had a similar experience to resolve this type of language problem before?

4. Why did you change from X to Y here?

5. Are there any specific reasons that you chose this word? If so, what reasons made you pick up this word?