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The Effects of Task Complexity and Working Memory on Korean Adult Learners' English Speaking Performance

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This study investigated whether task complexity may affect L2 speaking performance as predicted by the Cognition Hypothesis (Robinson, 2011), and whether the effect of task complexity may interact with individual differences in working memory capacity. A total of twenty Korean advanced-level EFL learners performed two separate picture description tasks, which were different in task complexity along [+/- here and now] dimension. Their working memory was measured by an L1 version of a reading span task. The results showed that there was no significant difference between Here-and-Now task (i.e., a simple task) and There-and-Then task (i.e., a complex task) in terms of complexity, accuracy, and fluency of English speaking performance, rejecting the prediction of the Cognition Hypothesis. Yet, it found that working memory correlated with accuracy in L2 performance on the complex task, but not on the simple task. This indicates that the effect of individual learners' working memory capacity is observable only when a task demands a high control of attentional resources. Conversely, when a task is simple, individual differences in working memory capacity do not result in significant differences in L2 speaking performance.

Key words: task complexity, working memory, Cognition Hypothesis, English speaking

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1. INTRODUCTION

In task-based language teaching (TBLT) framework, task complexity is regarded as an important concept for designing instructions. It has been argued that task complexity affects L2 learners' performance in terms of complexity, accuracy, and fluency. Yet, with regard to the precise relationship between task complexity and L2 performance, there are two opposing views. According to Skehan's (1998) Limited Capacity Hypothesis, learners' attention is limited and thus if a task is cognitively demanding, learners pay more attention to cognitive processing with less resources available for language forms, manifesting a trade-off effect. On the other hand, in the Cognition Hypothesis (2001a, 2003, 2011), Robinson argued that a cognitively more demanding task elicits more complex and more accurate language performance than a simple task.

To settle the controversy, many studies have explored the effect of task complexity on L2 performances, yielding overall mixed results (Y.-J. Kim, 2011; Michel, Kuiken, & Vedder, 2007; Nuevo, Adams, & Ross-Feldman, 2011; Oh & Lee, 2009; Robinson & Gilabert, 2007; Robinson, Ting, & Urwin, 1995; Song & Lee, 2015). One of the main reasons for the inconclusive results seems to lie in learner factors that may mediate the effect of task complexity in actual task performance. Robinson (2011) also points out that learner factors interact with task complexity in determining any effect of task demands on L2 performance. For instance, it is possible that the effect of task complexity is not observed when learners' cognitive abilities or affective factors fall far short of the demands of the task probably because of a floor effect. This calls for research on task complexity with due consideration of learner factors.

Among various learner factors, working memory capacity has received particular attention in the field of second language acquisition (SLA) along with increased interest in individual differences. Working memory is a cognitive system that deals with both storing and processing information (Baddeley, 2003). Given that L2 learning requires a high level of cognitive demands on L2 learners, it is natural that a number of studies have been conducted on the role of working memory in various aspects of L2 learning including sentence processing, vocabulary learning, interaction and feedback, reading, and writing (for a comprehensive review, see Juffs & Harrington, 2011). Yet, the influence of working memory has been less explored in relation to task complexity although the two constructs are conceptually of high relevance. It is very likely that a more complex task requires a higher level of working memory capacity. On this matter, Robinson (2011) makes a specific prediction that "working memory capacity is likely implicated specifically in successful performance on There-and-Then tasks, which require learners to hold in memory a description of some event, while verbalizing it concurrently, and also in performance on tasks requiring dual, simultaneous performance of subtasks" (p. 23).

In an attempt to empirically test the Cognition Hypothesis and Robinson's (2011) prediction on the interaction between task complexity and working memory, this study investigated Korean adult EFL learners' speaking performance on Here-and-Now task (i.e., a simple task) and There-and-Then task (i.e., a complex task), along with their working memory capacity. Two research questions were addressed as follows:

1) Are there differences in complexity, accuracy, and fluency of L2 English speaking performance on Here-and-Now versus There-and-Then tasks?
2) Is L2 English speaking performance differentially affected by working memory in Here-and-Now versus There-and-Then tasks?

2. LITERATURE REVIEW

2.1. The Effect of Task Complexity on L2 Performance

Within the TBLT framework, how to define and classify tasks is of utmost significance. Robinson's (2001a, 2011) Triadic Componential Framework (TCF) provides one of the most elaborated concepts and classifications of tasks, as illustrated in TABLE 1.

TABLE 1
Triadic Component Framework (adapted from Robinson, 2011)

Task Complexity (cognitive factors)	Task Condition (interactive factors)	Task Difficulty (learner factors)
a. Resource-directing	a. Participation variables	a. Ability variables
[+/- few elements]	[+/- open solution]	[H/L working memory]
[+/- here-and-now]	[+/- one way flow]	[H/L reasoning ability]
[+/- spatial reasoning]	[+/- convergent solution]	[H/L task-switching]
[+/- causal reasoning]	[+/- few participants]	[H/L aptitude]
[+/- intentional reasoning]	[+/- few contributions needed]	[H/L field independence]
[+/- prospective-taking]	[+/- negotiation not needed]	[H/L mind-reading]
b. Resource-dispersing	b. Participant variables	b. Affective variables
[+/- planning]	[+/- same proficiency]	[H/L openness]
[+/- single task]	[+/- same gender]	[H/L control of emotion]
[+/- prior knowledge]	[+/- familiar]	[H/L task motivation]
[+/- task structure]	[+/- shared content knowledge]	[H/L processing anxiety]
[+/- few steps]	[+/- equal status and role]	[H/L willingness to communicate]
[+/- independency of steps]	[+/- shared cultural knowledge]	[H/L self-efficacy]

The TCF suggests three categories of task characteristics: task complexity, task condition, and task difficulty. Task complexity refers to the intrinsic cognitive factor of a task itself and is divided into two subcategories such as resource-directing and resource-dispersing factors. Resource-directing factors promote learners to draw their attention and efforts to language features. For instance, the task with [- here-and-now] which requires learners to describe an event happening elsewhere in time and space makes greater demands on memory and directs learners' attention to non-prototypical use of tense and aspect morphology (Robinson, Cadierno, & Shirai, 2009). On the other hand, resource-dispersing factors affect learners' procedural and performative aspects. For instance, increasing complexity along resource-dispersing factors such as [-planning time] does not require more complicated conceptualization of language code but demands simultaneous handling of linguistic and non-linguistic aspects.

The second component, task condition, concerns interactive and situational factors that make interactional demands. Task condition is affected by participation variables such as information flow or convergence of solution, and participant variables such as differences in gender, proficiency level, and schema.

As for the last category, task difficulty reflects learner factors that can be further divided into affective factors and ability factors. Ability factors include working memory, reasoning ability, aptitude, or field independence, while affective factors include task motivation, processing anxiety, willingness to communicate, etc. According to Robinson (2011), task difficulty contributes to between-learner variation in L2 performance. Even when the same task is presented, its difficulty will be perceived differently among individual learners who vary in ability and affective factors.

Among the three task characteristics, task complexity has drawn great attention from many researchers, particularly in relation to Robinson's (2001a) Cognition Hypothesis which indicates that learners produce more accurate and more complex, although less fluent, language on cognitively demanding tasks than simpler tasks. One of the most frequently investigated task complexity factors is [+/- planning time], a resource-dispersing factor (Foster & Skehan, 1996; Lee, Oh, & Shin, 2007; Ortega, 1999; Wang & Lee, 2014; Yuan & Ellis, 2003). Previous studies on planning time have consistently showed that planning time facilities L2 fluency, but they have less agreed upon its effect on accuracy and complexity.

Some other researchers explored the effect of resource-directing factors on L2 performance. For instance, Robinson (2001b) examined L2 learners' performances on two versions of a map task which differ in the number of elements to describe. The results partially confirmed the Cognition Hypothesis in that learners showed greater lexical variety on the complex task requiring more elements, although no significant differences were found in structural complexity and accuracy. Y.-J. Kim (2011) investigated the effect of task complexity with more diverse factors such as [+/- few elements], [+/- here and now], and [+/- no reasoning] on Korean university students'

English writing. The results, however, showed that task complexity increased by these factors facilitated L2 fluency only, rejecting the Cognition Hypothesis.

Song and Lee (2015) compared relative effects of a resource-dispersing factor (i.e., [+/- planning time]) and a resource-directing factor (i.e., [+/- few elements]) on Korean middle school students' English speaking performance. They found that [+ planning time] yielded more fluent language, while [- few elements] led to more accurate and complex language, as predicted by the Cognition Hypothesis.

More recent studies have investigated the effect of task complexity along with task condition. For instance, Gilbert, Barón and Levkina (2011) investigated the effect of task complexity manipulated by [+/- here and now] and [+/- few elements] according to task types and modes. The results revealed that a complex task caused significantly less fluent but more accurate performance, and this was so in monologic mode only. Similar results were obtained by Michel, Kuiken and Vedder (2007) who also examined the effects of [+/- few elements] and task condition [+/-monologic] on L2 speaking. On the other hand, Oh and Lee (2012) who conducted a similar study with Korean EFL learners observed somewhat different results. The increased task complexity resulted in more complex language regardless of task condition. Furthermore, accuracy increased along with task complexity in two-way condition. Although the precise pictures are different, these studies suggest that there exists some interaction between task complexity and task condition.

Equally possible, and yet less explored, is the interaction between task complexity and task difficulty. The Cognition Hypothesis also acknowledges the potential interaction between task factors and learner factors in determining any predicted effects of task demands on L2 performance. Indeed, Robinson (2007) found that only those learners who have low output anxiety produced more complex speech on a complex reasoning task, while learners with high output anxiety were not affected by task complexity. Albert (2011) also explored the relationship between task complexity and learner creativity. She found differential effects of creativity depending on task complexity, with the stronger influence of the learner variable on the complex task. These studies provide some hints on why the previous studies on the effect of task complexity have yielded mixed results. Furthermore, from a pedagogical perspective, in order to obtain the expected effect on L2 complexity, accuracy, and fluency by manipulating task complexity, it is important to understand how learner factors intervene and interact with the effect of task complexity. This is why the present study investigated the influence of L2 learners' working memory in relation to task complexity.

2.2. The Role of Working Memory in L2 Acquisition

Working memory is a memory system of temporary storage plus processing of information (Baddeley, 2003). It is distinguished from short-term memory which has a function of storage only. The function of processing in working memory is in charge of manipulating information, retrieving already encoded information from long-term memory, and integrating them (Baddeley & Hitch, 1974). Working memory is assumed to intertwine with cognitive language processing such as comprehension, reasoning, and learning

Within the cognitive SLA framework, working memory has been increasingly researched as one of the most viable factors accounting for individual differences in L2 performance and acquisition. Sawyer and Ranta (2001) suggest that working memory capacity is an important component of language aptitude that has a close relationship with SLA. For instance, Harrington and Sawyer (1992) found that Japanese EFL learners' reading span task scores (i.e., a working memory measure) correlated with their grammar test scores at $r = .57$ and with their reading test scores at $r = .54$. The influence of working memory has been widely investigated on implicit learning (Robinson, 2002; Song & Lee, 2013), vocabulary learning (O'Brien, Segalowitz, Collentine, & Freed, 2006; Spciale, Ellis, & Bywater, 2004), interaction and recasts (Goo, 2012, 2014; Kim & Cho, 2017; Mackey, Adam, Stafford, & Winke, 2010; Mackey, Egi, Philp, Fuji, & Tatsumi, 2002), L2 sentence processing (Baek, 2013; Juffs, 2004; Lee, 2014a), and so on. The results of the studies have revealed that the influence of working memory varies depending on L2 domains and aspects.

What makes the picture more complicated is that the effect of working memory is not always direct and independent. Song and Lee (2013) investigated the effect of working memory on Korean EFL high school students' implicit learning but found no significant relationship between working memory and grammar accuracy after implicit learning. However, it was observed that the learners who showed a higher level of awareness during implicit learning tended to have a higher working memory, indicating the facilitative role of working memory at least in enhancing learners' awareness during implicit learning.

The effect of working memory also often interacts with other factors, as manifested in Lee (2014a). Lee investigated the relationship between Korean EFL learners' comprehension of long-distance *wh*-questions and working memory capacity. A significant correlation was observed only with object *wh*-questions, which involve a longer gap-filler distance and are considered more difficult to process than subject *wh*-questions. This result lends support to the claim that working memory exerts a stronger influence on complex structures that require high cognitive load than on simple structures that can be dealt with without much demand on cognitive resources (Boyle, Lindell, & Kidd, 2013; King & Just, 1991).

It is highly possible that not only structural complexity but also task complexity may interact with working memory in a way that learners' working memory may play a more significant role on cognitively complex tasks than on simple tasks. This idea was tested by Kormos and Trebits (2011) who examined the effect of working memory on English narrative task performances by 44 Hungarian-English bilingual secondary school students. The participants performed two tasks that differ in terms of [+/- reasoning]. The first task was to describe a comic strip consisting of six pictures. Since the pictures were presented in the correct order, it does not require much reasoning on a storyline. In contrast, the second task, which was to tell a story based on six unrelated pictures, requires learners' reasoning and imagination to relate the pictures and thereby invent a storyline. The learners' English speaking performances on the two tasks were analyzed in terms of complexity, accuracy, and fluency. In addition, their working memory was measured by a backward digit span task. The results, however, were rather unexpected. First, unlike the prediction of the Cognition Hypothesis, the learners did not show any significant differences in complexity, accuracy, or fluency between the two tasks. The researchers attributed the result to the relatively low proficiency level of the participants. This study also found the interaction between working memory and task complexity but its direction was the opposite of the prediction. The effect of working memory was observed in the cartoon description task which was supposed to be cognitively less complex. The learners with higher working memory provided more complex sentences on the task. The researchers suggested a possibility that contrary to the researchers' intention, the cartoon description task might have required higher attentional demands by enforcing the learners to narrate the given story than the story telling task which might have allowed the learners to adjust a story to their current linguistic resources. Put together, this study indicates that proper consideration of learners' English proficiency and more robust manipulation of task complexity are needed to explore the relationship between working memory and task complexity.

Arguing for the significance of research on the interaction between task factors and learner factors, Robinson (2011) addresses the potential relevance between working memory and There-and-Then tasks. Motivated by this idea, the present study manipulated task complexity in terms of [+/- here and now] and investigated its effect on L2 speaking performance and its relationship with working memory.

3. RESEARCH METHOD

3.1. Participants

Twenty Korean adult EFL learners with the age from 25 to 35 years participated in the study. They were recruited from two graduate school programs in Seoul. They all majored in English education. Their TOEIC scores were all above 800 and thus can be regarded as advanced level learners. As a reward to their participation in the experiment, they were provided with a coffee coupon.

3.2. Materials

3.2.1. Picture description tasks

To investigate the effect of task complexity, this study employed picture description tasks. In this study, task complexity was manipulated in terms of [+/- here-and-now] dimension of the Triadic Componential Framework (Robinson, 2011). Thus, two picture description tasks were prepared: Here-and-Now task and There-and-Then task (see Appendix). Both tasks required learners to describe a given picture for one minute after 30 seconds of preparation. The only difference between the two tasks was whether or not the picture is available during speaking performance. In the Here-and-Now task, the learners were allowed to refer to the picture while describing it. However, in the There-and-Then task, the picture was taken away right after the preparation time was over. According to Robinson (2011), the There-and-Then task is cognitively more demanding than the Here-and-Now task because learners need to hold in memory the information of a picture while conceptualizing what to speak.

In order to control for factors other than the availability of the picture during speaking performance, efforts were made to select two pictures that are comparable in terms of the number of characters and the complicatedness of the event. Both pictures were chosen from examples of TOEIC speaking test Part 2 named ‘Picture description test.’

3.2.2. Working memory task

In this study, the reading span test developed by Daneman and Carpenter (1980) was adapted to measure working memory. The test involved two components: judging the truthfulness of sentences and recalling final words of the sentences. The former was to measure the ability to process and the latter was to assess the temporary storage capacity.

The reading span task was implemented in Korean. Conducting the reading span task in L1 has an advantage of avoiding any possible interference of English proficiency. A high correlation between reading span tests taken in L1 and in L2 (Osaka & Osaka, 1992) also justified the use of the Korean version of the reading span task in this study.

The Korean version of the reading span task was developed by referring to the previous studies (S.-H. Kim, 2011; Lee, 1995). The task had 3 practice items and 15 test items consisting of two to six sentences, which were split into three sets, as shown in Table 2.

TABLE 2
The Reading Span Task

Section		Items
Practice items		3 items
Test items	Set 1	Item 1. 2 sentences Item 2. 3 sentences Item 3. 4 sentences Item 4. 5 sentences Item 5. 6 sentences
	Set 2	Item 6. 2 sentences Item 7. 3 sentences Item 8. 4 sentences Item 9. 5 sentences Item 10. 6 sentences
	Set 3	Item 11. 2 sentences Item 12. 3 sentences Item 13. 4 sentences Item 14. 5 sentences Item 15. 6 sentences

The test materials were prepared by using the Microsoft PowerPoint program. Each sentence was presented one by one on the screen with eight-second intervals, and participants were required to judge truthfulness of each sentence. Half of the sentences were semantically true and the other half sentences were false. In addition, all the sentences had declarative forms to avoid unnecessary disturbance from sentence structures. When the sign "+++" appeared on the screen at the end of a series of sentences, participants were required to recall and write the final words of each sentence. All the final words consisted of a noun and a particle -*(i)da*.

3.3. Procedures

All the experiments were held in a laboratory room located in the first researcher's workplace. The recruited participants made an appointment with the researcher and individually visited the laboratory. They performed both a simple task and a complex task consecutively. The sequence of the two tasks was counterbalanced. Their speaking performances were recorded and transcribed for analysis.

In the reading span test, participants were instructed to read aloud each sentence on the computer screen with normal speed. Once they read the sentence, they answered 'Yes' if the sentence was reasonable, and said 'No' if the sentence was not correct in 1.5 seconds. At the same time, they were asked to remember the final word of the sentence and recalled it at the end of a set by writing the word on an answer sheet provided separately.

3.4. Analyses

The participants' speaking performances were analyzed in terms of complexity, accuracy and fluency. Complexity was measured with syntactic and lexical complexity. To measure syntactic complexity, the number of subordinate clause per T-unit was calculated. Type token ratio was chosen as a measure of lexical complexity. The total number of different words was divided by the total number of words. Accuracy was measured by the number of errors per T-unit. For fluency, speech rate was calculated as the total number of words divided by the total amount of speaking time.

The results of the reading span task were scored in three ways, according to the scoring system proposed by Conway et al. (2005). First, a storage score was obtained by counting the number of the correctly recalled final words. Second, a processing score was calculated by counting the number of correctly judged sentences. Third, a composite score was calculated by counting the number of sentences that are correctly judged and correctly recalled simultaneously. Since there are a total of 60 sentences, the possible maximum score for each is 60.

The analyzed data were submitted to statistical analyses, using SPSS 18. Specifically, in order to test the effect of task complexity on L2 speaking performance, paired sample t-tests were employed. In addition, Pearson correlations were used to explore the relationship between working memory and L2 speaking performance on each task.

4. RESULTS AND DISCUSSION

4.1. The Effect of Task Complexity on L2 Speaking Performance

To investigate whether task complexity affects L2 speaking performance in terms of complexity, accuracy, and fluency, the participants' performances on the Here-and-Now Task and the There-and-Then task were compared in Table 3. Subordination per T-unit and type token ratio represent syntactic complexity and lexical complexity, respectively. The results of these complexity measures were very similar on the two tasks. The participants produced on average .32 subordinate clauses per T-unit regardless of task complexity. Their type token ratios were also very similar as .55 on the Here-and-Now task and .54 on the There-and-Then task. Speech rate indicating fluency also did not much differ between the two tasks. The participants produced 1.54 words and 1.53 words per second on the two tasks, respectively. The only notable difference was found in error ratio representing accuracy. The participants produced .37 errors per T-unit on the Here-and-Now task, while they made .33 errors per T-unit on the There-and-Then task.

TABLE 3
L2 Speaking Performance by Task Complexity

	Here-and-Now Task		There-and-Then Task		*t*	*p*
	M	*SD*	*M*	*SD*		
Subordination per T-unit	.32	.327	.32	.270	.020	.984
Type Token Ratio	.55	.107	.54	.074	.402	.692
Errors per T-unit	.37	.230	.33	.265	.755	.460
Speech Rate	1.54	.475	1.53	.495	.620	.543

In order to check whether the observed mean differences are statistically significant, paired sample t-tests were conducted for each measure. As presented in Table 3, there was no significant difference in the participants' performances on the two tasks.

This result is not in congruence with the Cognition Hypothesis. According to the Cognition Hypothesis, it was expected that the participants' performance on the There-and-Then task would be more complex and more accurate, although less fluent, than their performance on the Here-and-Now task. The result of the present study does not support Skehan's (1998) Limited Capacity Hypothesis either because there was no decrease in complexity, accuracy, and fluency. Rather, the present study shows that task complexity did not affect the participants' English speaking performances. Given that learners' L2 performance cannot but be restricted by their current interlanguage system, it is possible that even when the complex task requires more cognitive resources, as far as their available linguistic system is the same, their performance should be more or less similar.

Alternatively, it can be argued that English proficiency has a stronger effect than task complexity on learners' L2 speaking performance in this study. Considering the participants' advanced level of English proficiency, the There-and-Then task in this study might not have been challenging enough to yield the potential effect, if any, of task complexity. The mediating effect of learners' L2 proficiency on task complexity is also found in Kormos and Trebits (2011), who observed no significant effect of task complexity on Hungarian-English bilingual secondary school students' English performance. They attributed the result to the low proficiency level of the participants, arguing that "for these two narrative tasks, a certain proficiency threshold may be needed for a global task effect to be detectable." (p. 279). As a mirror image, the present study may show a ceiling effect where learners' advanced English proficiency overrides any effect of task complexity. This argument needs to be empirically tested by involving different levels of learners in future research.

4.2. The Relationship Between Working Memory and L2 Speaking Performance on Simple and Complex Tasks

The participants' performances on the reading span task were analyzed into three types of scores: storage scores, processing scores, and composite scores, as presented in Table 4.

TABLE 4

Results of the Reading Span Task

	M	*SD*
WM Storage	54.60	3.979
WM Processing	28.60	16.797
WM Composite	26.80	16.012

On average, the participants could recall 54.60 final words out of 60 sentences presented in the task. This fairly high storage score seems to be obtained at the expense of processing, as shown in the relatively low processing score of 28.60 out of 60. This indicates that the participants did not pay proper attention to judging truthfulness of sentences probably in order to recall final words of the sentences. Because of the low processing score, the composite score which counted both processing and storage was low as well. It is also notable in Table 4 that the participants showed a low standard deviation in storage score but extremely a high standard deviation in processing and composite scores. This indicates that there was relatively little individual variation in storing information but their ability to process information on-line widely varied.

The relationship between working memory and task complexity was further investigated by Pearson correlations. Table 5 shows the results on the Here-and-Now task. No significant correlation was found between working memory scores and speaking performance measures. In other words, the participants' working memory did not exert any significant influence on the participants' performance on the Here-and-Now task.

TABLE 5

Correlations Between Working Memory and L2 Speaking Performance on Here-and-Now Task

	Subordination per T-unit	Type Token Ratio	Errors per T-unit	Speech Rate
WM Storage	-.406	-.117	-.397	-.128
WM Processing	-.220	-.158	-.413	.070
WM Composite	-.417	-.121	-.409	-.123

On the other hand, the results of the There-and-Then task showed a different pattern, as presented in Table 6. The participants' error ratio was significantly correlated with two working memory scores. The correlation coefficients were negative as r = -.603 for the storage score and r = -.602 for the composite score. This means that the participants with higher storage and composite scores tended to make fewer errors, demonstrating greater accuracy. However, their working memory scores were not correlated with the complexity and fluency measures.

TABLE 6
Correlations Between Working Memory and L2 Speaking Performance on There-and-Then Task

	Subordination per T-unit	Type Token Ratio	Errors per T-unit	Speech Rate
WM Storage	-.139	-.044	-.603 (p = .005)	-.027
WM Processing	-.147	-.041	-.303	.135
WM Composite	-.183	-.050	-.602 (p = .005)	-.015

Put together, significant relationship between working memory capacity and L2 speaking performance was observed only in the There-and-Then task. This result supports Robinson's (2011) prediction that working memory would manifest its influence in a cognitively more complex task. When performing a simple task, learners may not be in need of much attentional resource and thus the influence of learners' working memory would not be visible. However, when they have to perform a cognitively demanding task where they need to deal with linguistic aspects and task completion simultaneously, their working memory capacity may play a significant role yielding variation in their L2 performance. This is particularly so in There-and-Then tasks where learners have to perform a task without seeing materials and thus hold information in memory. In this process, learners with greater storage capacity may have advantages in memorizing more details with greater precision. This explains why the storage component rather than the processing component showed significant relationship with L2 performance in this study. This further indicates that the two components of working memory capacity have separate effects on L2 performance and which component would function depends on the characteristics of a task.

The task-specific influence of working memory is also obtained in the previous studies. Lee (2014b) implemented with Korean college EFL learners two *wh*-questions processing tasks (i.e., a grammaticality judgement task and a listening comprehension task) and two working memory tests (i.e., a reading span task and a conceptual span task). The only significant correlation was found between the listening comprehension task and the processing component of the reading span task. Based on the result, Lee argued that when and how working memory comes into play is closely related to the specific demands of a task.

Kormos and Trebits (2011) also found that the influence of working memory differs depending on task complexity but they obtained the opposite result of the present study. A significant correlation between working memory and syntactic complexity was observed on the simple task rather than the complex task. There are several differences between the two studies, however. First, Kormos and Trebits manipulated task complexity in terms of [+/- reasoning] while the present study used [+/- here-and-now]. Also, their participants' proficiency level was low while the participants of the present study were advanced learners. When these two features are combined, the supposedly simple task in Kormos and Trebits might be cognitively demanding enough to require learners' active use of working memory capacity. This indicates that the relationship between working memory and task complexity needs to be explored in due consideration of learners' L2 proficiency.

It is also notable that the participants' working memory only affected accuracy of L2 performance. This indicates that learners' working memory capacity was activated in a way to facilitate learners' existing L2 knowledge rather than to expand it into more complex one. Again, this result may be attributed to the advanced level English proficiency of the participants in this study. Further studies are needed to be conducted with learners with a lower level proficiency.

5. CONCLUSION

This study was conducted to test the prediction of the Cognition Hypothesis that L2 learners perform greater in accuracy and complexity on the cognitively complex task than the simple one. This prediction was not borne out in this study. The Korean adult EFL learners did not show any significant difference between simple and complex tasks manipulated by [+/- here-and-now]. The result can be attributed to the advanced English proficiency of the participants, which may have overridden the effect of task complexity on speaking performance. It is possible that when learners' L2 proficiency is too low as in Kormos and Trebits (2011) or too high as in this study, the effect of task complexity would not emerge probably due to a floor effect or a ceiling effect. Thus, in order to demonstrate the effect of task complexity on L2 performance, learners' L2 proficiency needs to be taken into account.

Although the There-and-Then task in this study failed to elicit more accurate and more complex speaking performance within a learner, it clearly exhibited between-learner variation depending on working memory capacity. A significant correlation between working memory and speaking performance was observed only in the complex task, demonstrating the intervening influence of working memory on the effect of task complexity. As far as a task is simple, learners can perform the task without resorting to their cognitive resources and thus the influence of working memory is not visible. However, when a task is complex, learners' working memory capacity may be fully stretched to the increased demands of the task, demonstrating notable individual differences in L2 performance. This study also found that the influence of working memory is task-specific and limited to certain aspects of L2 performance. The significant correlation in the There-and-Then task was only between storage component of working memory and speaking accuracy.

The results of this study have pedagogical implications in designing tasks for instruction or assessment. Tasks need to be simple when a teacher or a tester wants to minimize the potential influence of individual differences in working memory on L2 performance. This, however, does not mean that complex tasks should be avoided in L2 classroom. Complex tasks may allow learners to fully stretch their cognitive resources and check the upper limit in their current L2 system. Yet, given the potential ceiling effect of English proficiency observed in this study, task complexity should be decided based on learners' current English level. Tasks should be challenging, but should not be overwhelming beyond their L2 system.

Despite of the above significant findings, there are several limitations in this study. First, the picture description task employed in this study might not be challenging enough to demonstrate the effect of task complexity particularly with advanced learners. It consists of only one picture with four characters, which might not push advanced learners to fully direct their attentional resources to the task. For future studies, it is recommendable to use a series of pictures such as a carton strip as in previous studies (Robinson, Ting, & Urwin, 1995). Also, for a better understanding on the interaction between L2 proficiency and task complexity, it is necessary to include learners with various levels of L2 proficiency.

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APPENDIX

Two Picture Description Tasks

1. Here-and-Now Task

Describe the picture below. You will have 30 seconds to prepare and 1 minute to speak.

2. There-and-Then Task

Look at the picture below. Thirty seconds are given to prepare for the description. Then, the picture will be taken away and you will talk about the picture for 1 minute without seeing it.

Applicable levels: Secondary, tertiary

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