

Second Language Task Grading and Syntactic Complexity in Writing

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Abstract: *This study is motivated by Robinson's Cognition Hypothesis and aims to investigate the impact of task grading along reasoning demands dimension on syntactic complexity in English as foreign language writing. The participants of the study were 90 intermediate EFL learners from three intact classes at, and a Control group. At first, the students in all groups took part in the writing pre-test which was a picture story description task. Next, the treatment sessions including 8 sessions of picture description task performance began, during which the first experimental group received a series of picture description tasks in a randomized order of cognitive complexity. The second experimental group received the same tasks, but ordered from simple to complex based on their required reasoning demands. The control group, however, did not receive any picture description tasks; rather they received some typical writing activities and performed extra writing tasks from the course book. Finally, during the last session, the post- test was administered to all participants. The results of the data analysis through Analysis of Variances (ANOVA) using the SPSS software showed a significant positive impact for sequencing tasks from simple to complex on syntactic complexity of Iranian intermediate EFL learners.*

Keywords: *Cognition Hypothesis; Task complexity; Reasoning demands; Syntactic complexity; Triadic Componential Framework (TCF).*

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1. Introduction

Due to their potential to help L2 learners to perform in real life conditions, pedagogic tasks have been greatly concerned by SLA researchers, educationalists, and curriculum developers around the world (Birjandi & Ahangari, 2008; Birjandi & Seifoori, 2009; Ellis, 2000, 2003, 2008; Long, 1989; Long & Crookes, 1992; Maftoon, Birjandi & Pahlavani, 2014; Nunan, 1989, 1991, 2004; Skehan, 1996; Skehan & Foster, 1997, among others).

Although there has been more attention to the application of pedagogic tasks (in comparison with linguistic units) in designing syllabi in new years, there has been no agreement among researchers about the criteria based on which tasks should be graded in the syllabus (Romanko & Nakatsugawa, 2010). Robinson (2001a, 2001b, 2005, 2007b, and 2010) proposed a set of cognitively based criteria for task grading by developing the Cognition Hypothesis (CH). According to him, “task sequencing, should be done by designing tasks simple on all relevant parameters of task demands first, and then gradually increasing their cognitive complexity on subsequent versions” (Robinson, 2010, p. 242). In fact, he mentioned that pedagogic tasks should be ordered based on the increase in their cognitive complexity in order to get more similar to the real-life tasks.

The CH seeks to provide a rationale for sequencing tasks by drawing on the Triadic Componential Framework (TCF). Robinson’s TCF distinguished “three dimensions which interact to influence task performance and learning: task complexity, task conditions and task difficulty, of which Robinson suggested complexity factors as the major basis for pedagogic task sequencing in task-based syllabuses” (Robinson, 2001a, 2001b, 2005, 2007b, 2010). In fact, he made distinction between two aspects of task complexity’s dimensions which are resource-directing dimensions, and resource-dispersing.

According to Robinson (2010), increasing task complexity along resource-directing dimensions can increase learners' attention and efforts at producing complex syntactic structures. However, using the resource-dispersing dimensions besides intensifying task complexity relates to an enhanced ability to obtain and apply knowledge during performance.

Many researchers have checked Robinson’s hypothesis by controlling task complexity along diverse resource-directing and resource-dispersing dimensions such as: “ $\pm$ here and now” (Gilabert Guerrero, 2005; Robinson, 1995; Robinson, Ting, & Urwin, 1995), “ $\pm$ reasoning demand”

(Iwashita, Elder, & McNamara, 2001), and “ $\pm$ few elements” (Kuiken, Mos, & Vedder, 2005; Kuiken & Vedder, 2007).

Most of the previous studies testing Robinson’s hypothesis had only addressed the direct results of manipulating task complexity variables; “i.e. they involve one-off experiments that examine task complexity variables at a specific point in time” (Ellis, 2005). Nevertheless, there have been few researches investigating the effects of using a cycle of simple to complex tasks taking place over a longer period of time than a single classroom session (e.g. Robinson, 2007a; Thompson, 2014); therefore, this study aims at filling the mentioned gap by investigating the potential effects of sequencing tasks based on their cognitive complexity on L2 learners’ writing task performance in terms of syntactic complexity.

Furthermore, although many studies have examined the relationship between task complexity and L2 oral task production, quite few reaserches have investigated the relationship between task complexity and writing task performance (Kuiken & Vedder, 2007; Rahimpour & Hosseini, 2010; Salimi, Dadashpour, & Asadollahfam, 2011). Hence, this study aims at investigating the potential results of manipulating task complexity on L2 learners’ writing task performance in terms of syntactic complexity.

2. Review of literature

2.1. Theories of task complexity in TBLT

Two models of task complexity in the field of Second Language Acquisition (SLA) have been developed. The first one was suggested by Robinson (2001a, 2001b, 2003) which is called “Cognition Hypothesis” and the second one proposed by Skehan (1996) as “Trade-off Hypothesis” (or the Limited Attentional Capacity Model). In this study, Robinson’s CH model (2001a, 2001b, 2003) was used. In what follows, the two models will be explained and the justification for choosing the Robinson’s CH will be explained.

2.1.1. Robinson’s Cognition Hypothesis (CH) and its Related TCF

Robinson (2001a, 2001b, 2003) distinguished two dimensions for task complexity. The first one refers to “Resource-directing”, which guides learner’s attention to special linguistic characteristics of a task, and the second one refers to “Resource-dispersing” which lessens learner’s attention on different parts of the tasks (Robinson, 2003, p. 59). “Reasoning demands” is an example for resource-directing dimension. In this situation, doing tasks does not require reasoning on the part of the learners, it only

requires simple communication of information and smaller amount of theoretical and linguistic attempt and resources. On the other hand, a task which requires reasoning demands requires a minimum cause-consequence subordination. Robinson states that if cognitive complexity increases through this form of dimensions, attentional and memory resources will be directed to task completion and the result would be a more exact and complicated speech; however, fluency would be influenced negatively (Robinson, 2003).

Having access to “planning time” during task performance could be an example of a resource-depleting variable. The reason lies on the fact that having no planning time leads to more complexity of a task since attentional resources would be directed over the different parts of the task. However this dimension prepares learners for real-life situations and it should be considered by syllabus designers. Considering resource-dispersing dimensions, it has been predicted that the increase in task complexity would have a negative influence on all parts of L2 production but it will improve interaction (Robinson, 2003).

Finally, CH claims that tasks’ sequencing based on the degree of complexity forms the perfect situations for practice; therefore, it leads to achievements in automaticity (DeKeyser, 2000), and “it helps the administrative processes of scheduling, and coordinating the component demands of complex tasks”.

Robinson improved the TCF in association with CH (Robinson, 2001a; 2007b). TCF has differentiated factors among task complexity, task condition and task difficulty. In the following a plan of the CH, along with its elements will be presented. Meanwhile, its organization into categories in the TCF (its different versions) will be discussed (Robinson, 2001a, 2001b; Robinson & Gilabert, 2007).

Robinson (2001a) identified three main factors, which communicate to influence task performance and learning including; “Task Complexity”, “Task Difficulty”, and “Task Condition”. The first one deals with “Task Complexity”. These are represented as “dimensions, plus or minus a feature, but can also be thought of in some cases as continuums, along which relatively more of a feature is present or absent” (p. 293). These dimensions of complexity, according to him, are “design features of tasks”, and they can be manipulated to improve or decrease the cognitive demands of task performance. “For example, tasks which require simple description of events happening now, in a shared context (+here and now), where few elements (+few elements) have to be described and distinguished consume less amounts of attentional, memory and reasoning resources than tasks which

require reference to events that happened elsewhere (–here and now), in the past, where many elements have to be distinguished (–few elements), and where reasons have to be given to support statements made (+reasoning)” Robinson (2001a).

The second group of factors in the TCF includes factors contributing to “Task Difficulty” (Robinson, 2001a). “Task Difficulty” can be affected by two different variables: (a) affective variables such as motivation, anxiety and confidence which could vary in a short period of time and (b) *ability* factors which can be evaluated in advance such as aptitude, proficiency and intelligence. These features are brought by learners to task performance and nothing can be done generally about them before the application of syllabus.

As a result, “Task Condition” factors deal with the nature of the participation required on task (e.g., one-way or two-way information exchange, closed or open task solution), and also participant variables, such as (same or different gender in pairs or groups, or being previously familiar/unfamiliar with each other).

Robinson and Gilabert (2007) believed that “gradually approximating target-task demands, by using increasingly complex pedagogic tasks, requires both developing an operational taxonomy for classifying target task features which can be used by task designers, and establishing some principles for sequencing these features, and combinations of them, in an order which approaches target-task demands”. According to them the taxonomic system for pedagogic task classification “should include categories of the design features of tasks that can be simulated and sequenced to promote further analysis and development of existing interlanguage knowledge in line with the target L2” (p. 163). To meet these criteria, Robinson and Gilabert (2007) added new parts to the current version of the TCF. The foundation of the model by Robinson and Gilabert (2007) was based on a difference between task complexity, task difficulty, and task conditions, and a subdivision within each category (Table1).

Table 1. The Triadic Componential Framework for task classification
(adopted from Robinson & Gilabert, 2007)

Task complexity (Cognitive factors)	Task condition (Interactive factors)	Task difficulty (Learner factors)
(Classification criteria: Cognitive demands)	(Classification criteria: interactional demands)	(Classification criteria: ability requirements)

(Classification procedure: information-theoretic analyses) (a)resource directing variables making cognitive/conceptual demands	(Classification procedure: behavior- descriptive analyses) (b)Participation variables making interactional demands	(Classification procedure: Ability assessment analyses) (a)ability variables and task-relevant resource differentials
+/-here and now +/-few elements -/+spatial reasoning -/+causal reasoning -/+intentional reasoning -/+perspective taking	+/-open solution +/-one-way flow +/-convergent solution +/-few participants +/-few contributions needed +/-negotiation not needed	h/l working memory h/l reasoning h/l task switching h/l aptitude h/l field independence h/l mind/intention- reading
(b)Resource-dispersing Variables making performative/procedural demands	(b)Participant variables Making interactant demands	(b)Affective variables and task-relevant state- trait differentials
+/-planning time +/-single task +/-task structure +/-few steps +/-independency of steps +/-prior knowledge	+/-same proficiency +/-same gender +/-familiar +/-shared content knowledge +/-equal status and role +/-share cultural knowledge	h/l being ready to experience h/l feeling management h/l task inspiration h/l processing anxiety h/l willingness to communicate h/l self-efficacy

Considering the impact of task complexity on L2 production , a different analysis was presented by Skehan based on the alternative Limited Attentional Capacity Model (1996).This model is going to be discussed in the next part.

2.1.2. Skehan’s Limited Attentional Capacity Model

Considering the Limited Attentional Capacity Model (also called as The Trade-off Hypothesis), “cognitively demanding tasks require trade-offs from limited attentional resources” (Skehan, 2003; Skehan & Foster, 1999).

A set of hypotheses about learners' differences in doing tasks with different cognitive complexity levels form the Trade-off Hypothesis (Skehan, 2009). It is assumed that attentional capacity and working memory are limited, and since performance in each of the three areas of, Complexity, Accuracy, and Fluency (CAF), requires attention and working memory involvement, committing attentional resources to one area might cause lower performance in others. In other words there is a competition between form (complexity and accuracy) and fluency, and most importantly, there is a competition between complexity and accuracy in cases where cognitive complexity of tasks increases. This is the most important distinction between the Trade-off Hypothesis, and the Cognition Hypothesis, where the latter assumes that simultaneous progress of accuracy and complexity will happen when cognitive task complexity of the task input is increased.

2.2 Justification for Choosing the Cognition Hypothesis

Drawing on Levkina's (2013) accounts on the benefits of using CH and its related TCF in empirical studies, the researcher provided some justifications for using this framework as a basis for design of this study:

First, Robinson's suggestion is based on studies in different fields such as sociology, psycholinguistics psychology and even economy. Therefore, his idea is highly theory-driven and it is based on the CH.

Meanwhile, a well-planned TCF in association with CH has been restructured based on empirical studies as well as theoretical ones to provide more opportunities for empirical studies. While Skehan (1996) elaborated on the factors that may influence performance on the tasks, Robinson (2001a) presented a detailed program for doing research on tasks, which was highly supported by theory. Based on this program, researchers have a clear picture of the framework which can help them to design an experiment based on task complexity, and rationalize their results based on theories.

Finally, the model organized the main characteristics of task into three main groups including: task conditions, task complexity, and task difficulty. Through this organization, any confusion would be prevented when applying the theory into practice, particularly when "task complexity" is contrasted with "task difficulty". So both researchers and syllabus designers could use the model.

2.3. Reasoning demands as a variable of task complexity

As mentioned previously, Robinson (2001a, 2001b, 2005, 2007a, 2011) categorizes reasoning demands as a part of the resource-directing dimension of task complexity. Getting incites from first language acquisition

studies and psychological research, Robinson (2011) identified three aspects of reasoning, including: “spatial, intentional, and causal reasoning” (p. 15). In some studies, researchers attempted to distinguish different types of reasoning demands (spatial reasoning, i.e., reasoning about distance and position in physical space; intentional reasoning, i.e., reasoning about motives and intentions of people; and causal reasoning, i.e., reasoning about causes and effects of events), however, in other studies no distinction were made due to the fact that the distinction is very delicate, especially between intentional and causal reasoning.

The claim about “intentional reasoning” was originated from first language acquisition research. Intentional reasoning entails “reasoning about, and successfully understanding (intention-reading) the motives, beliefs and thoughts which cause people to perform actions” (Robinson, 2007a, p. 194), “which has been a much studied subject in both developmental and differential cognitive psychology, and in theories of the relationship between language and thought in child development”. Shatz, Wellman and Silber (1983) mentions that “the ability to represent, conceptualize and reason about psychological, mental states has been called a person’s theory of mind” which “frames and interprets perceptions of human behavior in a particular way; as perceptions of agents who can act intentionally and who have feelings, desires and beliefs that guide their actions” (Malle 2005, as cited in Robinson, 2007a). Lee and Rescola (2002) found that cognitive state terms (e.g., *think*, *know*) emerged later in children than physiological (e.g., *sleepy*), emotional (e.g., *happy*), and desire terms (e.g., *want*). They also represented that the application of psychological, cognitive state terms was related considerably and positively with the use of complex syntax in child development using measures from Scarborough’s (1990) “Index of Productive Syntax (IPSYN)”.

In L2 English, as Robinson (2011) proposed, “the same process happens; in other words, tasks which require complex reasoning about the intentional states that motivate others to perform actions can be expected to draw the use of cognitive state terms for reference to other minds”.

There have been a number of studies on intentional reasoning in oral modality (e.g. Baralt, 2010; Choong, 2011; Kim, 2009; Lee, 2002; Nuevo, 2006; Révész, 2011; Robinson, 2000, as cited in Robinson, 2005, among others). However, of the small group of studies on cognitive task complexity and writing, the work of Choong (2014), Frear (2014), Kuiken, Mos, and Vedder (2005), Kuiken and Vedder (2007, 2008, 2011, 2012), Masrom, Alwi, and Daud (2015), and Sercu, De Wachter, Peters, Kuiken, and Vedder (2006) manipulated task complexity along reasoning demands dimension; in fact,

some of these studies manipulated task complexity along both reasoning demands and number of elements.

2.4. Measuring written task performance

Measurement considerations should be addressed as an important part of every study of the effect of task complexity on L2 task performance. In this part, issues related to the measurement of the writing task performance in terms of syntactic complexity will be addressed.

According to Foster and Skehan (1996) complexity draws attention to the "progressively more elaborate language", as well as "a greater variety of syntactic patterning" (p.303). In general, high complexity is shown by using a wide variety of both simple and sophisticated grammatical structures, while low complexity is indicated by using only simple structures. The syntactic complexity measures were classified into three groups generally used across language-related fields (Norris & Ortega, 2009): "(a) measures based on length in which syntactic complexity is calculated by dividing words by a chosen production unit. (b) metrics that measure amount of subordination, in which syntactic complexity is calculated by counting all clauses and dividing them over a given production unit of choice, yielding, and (c) measures using a variety of formulas" devised in other fields in order to capture the variety, sophistication, and acquisitional timing of grammatical forms used in production, such as Scarborough's (1990) Index of Productive Syntax.

Norris and Ortega (2009) emphasized that SLA researchers should approach "syntactic complexity from a multidimensional perspective; in fact, at best, they should measure overall complexity (e.g. mean length of T-unit), complexity by subordination (e.g. mean number of clauses per T-unit), and complexity by sub-clausal or phrasal elaboration (e.g. mean length of clause)". However, they argued that in order to choose one measure among others researchers should use measures that best fit the proficiency level of the subjects of their study; they mentioned that at beginning levels of development coordination is expected to be the most indicative source of complexification, whereas at intermediate levels subordination is a useful and powerful indicator of complexification. However, at higher levels, using more phrasal-level complexification is considered as a sign of syntactic complexification.

Considering the above mentioned literature, the present study designed to analyze the following research question and research hypothesis:

Research Question: Does grading tasks based on their reasoning demands have any significant impact on EFL learners' writing task performance in terms of syntactic complexity?

Null Hypothesis: Grading tasks based on their reasoning demands does not have any significant impact on EFL learners' writing task performance in terms of syntactic complexity.

3. Method

3.1. Participants

90 students from three intact classes at Islamic Azad University, Shahr-e-Qods Branch, participated in the study. Their ages were between 20-32 years and the participants were both male and female. They were selected from a larger group of 120 learners based on their performance on Preliminary English Test (PET). Students who scored within the range of one standard deviation below and above the mean in the PET test were selected for the purpose of the study. They were B.A. students majoring in English language translation. During the study they were taking two-credit essay writing course. They were expected to have studied English for 7 years in junior and senior high school levels before entering university. The sample was assumed to represent the larger population of Iranian university students, for they were from different provinces of Iran and factors such as age and gender were randomly distributed. During the course, all the students studied the same text book "The practical writer" by Bailey and Powell (2009).

3.2. Instruments

To obtain the required data for this study, the following instruments were employed:

3.2.1. Preliminary English Test (PET)

PET (Preliminary English Test, 2015); taken from the website <http://www.cambridgeenglish.org/exams/preliminary/exam-format>, is made up of three papers developed to test the participants' English skills. It consists of three sections: reading and writing, listening, and speaking. For the purpose of this study just reading, writing and listening part were administered.

3.2.2. Pre-test and post-test

A cartoon picture description task adopted from Abdollahzadeh and Kashani (2011) was used as both the pre-test and post-test. The task involved writing a story based on a set of nine cartoon pictures. The selected picture story, although clearly structured with a chronologically ordered series of events, requires interpretation on the part of the learners because the character's motive for performing different actions is uncertain until the final picture.

3.2.3. Picture Arrangement (PA) subtest of Wechsler Adult Intelligence Scale, Revised version (WAIS-R)

The Wechsler Adult Intelligence Scale (WAIS) is a test of intelligence designed to determine cognitive ability in adults. The original WAIS was mentioned in Wechsler (1955, as cited in <https://www.wechsleradultintelligencescale.com/>). "It is currently in its fourth edition (WAIS-IV) released in 2008, and is the most widely used IQ test for both adults and older adolescents in the world. The WAIS-R, a revised form of the WAIS, was released in 1981 and consisted of six verbal and five performance subtests". For the purpose of this study the Picture Arrangement (PA) subtest of WAIS-R was used to operationalize intentional reasoning demands. It is based on a set of pictures which increasingly require more reasoning ability in performing tasks about characters of motives and their intentions behind doing actions.

3.3. Procedure

In order to answer the research questions the following steps were taken in the current study:

For the purpose of homogenizing the participants, a sample of PET was used to ensure that the participants were from almost the same general proficiency level. After the main administration of the test, the participants were given a score based on their performance and those participants whose scores were within the range of one standard deviation above and below the mean were chosen to participate in the study. The selected participants were distributed in three groups: Experimental A, Experimental B, and a Control group; each consists of 30 students.

During the first session, the students in all groups took part in the pre-test. A cartoon picture description task adopted from Abdollahzadeh and Kashani (2011) was used as the pre-test. The participants were required to write a narrative account for the cartoon picture in thirty minutes. From

the second session, the treatment sessions including 8 sessions of picture description task performance began, during which the first experimental group (Experimental A) received a series of 8 picture description tasks in a randomized order of cognitive complexity; each in one session. The second experimental group (Experimental B) received the same tasks, but this time the tasks were ordered from simple to complex based on their required reasoning demands; in other words the simplest task were administered in the first session and the most complex one was administered in the last session of the treatment. The control group, on the other hand, did not receive any picture description tasks; rather they received some typical writing activities and performed extra writing tasks from the course book. In fact, during the first forty five minutes of every session students in all groups received the writing lesson from the book based on a pre-specified syllabus, and write a paragraph or an essay about an agreed upon topic. They were supposed to revise their pieces of writing and give them to the instructor as their assignment for the next session. Two of the students were required to copy their papers for the whole class to be corrected by the other students and the instructor during the next session. The treatment tasks were administered to the participants in the experimental groups during the second forty five minutes of the session time. During the second half of the class time, first linguistic input, in the form of phrases that would be helpful, but not essential, for completing the tasks, were provided to the students along with the set of pictures for each task. Next, the students were given 30 minutes to perform the task during which they were allowed to use a Persian to English dictionary. After that the correct arrangement of the pictures was provided to the learners along with a clear description of the story; therefore, the students became aware of their errors, and ask and answer questions regarding grammatical points and word choice. The questions were answered by either the other students or the instructor. Finally, during the last session the post- test which was the same as the pre- test was administered to the participants.

3.3.1 The Treatment Tasks

Most of the previous studies related to task complexity and writing had been cross-sectional studies that only required students' participation at one point in time. However, in this study the treatment tasks were sequenced to increase in complexity according to the claims of Robinson's (2003) CH. This involved sequencing the tasks so they increased in complexity along the resource-directing dimensions by increasing the intentional reasoning demands of the tasks.

Getting insights from Robinson (2000, as cited in Robinson, 2005) reasoning demands was operationalized by using a series of one-way, closed picture arrangement tasks. "The participants were asked to view a randomly ordered series of pictures showing characters performing different actions, and decide which chronological sequence they should be arranged into in order to depict a coherent story". Then they were supposed to provide a written account of the story that the order of pictures presented (based on the sequential order). Reasoning demand was differentiated by using a set of least to most complex picture sequences from the PA subtest of the WAIS-R. PA consists of ten tasks; the last eight of which were administered during the eight sessions of treatment.

During the PA subtest, a set of pictures was used which increasingly require more reasoning ability in performing tasks about characters of motives and their intentions behind doing actions. The simplest chain was made by using three pictures showing three stages, or sequential actions, which are required in building a house with no justification about the thoughts or intentions of the people. On the other hand, the most difficult form can only be ordered successfully if intentions, motives and thoughts can be understood. Based on Robinson's description of different types of reasoning; the tasks were designed to measure intentional reasoning.

To perform the data coding, among different measures of syntactic complexity, the measure of subordination, which is the most employed type of complexity measure in SLA research, was employed in this study. The subordination measure which was employed in this study was the number of clauses per t-unit. A t-unit was defined as "an independent clause and its dependent clauses" (Hunt, 1965, as cited in Polio, 1997).

Since the CH argues that increasing task complexity along resource-directing dimensions such as intentional reasoning demands will necessitate the use of logical subordinators, this measure seemed to be the most appropriate of all measures of syntactic complexity. This measure is calculated using the following formula: Number of clause/Number of t-units

The students' performances in writing were scored by two raters; both the researcher and another expert teacher, according to the performance measures of syntactic complexity. To increase the accuracy of the rating, the researcher repeated the rating. Intera-rater reliability and inter-rater reliability with the second rater were calculated.

4. Results

In order to answer the research question and to verify the null hypothesis, first the quality of the numerical data was analyzed with one-sample Kolmogorov-Smirnov tests of normality. Later, reliability of the estimates of syntactic complexity was investigated and homogeneity of the samples in terms of their members' language proficiency and writing ability was evaluated. Then the effect of the treatment provided in each of the samples on the subjects' writing complexity was examined individually (with three Wilcoxon signed rank tests) and later in comparison with the other groups (with two independent-samples Kruskal-Wallis hypothesis tests). Tables 2 through 7 summarize results of the Wilcoxon signed rank tests of the pretest and posttest of syntactic complexity in the samples.

Table 2. Wilcoxon signed rank test of the pretest and posttest of writing complexity of the first experimental group

Total N	30
Test Statistic	465.000
Standard Error	48.602
Standardized Test Statistic	4.6784
Asymptotic Sig.(2-sided test)	.000

Table 3. Wilcoxon signed rank hypothesis test of writing complexity of the first experimental group

Hypothesis Test Summary

	Null hypothesis	Test	Sig.	Decision
1	The median of differences between the pretest of writing complexity of the 1st experimental group and the posttest of writing complexity of the 1st experimental group equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed.

The significance level is .05.

In Tables 2 and 3, the two-sided asymptotic level of significance of the difference between the first experimental group members' writing complexity scores in the pretest and the posttest, which was ($p = .000$), was

smaller than the standard level of significance which was ($p = .05$); consequently, it was concluded that a statistically considerable improvement had happened in the first experimental group.

Table 4. Wilcoxon signed rank test of the pretest and posttest of writing complexity of the second experimental group

Total N	30
Test Statistic	464.000
Standard Error	48.617
Standardized Test Statistic	4.762
Asymptotic Sig.(2-sided test)	.000

Table 5. Wilcoxon signed rank hypothesis test of writing complexity of the second experimental group

Hypothesis Test Summary

	Null hypothesis	Test	Sig.	Decision
1	The median of differences between the pretest of writing complexity of the 2nd experimental group and the posttest of writing complexity of the 2nd experimental group equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed.

The significance level is .05.

Tables 4 and 5, on the other hand, suggest that there was a statistically significant difference between the second experimental group members' performance in the pretest and posttest of writing in terms of writing complexity. In other words, because the estimated level of significance of the difference between the two sets of scores was ($p = .00$), which was smaller than the standard level, it was proven that, like the case with the first experimental group, the treatment given in this group was statistically effective.

Table 6. Wilcoxon signed rank test of the pretest and posttest of writing complexity of the control group

Total N	30
Test Statistic	374.000
Standard Error	41.611

Standardized Test Statistic	4.446
Asymptotic Sig.(2-sided test)	.000

Table 7. Wilcoxon signed rank hypothesis test of writing complexity of the control group

	Null hypothesis	Test	Sig.	Decision
1	The median of differences between the pretest of writing complexity of the control group and the posttest of writing complexity of the control group equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Finally, exactly similar to the two experimental groups, the control group members who had not been provided with any picture description tasks improved significantly throughout this research. This conclusion was made since the estimated level of significance reported in Tables 6 and 7 (i.e. $p = .000$) was less than the pre-specified level of significance ($\alpha = .05$). Subsequently, it was established that the members of the control group had enhanced their writing complexity.

Following inspection of the effect of the treatments given in each sample, the effect of the treatments on the three groups was compared comparatively. This was done with two nonparametric tests (i.e. independent samples Kruskal-Wallis tests) because the data being analyzed was not normal. Tables 8, 9, 10 and 11 and Figures 1, 2 and 3 summarize the findings of these statistical tests.

Table 8. Independent-samples Kruskal-Wallis test of the pretest of writing complexity of the three groups

Total N	90
Test Statistic	.422
Degrees of Freedom	2
Asymptotic Sig. (2-sided test)	.810

Table 9. Independent-samples Kruskal-Wallis test of the posttest of writing complexity of the three groups

Total N	90
Test Statistic	46.362
Degrees of Freedom	2
Asymptotic Sig. (2-sided test)	.000

The test statistic is adjusted for ties.

Table 10. Independent-samples Kruskal-Wallis hypothesis test of the three groups

Hypothesis Test Summary

	Null hypothesis	Test	Sig.	Decision
1	The distribution of the pretest of writing complexity is the same across categories of group membership.	Independent-Samples Kruskal-Wallis Test	.810	Retain the null hypothesis.
2	The distribution of the posttest of writing complexity is the same across categories of group membership.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 11. Pairwise comparison of the independent-samples Kruskal-Wallis hypothesis test of the three groups

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig
Experimental Group 1 (Tasks used in a randomized order of cognitive complexity) – Experimental Group 2 (Tasks sequenced based on their cognitive complexity)	-31.417	6.734	-4.665	.000	.000
Experimental Group 1 (Tasks used in a randomized order of cognitive complexity) – Control	13.217	6.734	1.963	.050	.149

group (No picture description task)					
Experimental Group 2 (Tasks sequenced based on their cognitive complexity) – Control group (No picture description task)	44.633	6.734	6.628	.000	.000

Each row tests the null hypothesis that the sample 1 and sample 2 distributions are the same
Asymptotic significances (2-sided tests) are displayed. The significance level is .05.

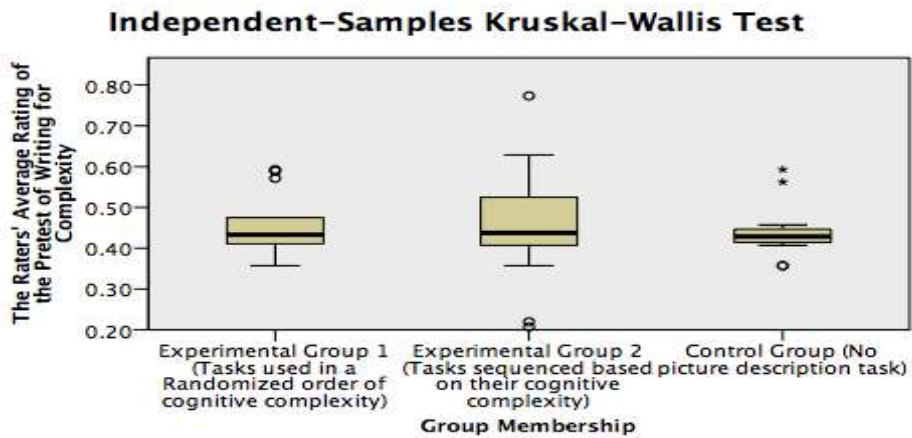


Figure 1. Independent-samples Kruskal-Wallis test of differences between the pretest of writing complexity in the three groups

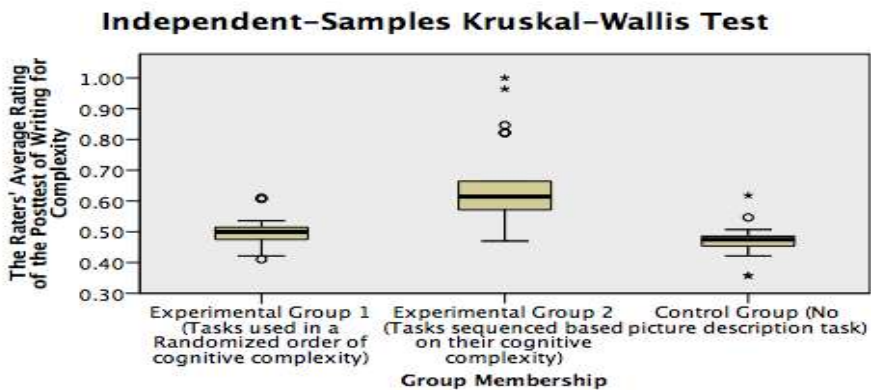


Figure 2. Independent-samples Kruskal-Wallis test of differences between the posttest of writing complexity in the three groups

The next step to be taken was identification of the pairs of samples differences which had led to the observed dissimilarity. This was done using pairwise comparison of the independent-samples Kruskal-Wallis test shown in Table 11 and Figure 3.

It is clearly specified in Table 11 that the second experimental group was considerably better than the other two groups in terms of writing complexity. This conclusion was made because the adjusted levels of significance of the pairs of experimental group 1 – experimental group 2 and experimental group 2 – control group were both .000 which was less than .05. This is illustrated in Figure 3.

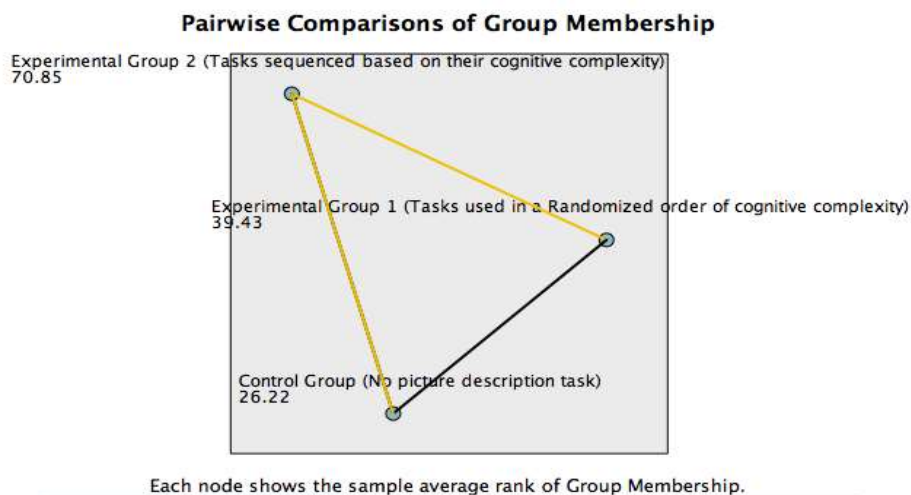


Figure 3. Pairwise comparison of differences between the posttest of writing fluency in the three groups

It is clearly specified in Table.11 that the second experimental group was considerably better than the other two groups in terms of writing complexity. This conclusion was made because the adjusted levels of significance of the pairs of experimental group 1 – experimental group 2 and experimental group 2 – control group were both ($p = .000$) which was less than .05. This is illustrated in Figure 3.

5. Discussion

Based on the results of the data analysis, the null hypothesis (i.e. “manipulating task complexity along reasoning demand does not have any significant impact on EFL learners’ writing task performance in terms of syntactic complexity”) was rejected. This is because, the second experimental group members performed better than the members of the other two

groups. In other words, manipulating task complexity along reasoning demand affects EFL learners' writing syntactic complexity if tasks are sequenced on the basis of cognitive complexity.

In the rest of this section first the compatibility of the results of the study with Robinson's CH (2001a, 2001b, 2003) will be examined, and then the results of the study will be compared to and contrasted against some previous related studies.

According to Robinson (2003) "manipulating task complexity along resource-directing dimensions (e.g. the amount of reasoning) may direct attentional and memory resources to task completion and therefore generate more complex speech" (Robinson, 2003). Therefore, the findings of this study partially confirm the Robinson's cognition hypothesis; in that, it provides further support for the positive impact of task complexity manipulation (along intentional reasoning demands dimension) on EFL learners' writing complexity.

There are some studies which have investigated the effect of manipulating task complexity along different resource-directing dimensions on different aspects of writing performance (Choong, 2014; Frear, 2014; Frear & Bitchener, 2015; Ishikawa, 2006; Kuiken & Vedder, 2007; Masrom et al., 2015; Rahimpour & Hosseini, 2010, and Sercu et al., 2006).

The results of this study are to some extent in line with Ishikawa's findings (2006) who concluded that increasing task complexity with respect to resource-directing dimension of (+/-here and now) improved written language productions' complexity. On the other hand, the findings are in opposition with the results of Rahimpour and Hosseini (2010) who analyzed the influence of task complexity along the resource directing dimensions of (+/-here-and-now and +/-contextual support) and demonstrated no significant effect for complexity on writing performance.

Among these studies Choong (2014), Frear (2014), Kuiken and Vedder (2007) and Sercu et al. (2006) manipulated task complexity along the same resource directing dimension as this study (i.e. reasoning demands). However, it has to be mentioned that none of these studies manipulated task complexity along a period of time; in fact, they manipulated task complexity in one-shot studies by providing the learners with two or more versions of the same task (with different degrees of complexity) during a single session. Except for this research there has been paucity of research directed specifically at the effect of a cycle of simple to complex versions of a task taking place over a longer period of time (e.g. Robinson, 2007a; Thompson, 2014); nevertheless, it is worth mentioning that both of these studies have been conducted in the oral mode of performance. In what follows, the

results of this study will be compared with previous studies which have been closer to this study.

The results of the present study are partly similar to the results of the study done by Masrom et al. (2015) in that they showed task complexity significantly improved syntactic complexity of language production throughout “asynchronous computer-mediated communication (ACMC) writing tasks”. However, their study was different from this study in that they analyzed the results of managing the resource directing dimension of (+/- causal reasoning demand) and another resource dispersing dimension (+/- task structure) simultaneously within computer-mediated communication.

The results of this study also confirm the results of the studies done by Abdollahzadeh and Kashani's study (2011) who manipulated task complexity along resource-directing dimension of (+/-here and now); in that they reported significant positive impact for task complexity on complexity in writing performance.

However, the findings of the present study were in contrast with Frear (2014) study which manipulated task complexity along (+/- reasoning demands and +/- few elements) through using three letter writing tasks with low, medium, and high complexity which reported negative effect for task complexity on complexity in writing task performance. and

Among those studies which manipulated task complexity along the reasoning demands dimensions the results of this study are only in line with the findings of Choong's (2014) and Frear and Bitchener (2015) studies that examined the impact of task complexity manipulation along reasoning demands on written production and reported significant positive impact for task complexity on syntactic complexity.

6. Conclusion

This study investigated the impact sequencing tasks based on the resource-directing dimension of intentional reasoning demands from simple to complex on writing task performance in terms of syntactic complexity. The findings of the study showed that the second experimental group members outperformed the other two groups. In other words, manipulating task complexity along the reasoning demands dimension positively affects EFL learners' writing in terms of syntactic complexity if tasks are sequenced from simple to complex on the basis of their required reasoning demands. The goal of future research might be to address the limitations of this study to pursue future research objectives, and thereby extend the potential

significant theoretical, methodological, and pedagogical implications in L2 acquisition theory and practice.

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Biodata



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