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The Role of Task Complexity and Working Memory Capacity in L2 Accuracy and Fluency*

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Abstract
This study explored the impact of task complexity on task performance of Iranian lower-intermediate and advanced language learners. It also investigated how working memory was related to task performance and mediated the influence of complexity conditions on language performance. Task complexity was operationalized by designing differing tasks along the +/- reasoning and the +/- few elements dimensions. Eighty Iranian EFL learners (40 lower-intermediate and 40 advanced) carried out argumentative tasks which differed in complexity level. Working memory capacity was measured by applying the Persian translation of Wechsler's (1987) working memory test, and task performance was measured in terms of accuracy and fluency. The results revealed that for lower-intermediate learners, task complexity led to decrease in accuracy in the complex tasks, while fluency was boosted in simple task condition. For advanced learners, task complexity resulted in improved accuracy, while fluency decreased in complex condition. The results of multivariate analyses revealed that learners' language performance in the complex group significantly differed from that of the simple group on the combined dependent variables for both lower-intermediate and advanced learners. There was no significant correlation between working memory and any performance measures.

Key words: *Task-based language teaching, argumentative task, task complexity, working memory, accuracy, fluency*

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1. Introduction

Task-based language education comprises both a revolutionary way of teaching foreign languages and a thriving field of second language learning studies (Ahmadian, 2016). Communicative task, as a significant instrument both for the systematic instruction of language and for broadening learners' current linguistic knowledge, is a logical improvement from the perspective of the classroom and foreign language learning research (Bygate, 2015). As an extension of communicative language teaching, task-based language teaching aims for the occurrence of effective learning by engaging learners in using the language to perform tasks (Bao & Du, 2015). The rationale for task-based language teaching is that tasks can be structured and employed in the classroom to involve learners in interactive use of language to enable them to understand how various facets of language function and how language is integrated into their successful communicative use.

Within this dynamic area of research, a crucial purpose has been to conduct investigations into the impact of task complexity on language production and development in order to define task grading and sequencing standards to guide curricular decisions (Robinson, 2001; Skehan, 1998). Skehan (2014) and Robinson (2001, 2011) have formulated hypotheses concerning the way task design characteristics exert an influence on learning by putting various degrees of cognitive demands on cognitive resources of learners and drawing learners' attention to specific aspects of use, performance, and learning of language. The limited attentional capacity model (Skehan, 2001; Skehan & Foster, 2001, 2012) views task complexity at variance with learners' ability to pay attention to both content and form. On the contrary, the cognition hypothesis (Robinson, 2003) assumes that attentional resources do not actually clash with one another. Instead, various aspects of task complexity contribute to widening the current L2 system of learners' and promoting access to it.

van Patten, (2007) contends that learners have restricted capacity processing and encounter problems in striking a balance between divers facets of language production such as lexical complexity, syntactic

complexity, accuracy, and fluency. It is claimed that manipulating tasks attract learners' attention to various aspects of performance and assist them in developing a balanced interlanguage (Robinson, 2015; Skehan, 2016). Hence, anticipating which task characteristics lead to improvement in each dimension of second language is crucially significant (Skehan, 2016).

Motivated by Robinson's (2001) cognition hypothesis, the present study examined the effect of task complexity and working memory capacity on L2 accuracy and fluency in more or less complex tasks. Cognition hypothesis anticipates that cognitive and affective individual differences that relate to attentional demands of tasks would progressively make difference in learners' performance as task complexity is increased (Robinson, 2007). That is, diversities in cognitive abilities, like memory capacity, help provide a rationale for variance in learners' performance when they are involved in more cognitively complex tasks. Despite the fact that this prediction has been put to test in a number of studies with respect to affective factors (Revesz, 2011), there have been few studies to date on the degree to which working memory capacity might serve as a mediator between task complexity and the output of L2 (Jung, 2018; Zalbidea, 2017).

2. Review of the Related Literature

2.1. Task-based Language Teaching

Based on the communicative language teaching methodology, tasked-based approach to language teaching came into the world of language teaching in response to some restrictions of the traditional process of presentation, practice, and performance approach (Ellis, 2003). Bygate (2015) argues that task based language teaching paves the way for systematic teaching of language and expands learners' knowledge of language. This increasing interest in task-based approach could be due to such built-in attributes of tasks as influencing and prompting learners to make use of their cognitive and linguistic resources, focusing primarily on meaning and being outcome-oriented in the manner that learners are expected to make use of language with the purpose of fulfilling some kind of real-world goals (Ellis, 2003).

Bygate (2015) argues that task-based language teaching came in vogue out of the desire of language instructors to assist learners in the acquisition of the language and boosting their abilities and skills to apply their knowledge of the language in real-world activities. Involving learners in task work offers an appropriate situation for the activation of learning processes, hence providing better opportunities for language learning to occur.

Perhaps, one of the well-known definitions of task is provided by Long (1985). He considers task as a piece of work carried out for oneself or for others, freely or for some rewards. Therefore, instances of tasks entail buying a pair of shoes, borrowing a library book, making an airline reservation, filling out a form, making a hotel reservation, taking a driving test, typing a letter, finding a street destination, writing a check, and helping someone across the road. According to Skehan (1996), a task is an undertaking for which meaning plays the main role; there is some kind of connection to the real world; fulfillment of the task has some priority; and task evaluation occurs in terms of the result of the task. To Nunan (1989), a communicative task is considered to be a piece of classroom technique which engages learners in understanding, manipulating, interpreting, and generating in the target language, while their attention is mainly focused on meaning rather than form.

Bygate, Norris, and Branden (2015) contend that task aims to accomplish two purposes. Firstly, it intends to foster communication challenges to motivate the introduction and practice of language. Secondly, it offers contexts which assist learners to comprehend, acquire, and apply language for meaningful communicative purposes.

2.2. Cognition Hypothesis

Two theoretical frameworks, Skehan's (1998) limited capacity hypothesis and Robinson's cognition hypothesis, explain the influence of task characteristics on the degree of attention learners allocate during task performance. These two hypotheses concern how increasing the attentional demands of tasks exert influence on language performance (Robinson, 2011).

The limited capacity hypothesis assumes a limited capacity for learners' attentional resources and posits that tasks bearing more complex cognitive load call for learners' attentional resources. Skehan (1998), drawing on the limited capacity hypothesis, contends that there is a trade-off between attention to form and attention to meaning during task performance. Hence, tasks bearing more complex cognitive load, necessitate more attention to content and, accordingly, less attention remains for learners to focus on linguistic codes (Skehan, 1998).

The cognition hypothesis put forward by Robinson's (2001) assumes that there are various and noncompetitive pools of attention for learners. Robinson rejects the existence of a trade-off between attention to accuracy and attention to complexity of language production. Robinson (2001) indicates that enhancing the complexity of collaborative tasks promotes the occurrence of more reciprocal characteristics such as corrective feedback and negotiation for meaning which, in turn, develops interlanguage knowledge (Robinson, 2001, 2007)

Within almost the same lines of reasoning, Robinson (2011) suggests a multiple resource perspective on language processing in his cognition theory, operationalized in the triadic componential context, which forecasts mental conditions of tasks that enable learners to make use of various resource pools and concurrently process various aspects of language. Robinson, therefore, argues that the intellectual specifications of tasks bearing more complex cognitive load direct the various focus capabilities of learners to sophistication and precision and promote language learning and development. There are three facets to this framework: tasks complexity, tasks conditions, and tasks difficulty. Task complexity is composed of resource-directing and resource-dispersing dimensions. Depending on the conceptual requirements of the tasks, such as reference to past or present events, the number of past or present events, the resource-directing dimension places different levels of cognitive requirements on the attention resources of the learners. The resource-dispersing facet places procedural requirements on the cognitive resources of the learners and entails, among others, planning time, prior knowledge of the assignment, and the set of tasks

which need to be completed. Task condition encompasses the circumstances under which pedagogical tasks are carried out. Task difficulty represents features of learners that affect the performance of tasks. The characteristics of learners include both cognitive and affective variables. Robison (2001, p. 31) states that

Increasing task complexity along resource-directing dimensions makes greater resource demand which can be met by using specific features of language code such as logical connectors. In contrast, complex task along resource depleting dimensions make greater demands on attention and working memory, but do not direct resources to features of language code that can be used in completing the task.

Robinson (2011) argued that raising task complexity along the resource-directing facets gives rise to simultaneous improvements in language production of accuracy and complexity as learners need to utilize their various attention resources to satisfy the task's various conceptual requirements. However, the fluency in their language output can deteriorate as learners have to absorb language. In comparison, as the task sophistication along the resource-dispersing axis would place procedural criteria on the working memory of learners, it will contribute to decreased fluency, precision, and complexity of the output of language for learners.

2.3. Working Memory

Working memory is among various variables that can codetermine the production of language through mediating input processing (Baddeley, 2003; Cowan, 2014). Disparities in cognitive capacity such as attentional resources, memory, and abilities in processing also have an effect on task performance and the influence of task complexity (Kim, Payant, & Pearson, 2015). In general, working memory is described as memory system with a restricted capacity where the arriving perceptual stimuli are simultaneously retained and interpreted for complex cognition (Baddeley, 2007). Working memory refers to "a brain system that temporarily stores and manipulates the information necessary for such complex cognitive tasks as understanding language, learning, and reasoning" (Baddeley, 1992, p. 556).

Working memory refers to the ability of a person to store, recapture, and interpret linguistic knowledge. According to Baddeley (2003), working memory consists of the central executive system and its three sub-systems: (a) a phonological loop, which accounts for the temporary storage of phonological information, (b) a visual-spatial sketchpad that deals with spatial details and visual images, and (c) an episodic buffer, which is responsible for storing information from the other sub-systems and long-term memory. The central executive system which incorporates data from multiple sources and handles attentional resources governs the three sub-systems.

According to Levelt's (1989) speech production model, speech process is composed of conceptualization (i.e., message planning), formulation (i.e., linguistic encoding), articulation (i.e., verbalization), and monitoring. Controlled processing is needed to access and retrieve L2 linguistic information, and this mechanism is said to be controlled by working memory or the central executive system in Baddeley's (2003) term (Payne & Whitney, 2002). Working memory takes a role in speaking in such a way that speakers need to prepare and organize what to say and provisionally store the preparations until they are ready to produce them as terms, phrases, and sentences (Daneman, 1991). This is attributed to the linear and transient nature of speaking and spoken output.

2.4. Previous Research Findings

A large number of studies have been performed on the function of task complexity along various cognitive variables, mostly focused on the role of task complexity drawing primarily upon Robinson's (2015) triadic componential framework. For one, Khatib and Farahanynia (2020) examined the impact of strategic planning, task repetition, and task complexity at various degrees on the oral performance of L2 learners. The findings showed that the complex tasks encouraged fluency, overall complexity, and lexical complexity, but decreased accuracy and subordination. Similarly, the effect of task complexity and pre-task preparation on L2 writing output was explored by Rahimi and Zhang (2018). Eighty L2 upper-intermediate English learners were

required to carry out two writing assignments of diverse levels of complexity based on the demand of reasoning and the number of elements. The findings revealed that increasing task complexity and pre-task preparation enhanced the use of subordination, content, organization, and quality of written texts. However, growing task complexity decreased writing accuracy and there was no substantial impact on improving accuracy by offering pre-task preparation. No significant change in lexical diversity resulted in increasing task complexity and pre-task planning; only increasing task complexity increased advanced use of vocabulary. Fluency in the writing production of L2 learners decreased as a consequence of increasing task complexity and no pre-task planning.

Revesz, Kourtali, and Mazgutova (2017) investigated task complexity as the absence versus presence of content support on the fluency, pausing, and revision manners of second language writers and the cognitive-related processes underlying these behaviors. It was discovered that content support led to less pausing, more revision, and increased linguistic complexity. More regular pauses and revisions were related to less sophisticated lexis when content support was missing. The findings indicated that content supports possibly reduced processing burden on preparation processes, thus promoting commitment to linguistic encoding.

Cho (2018) explored the roles that task complexity and modality played in task performance and how working memory was related to task performance and arbitrated the impact of task variables on performance. In doing so, thirty-nine learners carried out four argumentative tasks, with differing levels of task complexity and modality. Reading span and operation span tests were utilized to measure working memory and an evaluation was conducted on task performance with respect to complexity, accuracy, and fluency. The findings demonstrated that task complexity was associated with an increase in syntactic complexity only through phrasal-level measure. Task complexity resulted in reduced accuracy, but fluency was not influenced by task complexity. Impacts associated with task complexity

were not dissimilar across modalities. As for modality on performance, speaking enjoyed more accuracy, but less fluency than writing. Intriguingly, speaking led to higher syntactic complexity than writing. No significant correlation was found between working memory and any performance measures. In another experience, Jung (2018) launched a study to examine the influence of cognitive task complexity on reading comprehension in second language and whether or not the impact of task complexity was regulated by working memory ability. The participants were assigned to either simple or complex conditions randomly, and were given two TOEFL passages to read when answering reading comprehension questions. Whereas the simple versions contained coherent texts, the complex version comprised texts whose paragraphs were disordered, and participants were expected to order them coherently. The participants' phonological short-term memory was measured by means of a forward digit span test, and a backward digit span test and an operation span test were utilized to assess their complex working memory. The findings demonstrated that although the participants conceived of complex tasks as being significantly more demanding, task complexity did not influence reading comprehension scores.

Zalbidea (2017) explored the independent and interactive impacts of task complexity and task modality on linguistic facets of second language (L2) performance and examined how individual differences moderated these effects in working memory capacity. An analysis was conducted on performance with respect to general (complexity and accuracy) as well as task-relevant (conjunctions) linguistic measures. Quantitative analyses showed that task modality had a bigger role to play than task complexity in bringing about enhanced linguistic performance during task-based work: Speaking tasks resulted in more syntactically complex output whereas writing tasks caused language with more lexical complexity and accuracy. Moreover, correlations between working memory capacity and diverse linguistic measures were only confirmed when the cognitive complexity of tasks was increased.

Baralt (2010) conducted an investigation into the role of task complexity and working memory in the promotion of the Spanish past subjunctive through recasts in both face to face and online CMC modes. Task complexity was operationalized as (+/− intentional reasoning). Learners who belonged to the less complex group were required to retell a story (−intentional reasoning), while learners in the more complex group, besides retelling a story, also needed to hypothesize why a character in the story took a particular action (+intentional reasoning). Learners in all circumstances were presented with recasts during interaction. With respect to the impact of working memory, the results recommended that working memory did not affect the correlation between task complexity and the production knowledge development of the Spanish past subjunctive. Nevertheless, high working memory was shown to influence the enhancement of receptive knowledge in the simple group and in the face to face mode only in a significant way.

Kormos and Trebits (2011) inquired into how working memory mediated 44 EFL secondary school students' oral production-with regard to complexity, accuracy, and fluency-during two narrative tasks (complex picture- vs. simple cartoon-narration tasks). The findings demonstrated that students produced significantly more different vocabulary during the simple cartoon picture task than the complex picture-narration task, but no difference was observed in other areas. In addition, a backward digit span test measuring working memory effects showed that only the cartoon-narration task had a significant impact of working on syntactic complexity, recommending a restricted role of working memory in L2 oral language production. Kormos and Trebits concluded that working memory capacity might not influence language production, but, rather, may exert an influence on the amount of attention that learners can pay to noticing diverse linguistic features they are provided with in the input.

Reviewing the related literature, dearth of empirical research concerning the efficacy of task complexity across the two proficiency levels of Iranian EFL learners (i.e. pre-intermediate and advanced) was found to be outstanding. The present study, thus, aimed at investigating

whether task complexity produced a difference in L2 accuracy and fluency across the two proficiency levels of Iranian advanced and pre-intermediate EFL learners. Furthermore, this study addressed to what extent the impact of task complexity on linguistic performance in L2 was influenced by learners' working memory capacity. Therefore, the study was set out to answer the following research question:

1. Does task complexity make a statistically significant difference in L2 accuracy and fluency of Iranian pre-intermediate and advanced EFL learners?
2. Is there any statistically significant relationship between working memory capacity and L2 accuracy and fluency of Iranian pre-intermediate and advanced EFL learners in performing more and less complex tasks?

3. Methodology

3.1. Participants

A total of 80 (40 pre-intermediate and 40 advanced) Iranian EFL learners participated in this study. Forty of them (20 pre-intermediate and 20 advanced) were assigned to complex task and the next forty (20 pre-intermediate and 20 advanced) were required to complete the simple task. The participants' English proficiency was measured via the standardized test scores of Oxford Placement Test. Participation was voluntary. The participants were informed by some ads and flyers attached to the institute news board indicating that such a study was going to be done and they could voluntarily enroll for the study.

3.2. Instruments

3.2.1. Working Memory (WM) Measure

This study measured participants' working memory by means of Wechsler's (1987) working memory test administered in L1 Persian. This test has been normed and standardized for the Iranian community by Orangi, Atefvahid, and Ashayeri (2002). The test is made up of the following subtests measuring different components of WM:

1. The information part includes six questions on general knowledge.

2. The orientation part includes five questions for orientation in time and place.

3. Mental control section includes the ability to repeat sequences such as counting backwards. 4. Logical memory contains two story synopses which are read out to the participants and then the participants recall the stories by heart.

5. Digits forwards and digits backward section consists of the conventional digit span tests.

6. Visual reproduction section requires the participants to draw three simple designs presented to them individually for 10 seconds.

7. Verbal paired association comprises a section wherein the participants are given three trials to learn 10 pairs of words presented to them auditorily. After reading these words to participants, the tester reads out the first word of each pair and the participants should recall the second word. Subjects' overall memory scores are calculated by adding up scores from different subtests yielding a composite score.

3.2.2. Argumentative Tasks

Learners at the advanced level of proficiency were engaged in the experimental task adapted from Watson, DeSanctis, and Poole (1988). The imaginary scenario includes the participants as members of a board for a personal trust foundation which was established with the goal of conducting finance projects in their city. Their task was to assess competitive appeals for funding and make judgments about their relative advantages. Those individuals who are presented with simple task have to decide about a foundation worth $500,000, which the board can administer among three projects. And students provided with complex task should make a decision about foundation worth $10,000,000, which the board should budget for six programs. The potential projects all include community programs that merit funding, like buying extra volumes for the library system, provision of medical insurance for low-income families, construction of bike paths, and the reinstatement of government facilities. Considering the limited

resources, participants were requested to allocate funds only to those programs that they considered highly worthy of donation.

For participants at the pre-intermediate level of proficiency, the task was adapted from Kuiken and Vedder's (2011) study. The task involves giving oral advice to a friend with respect to the choice of a holiday destination out of five options. Three criteria should be taken into consideration in the non-complex version when choosing the destination, while six requirements should be fulfilled in the complex version, like the availability of a garden, a peaceful area or the possibility of performing physical activity.

Task complexity was operationalized by designing differing tasks along the +/- reasoning and the +/- few elements dimensions. Students had to present arguments for their choice. Tasks that direct learners' attention to mention more elements in the context of argumentation are supposed to elicit more reasoning and are consequently more cognitively complex at the conceptualization stage than tasks with fewer elements (Robinson, 2001). Tasks that evoke more reasoning and/or reference to a larger range of items are agreed to be more cognitively complex than tasks with reduced demands in terms of these design characteristics (Ellis, 2003; Robinson, 2001, 2005). In the simple version of the argumentative task (−Complex), participants had to satisfy fewer requirements. The complex version (+Complex) was produced by enhancing the number of requirements, since it necessitates learners to supply reasons and justifications for the purpose of putting a larger number of proposals in order.

3.3. Procedure

At the initial stage of the study, the Oxford Placement Test was administered as a measure of learners' general English proficiency in order to homogenize them and ensure that the participants were at advanced and pre-intermediate levels of English proficiency. Eighty participants whose scores were identified at these levels were selected as the study participants. Participants met individually with the researcher and were required to complete either a complex or simple task which lasted approximately 10 minutes. The adapted form of

Watson, DeSanctis, and Poole's (1988) experimental task was prsented to learners at the advanced level of proficiency. The participant took the role of a member of a board for a personal trust foundation and was asked to allocate funds to various projects in the city. Intermediate learners were given the task obtained from the study carried out by Kuiken and Vedder (2011). This task involved giving oral advice to a friend with respect to the choice of a holiday destination, from five options. After performing the task, participants completed the working memory test as a measure of their working memory capacity.

3.4. Data analysis

Accuracy was assessed by counting the number of error-free clauses per T-unit (EFC/T). Error pertains to grammatical and lexical errors per T-unit. Fluency was marked by efficiency in production processes and "native-like rapidity" (Lennon, 1990, p. 390); hence, the rate and the density of language production were measured like previous study (Gilabert, Bar-on, & Levkina, 2011). To measure speed fluency, the number of words produced per minute (W/M) were tallied, and for pause fluency, which shows participants' pausing behaviors, the number of pauses per 100 words were counted (P/W). A threshold level of two seconds of unfilled pause or utterances filled with semantically non-significant discourse markers such as hedges (i.e., ah, uh) was known as a pause in speaking.

In order to answer the first research question addressing whether task complexity produced a difference in L2 accuracy and fluency of Iranian advanced and pre-intermediate EFL learners, MANOVA was run. To answer the second research question investigating the existence of any significant relationship between working memory capacity and L2 accuracy and fluency in more or less complex task, Pearson correlation was adopted.

4. Results

To examine the effect of task complexity on L2 accuracy and fluency of Iranian advanced and pre-intermediate EFL learners, MANOVA was run. Descriptive statistics for accuracy, speed fluency, and pause

fluency dimensions of L2 production in simple and complex tasks for lower intermediate groups are first displayed in Table 1.

Table 1
Descriptive Statistics for Pre- Intermediate Levels

	Complexity	Mean	Std. Deviation	N
Accuracy	Simple	47.15	4.55	20
	Complex	42.95	3.81	20
	Total	45.05	4.66	40
Speed	Simple	37.55	5.41	20
	Complex	29.40	3.37	20
	Total	33.47	6.07	40
Pause	Simple	8.250	1.48	20
	Complex	10.00	1.83	20
	Total	9.125	1.86	40

As revealed in Table 1, for pre-intermediate learners, accuracy decreased in the complex tasks compared to the simple tasks. As for the two types of fluency measures, speed fluency was greater in simple condition, and the frequency of pauses was lower in the simple task than in the complex condition. Now, the results of MANOVA are presented in Tables 2 and 3.

Table 2
Multivariate Test

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.99	1970.28[b]	3	36	.00	.99
	Wilks' Lambda	.00	1970.28[b]	3	36	.00	.99
	Hotelling's Trace	164.19	1970.28[b]	3	36	.00	.99

	Roy's Largest Root	164.19	1970.28[b]	3	36	.00	.99
Complexity	Pillai's Trace	.57	16.25[b]	3	36	.00	.57
	Wilks' Lambda	.42	16.25[b]	3	36	.00	.57
	Hotelling's Trace	1.35	16.25[b]	3	36	.00	.57
	Roy's Largest Root	1.35	16.25[b]	3	36	.00	.57

a. Design: Intercept + complexity
b. Exact statistic

Table 3
Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Accuracy	176.4[a]	1	176.4	9.98	.00	.20
	Speed	664.22[b]	1	664.22	32.62	.00	.46
	Pause	30.62[c]	1	30.62	11	.00	.22
Intercept	Accuracy	81180.1	1	81180.1	4593.95	.00	.99
	Speed	44823.02	1	44823.02	2201.32	.00	.98
	Pause	3330.62	1	3330.62	1196.82	.00	.96
Complexity	Accuracy	176.40	1	176.4	9.98	.00	.20
	Speed	664.22	1	664.22	32.62	.00	.46
	Pause	30.62	1	30.62	11	.00	.22

a. R Squared = .2 (Adjusted R Squared = .18)
b. R Squared = .46 (Adjusted R Squared = .44)
c. R Squared = .22 (Adjusted R Squared = .20)

As the results in Table 3 indicate, there were statistically significant differences between pre-intermediate learners' language performance in simple task and complex task on the combined dependent variables, F(3, 36) = 16.25, p=.00, Wilks' Lambda= .99, Partial Eta Squared= .57. When the results for the dependent variables were considered

separately, it showed that accuracy, speed fluency, and pause fluency scores of simple task condition significantly differed from complex condition (F= 9.9, 32.62, 11, p= .00, p<.05).

Considering the eta squared values for the statistical differences between the two conditions in terms of accuracy (Eta Squared=.20), the speed fluency (Eta Squared= .46), and pause fluency (Eta Squared= .22), it can be stated that task complexity has been superior in its effect on the participants' speed fluency.

Table 4 summarizes the results of descriptive statistics for accuracy, speed fluency, and pause fluency dimensions of L2 production in simple and complex tasks for the advanced group.

Table 4
Descriptive Statistics

	Complexity	Mean	Std. Deviation	N
Accuracy	Simple	60.6500	4.46360	20
	Complex	63.9000	3.75430	20
	Total	62.2750	4.39106	40
Speed	Simple	58.2500	3.20977	20
	Complex	56.9500	3.61976	20
	Total	57.6000	3.44033	40
Pause	Simple	6.5500	1.60509	20
	Complex	8.2500	1.37171	20
	Total	7.4000	1.70670	40

The results of descriptive statistics in Table 4 show that accuracy of advanced learners was boosted; moreover, the complex task resulted in a lower rate speed fluency and pause fluency was higher in complex condition. The results of MANOVA are now presented in Table 5.

Table 5
Multivariate Test

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.998	7845.919[b]	3.000	36.000	.000	.998
	Wilks' Lambda	.002	7845.919[b]	3.000	36.000	.000	.998
	Hotelling's Trace	653.82	7845.919[b]	3.000	36.000	.000	.998
	Roy's Largest Root	653.82	7845.919[b]	3.000	36.000	.000	.998
Complexity	Pillai's Trace	.376	7.226[b]	3.000	36.000	.001	.376
	Wilks' Lambda	.624	7.226[b]	3.000	36.000	.001	.376
	Hotelling's Trace	.602	7.226[b]	3.000	36.000	.001	.376
	Roy's Largest Root	.602	7.226[b]	3.000	36.000	.001	.376

a. Design: Intercept + complexity

b. Exact statistic

As shown in Table 5, learners' language performance in complex group significantly differed from that of simple group on the combined dependent variables F (3, 36) = 7.22, p= .00, Wilks' Lambda= .99, Partial Eta Squared = .37. Now, the results of the tests of between-subject effects are presented in Table 6.

Table 6
Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Accuracy	105.625[a]	1	105.625	6.210	.017	.140
	Speed	16.900[b]	1	16.900	1.444	.237	.037
	Pause	28.900[c]	1	28.900	12.966	.001	.254
Intercept	Accuracy	155127.025	1	155127.025	9120.17	.000	.996
	Speed	132710.400	1	132710.400	11340.2	.000	.997

Complexity	Pause	2190.400	1	2190.400	982.706	.000	.963
	Accuracy	105.625	1	105.625	6.210	.017	.140
	Speed	16.900	1	16.900	1.444	.237	.037
	Pause	28.900	1	28.900	12.966	.001	.254

a. R Squared = .140 (Adjusted R Squared = .118)
b. R Squared = .037 (Adjusted R Squared = .011)
c. R Squared = .254 (Adjusted R Squared = .235)

As indicated in Table 6, when the results were separately considered for the dependent variables, it was revealed that accuracy and pause fluency scores of simple task condition significantly differed from complex condition (F= 6.21, 12.96, p<.05). However, there was no statistically significant difference between simple and complex conditions with respect to speed fluency (F= 1.44, p> .05)

Taking into account the eta squared values for the statistical differences of the two conditions with respect to accuracy (Eta Squared=.14) and pause fluency (Eta Squared= .25), it can be asserted that task complexity has been superior in its effect on the participants' pause fluency.

To answer the second research question addressing whether there was any statistically significant relationship between working memory capacity and L2 accuracy and fluency of pre-intermediate EFL learners, a Pearson correlation was run, the results of which are presented in Table 7.

Table 7
Correlation Between Working Memory and Language Performance of Pre-Intermediate Learners on Simple Task

		accuracy	Speed	Pause
Working memory	Pearson Correlation	.400	-.068	-.088
	Sig. (2-tailed)	.081	.775	.711
	N	20	20	20

As displayed in Table 7, there was no statistically significant relationship between working memory and language performance dimensions of pre-intermediate learners performing simple tasks (p= .08, .77, .71, p>.05). Now, the results for complex tasks are presented in Table 8.

Table 8
Correlation between Working Memory and Language Performance of Pre-Intermediate Learners on Complex Task

		Accuracy	Speed	Pause
Working memory	Pearson Correlation	-.621**	.137	-.304
	Sig. (2-tailed)	.003	.564	.192
	N	20	20	20

As shown in Table 8, there was no statistically significant relationship between working memory and speed and pause fluency of pre-intermediate learners (p=.56, .19 respectively, p> .05), while accuracy and working memory were in significant relationship with each other in complex condition (p= .00, p<.05). The results for advanced level participants with regard to simple tasks are now presented in Table 9.

Table 9
Correlation between Working Memory and Language Performance of Advanced Learners on Simple Task

		Accuracy	Speed	Pause
Working memory	Pearson Correlation	.235	.128	.207
	Sig. (2-tailed)	.318	.591	.381
	N	20	20	20

As revealed in Table 9, there was no statistically significant relationship between working memory and language performance of advanced learners carrying out simple tasks (p= .31, .59, .38, p>.05).

The results for advanced learners in terms of complex tasks are now presented in Table 10.

Table 10

Correlation between Working Memory and Language Performance of Advanced Learners on Complex Task

		Accuracy	Speed	pause
Working memory	Pearson Correlation	-.025	-.155	-.293
	Sig. (2-tailed)	.916	.515	.210
	N	20	20	20

As indicated in Table 10, there was no statistically significant relationship between advanced learners' language performance on complex tasks and their working memory capacity (p= .91, .51, .21, p>.05).

5. Discussion

This study was set out to investigate the role of task complexity and learners' working memory capacity on L2 accuracy and fluency of Iranian advanced and pre-intermediate EFL learners in terms of simple and complex tasks. The results of descriptive statistics for pre-intermediate participants showed that, compared to the simple tasks, accuracy decreased in the complex tasks. Regarding the two types of fluency measures, speed fluency was greater in simple condition, and the frequency of pauses was lower in the simple task than in the complex condition. The results of descriptive statistics for advanced learners illustrated that increased task complexity led to enhanced accuracy, while fluency dropped. These findings lend support to Robinson's (2001) cognition hypothesis and run counter to Skehan's (1996, 1998) trade-off hypothesis. As the cognition hypothesis posits, raising task complexity induced L2 output characterized by greater accuracy, but had a major adverse effect on fluency.

It appears that having been equipped with rich and robust knowledge of lexicon and syntactic forms, the advanced group had the capability

of paying attention to multiple performance areas simultaneously. In other words, as a consequence of their advanced levels of language proficiency, advanced learners were competent to pay attention to various resource pools at the same time, giving rise to their accuracy in performance on the complex tasks. Quite the opposite, pre-intermediate learners went down like a lead balloon in coping with the ambiguities of more demanding and taxing tasks since they were not armed with adequate linguistic resources to do so. The results can be corroborated by the claims of Kuiken, Mos, and Vedder (2005) who asserted that the role of task complexity in L2 output may be smaller among lower proficiency learners due to the fact that they may not have gotten to the threshold level in their L2 proficiency needed to devote their attention to both the enhanced cognitive complexity of the task and to the basic formulation processes.

The results brought to light the way task complexity led to a decrease in the learners' fluency which is aligned with the findings of other studies coming to the conclusion that increased attention to form lowered the status of fluency (Michel, Kuiken, & Vedder, 2012; Rahimi & Zhang, 2018). In terms of the amount of attention supposed to be allocated to more than one aspect of performance simultaneously, the participants came to failure in living up to this demand by virtue of their inadequate attentional capacity. Robinson's (2011) predication of undesirable synergistic impacts of raising task complexity on fluency in L2 production is manifested in the low fluency by which the learners' perform the complex task. Proficient L2 speakers take account of various areas of performance due to their enjoying high levels of attentional capacity. Low-proficiency speakers, on the other hand, are only able to give thought to some performance areas selectively which give rise to restricted control of the language on the part of the speakers. Interpreted in this way, the findings might affirm the dynamic nature of the human capacity attention giving the thumbs down to the idea of its being a static process. That is, the more the proficiency in the second language develops, the more flexible the attentional capacity becomes

in order to measure up to the cognitive demands of the more challenging complex tasks.

In addition, the results confirmed no association between working memory and task performance in any (simple-task or complex-task) conditions. This finding is in line with those of Baralt (2010) and Kormos and Trebits (2011) which concluded that working memory capacity did not play a significant role in language production. However, this finding is in contrast with those of previous studies that showed significant relationship between working memory and L2 language performance (Mackey, Philip, Egi, Fujii, & Tatsumi, 2002, Kim & Tracy-Ventura, 2011; Revesz, 2012). The results also contradict Robinson's (2011) discussion that learners' cognitive individual differences could mediate the role of task complexity in language development. The cognition hypothesis put forward by Robinson (2007) asserts that individual differences related to the attentional requirements of tasks appear to increasingly contribute to distinguishing learner performance as the cognitive complexity of tasks is increased. To put it in other words, differences in learners' cognitive profiles appear to be most relevant when the cognitive requirements of tasks are augmented. In the current study, this was only witnessed and evidenced for pre-intermediate learners performing in the complex condition.

The argument that working memory appears more relevant to the allocation of attention in process-based learning and input processing than in the production of oral language can give grounds for the lack of relationship between working memory and task performance (Kormos & Trebits, 2011). The production of language entails a number of affective and cognitive variables including proficiency level, motivation, and strategies; hence, it seems plausible that participants with poor working memory can make use of strategies to compensate for this problem in actual task performance.

6. Conclusion and Implications

The present study was carried out to explore the impact of task complexity on accuracy and fluency of pre-intermediate and advanced

Iranian EFL learners. Moreover, the study was targeted at probing into how individual differences in working memory capacity associated with the learners' performance across different tasks. Findings for the first research question demonstrated that task complexity played an instrumental role in enhancing accuracy among advanced learners while fluency dropped. Furthermore, it was found that pre-intermediate learners produced more fluent language in carrying out simple tasks.

These results might be of paramount pedagogical significance as they keep teachers informed regarding how to exploit levels of task complexity to help learners tackle problems in different production dimensions and foster a more balanced interlanguage. The performance improvement in advanced learners' accuracy on the complex task implies that the task bearing higher cognitive demands succeeded more in grabbing attention to form-meaning connections. Such occurrences can offer opportunities for task-induced pedagogical interventions, which in turn might give rise to learners' linguistic accuracy.

Teachers have to consider balancing the degree of task complexity with the level of competence of their L2 learners by changing the level of reasoning and the number of elements to improve accuracy and fluency of learners across various proficiency levels. Moreover, it is possible to bring about some opportunities for contextualized pedagogical mediations drawing on particular tasks for the development of accuracy.

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