A Systematic Review of Task Complexity in Language Learning

Yan Wang
School of Educational Studies, Universiti Sains Malaysia, Penang, Malaysia
DOI: 10.32629/jher.v3i5.1053

Abstract: Task complexity has attracted increasing attention from researchers since it plays a crucial role in language learning. Researchers have examined it using various perspectives and achieved different results in terms of language learning. Nevertheless, to have a clear and overall understanding of the significance of task complexity, some questions are raised: (1) What are the appropriate theoretical frameworks?; (2) What other factors are relevant to task complexity?; (3) How is language learning related to task complexity? This literature review aims to map the results and findings of task complexity in language learning to answer the above three questions. According to the PRISMA diagram 2020, 23 articles from SCOPUS between 2012 and 2020 were selected for analysis. Findings show that task complexity is one of the most important factors in different language tasks based on two hypotheses, i.e. Cognitive Hypothesis and Limited Attentional Capacity Hypothesis. In addition, factors such as aptitude and working memory usually are co-studied with task complexity. Finally, limitations and further questions are concluded.
***Keywords*:** PRISMA, task complexity, TBLT, language learning

1. Introduction

Due to the vast development of our world, language learners have more opportunities to use language skills for personal and academic purposes (Navidinia et al., 2018). Prabhu (1987) first introduced the concept of 'task-based' into teaching and learning with his publication of Second Language Pedagogy, in which he emphasizes that learners learn the target language more effectively when they are required to fulfill meaningful task-based activities. Task-based Language Teaching (TBLT) is an approach based on tasks as the core unit of planning and instruction in language teaching, which is derived from the Communicative Language Teaching Approach (CLTA). Task and TBLT could mean different things to different people. Some may simply equate them to focused linguistic exercise. However, they contain more beyond that (Long, 2016). Although varied researchers give different definitions of 'task', it is commonly recognized that a task is meaningful in learning to use a language in a 'real' context, such as reading a map or set of instructions and assembling a toy (Richard & Rogers, 2014, p. 223-224). Ever since its introduction, tasks have kept attracting considerable attention in the field of language teaching because their effectiveness and benefits in language teaching have been noted in a large number of studies (Calvert & Sheen, 2015; Kim et al., 2017; Mao, 2012).

Due to its solid theoretical foundations in the scope of second language acquisition (SLA) research and theories, TBLT is an alternative to the traditional teaching methods such as present-practice-production and grammar-translation (Bryfonski & McKay, 2019). According to Ellis (2000), the grammar exercise in traditional language teaching is mostly fill-in-the-blank ones that give significant priority to linguistic correctness with little relationship to the real communicative goal. However, TBLT focuses on the need to develop linguistic skills for the development of communicative abilities, with the idea that linguistic abilities are developed through communicative activity. Also, these pedagogical tasks are sequenced and operated in teaching according to their intrinsic complexity, which ultimately forms a task syllabus (Long, 2016).

At the same time, considering the benefits of TBLT, researching task design and performance conditions has become a burgeoning area within task-based language teaching, learning, and assessment during the past two decades (Salimi & Dadashpour, 2012). According to Ellis (2000), this is because the task design and its implementation impact the skillfulness of learners' language performance and learners' achievement, which could be the key in evaluating the task design (Ellis, 2000). Bringing research and pedagogy together, TBLT has provided a perspective into task design features for teachers, simultaneously concerning cognitive and interactional factors that assist language learning (Monteiro & Kim, 2020). Among task features and task conditions, the effect of cognitive task complexity on students' performance has remained a vibrant area of research in L2 acquisition (Khatib & Farahanynia, 2020), since many studies have concluded that task complexity has an impact on learners' learning performance (Cho, 2018; Kuiken & Vedder, 2008; Robinson, 2007; Skehan, 2009; Torres, 2018).

According to Robinson and Gilabert (2007), the aim of the pedagogic tasks sequence is to approach, in the teaching

context, the full complexity of real world target task demands, which thus requires a manageable, but continuously extending, developmental and performative route. Also, features of these tasks contribute to learners' cognitive complexity. But the main problem in TBLT and syllabus design lies in establishing a valid criterion for grading and sequencing the tasks. Therefore, considering the teachability and learnability, task design and task complexity can be operated to fulfill the purpose of satisfying learners' development sequence and their proficiency level (Salimi & Dadshpour, 2012).

Several studies have investigated task complexity according to different theoretical hypotheses and yielded various significant findings. For instance, complex tasks can promote the production of more complex language in terms of syntactic mode in writing (Kang & Lee, 2019; Salimi & Dadshpour, 2012). Sasayama (2016) also finds that the designed-to-be-simplest task and the designed-to-be-most-complex show statistically significantly different in terms of cognitive complexity in communicative tasks. Also, it is found that the learners conduct a better performance on simple tasks than on complex tasks (Attarzade & Farahani, 2014). The findings of these studies support that task complexity is a key predictor of learners' performance in various language skills.

Nevertheless, gaps in the above respect that still need to be addressed, especially when the current studies examine task complexity in language learning using varied theoretical frameworks. On this note, researchers have always related task complexity with other different elements or factors like working memory or aptitude (Awwad & Tavakoli, 2019; Kourtali & Révész, 2020). Also, existing studies scrutinize different aspects of language skills learning (in isolation), and therefore, no clear emerging themes of task-based learning are evident. Hence, despite the extensive research on task complexity, the findings obtained are not consistent and generalizable, partly due to various methodologies and instruments applied in the studies (Cho, 2018). Robinson (2011) reviewed earlier studies on how task-based learning stimulates language acquisition and strongly suggests that more pedagogically contextualized research is needed.

It is important to have a transparent understanding of the theoretical framework since it serves as a guideline for previous and further research. Also, this study will follow the steps of PRISMA (2020), which could synthesize the studies in a standard quality assessment. It will depict a vivid map for the researchers about what has been studied, what is being studied and what will be studied. They will clearly know what concepts and factors contributing to language learning and task complexity in a pedagogical context. This systematic study aims to synthesize the literature on task complexity and make a clear understanding of its theoretical foundation and effects on language learning after 2012. The research questions are as follows.

(1) What are the theoretical frameworks and methodologies used in recent task-complexity research?

(2) What other factors are examined together and related with task complexity?

(3) What language skills are significantly influenced by task complexity?

These questions would facilitate practitioners and researchers in understanding more of the theoretical frameworks used in previous studies and generate innovative future research by exploring frameworks that have not been experimented or implemented. Secondly, what constructs or factors that are closely related to task complexity in language learning will be also displayed so that they could find a direction for further investigation. Last but not the least, it would also contribute to the pedagogical cultivation in teaching different language skills.

2. Methods

To have a clear understanding of task complexity, the method used in conducting this review article is Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The PRISMA method (2020) includes a 27 item checklist which is typically used in technological science research such as medical review studies, and it makes the review transparent. And now, it is also used in social science and helps the researcher improve the reporting of studies (Qureshi et al., 2020). In 2011, Robinson edited a guiding book Second Language Task Complexity, which depicted a formidable advance in the theoretical and empirical understanding of crucial phenomena in task-based language teaching and shed light on later studies. It could be revelatory to review the studies afterward and depict a clear research map. Hence, the articles selected here include peer-reviewed open access English articles in SCOPUS from 2012 to 2020. The PRISMA statement template is used to explain the overall selection and rejections of articles for the review of task complexity in language learning. The literature is restricted to the studies published. The phases and criteria of deciding the articles are as follows.

(1) Pre-review literature selection. Key words “task complexity”, OR “task-complexity”, AND “ language” are used to search the databases. All the search results will be limited to journal articles, the term 'English' and from the year 2012 to year 2020.

(2) Exclude the literature unrelated with task complexity by reading the abstract.

(3) Download all the open access articles.

(4) Read all the articles downloaded which are related to the topic or interests of research.

SCOPUS is the database where literature is searched with key words “task complexity” OR “task-complexity” and “language”. The literature was searched on 13th February, 2021. The total number of articles is 224. After the results are limited to open-access English articles which were published in the period between 2012 and 2020, there are 42 articles left. The data is then imported to excel sheets for further assessment of the literature. The articles are selected according to the details in the excel sheets. After reading and analyzing the abstract and keywords of the 42 articles, those which are not related to task complexity in language learning are canceled, leaving 27 articles for further assessment. All the 27 articles are downloaded for detailed analysis. Furthermore, 4 articles are canceled due to their content unrelated to this topic, leaving 23 final articles for this study.

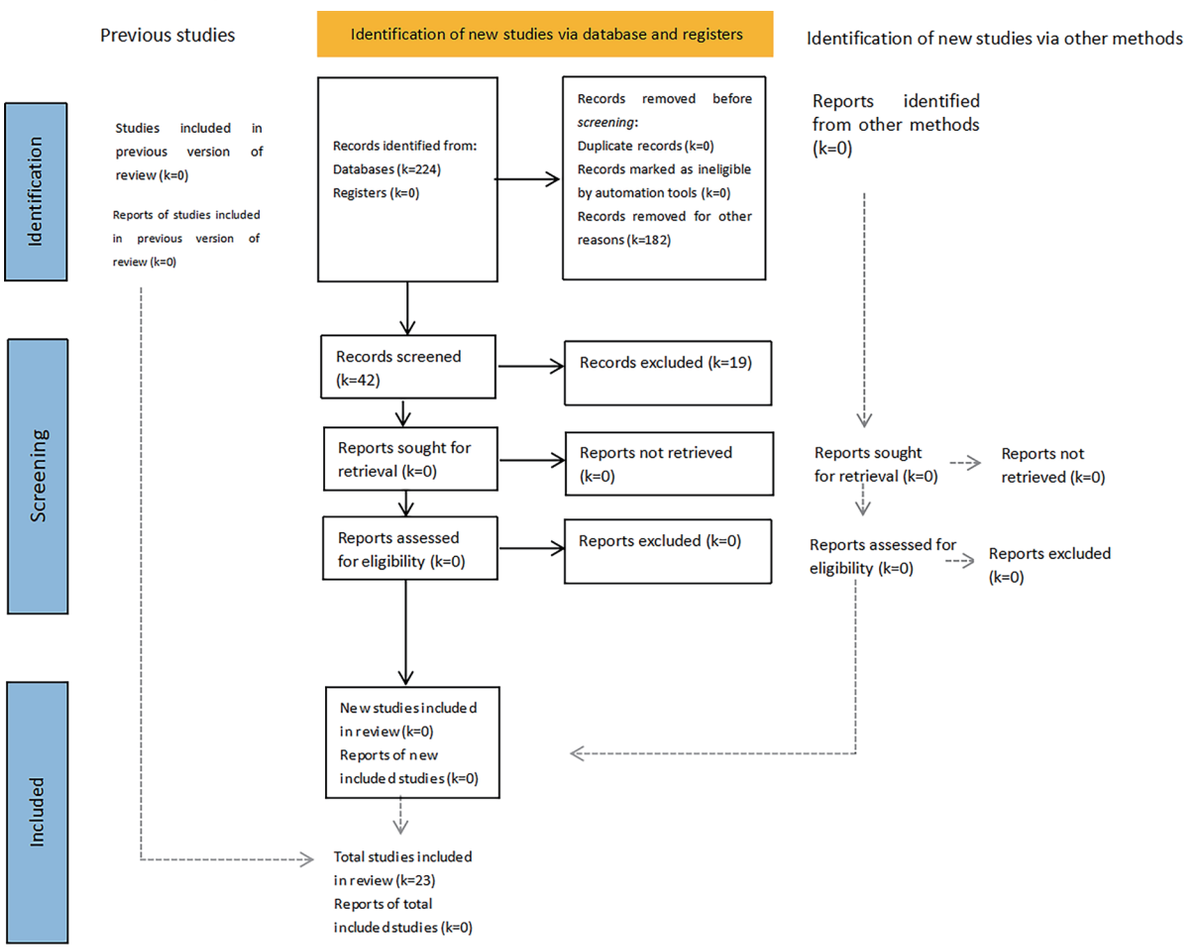

Figure 1. PRISMA 2020 flow diagram template for systematic reviews

3. Eligibility and inclusion criteria

The criteria for eligibility and inclusion of articles are quite essential and critical for this literature review, since it is based on the PRISMA checklist and flowchart which are evidence-based and transparent. They are required as followings:

a. All from SCOPUS

b. Articles

c. In English

d. Open access

e. Between 2012 and 2020

f. Not review articles

The two authors then evaluated the above 27 articles independently based on the three aspects suggested by Dybå and Dingsøyr (2008): (i) rigor (thoroughness and appropriateness of research approaches were described and explained, For example, sample size, design and methods. For conceptual papers, the use of appropriate theoretical framework must be evident); (ii) credibility (discussion and conclusions are grounded on logical and accurate analysis and reasoning) and;

(iii) relevance (ensured that only articles that would be relevant in addressing the research questions and focused on 'task complexity in language learning'. We strictly followed these three aspects, which facilitated us in confirming the suitability and appropriateness of the 23 articles for this review.

4. General information of the articles.

In this section, we present findings of our analysis in terms of situation of citation i.e. most cited articles (in other SCOPUS-indexed journals), year and journal atlas (of the source).

4.1 Situation of citation

Of the 23 articles, the most cited is article 19, The Role of Task Complexity, Modality, and Aptitude in Narrative Task Performance by Kormos and Trebits (2020) which is cited 45 times by other SCOPUS-indexed journals. The second most cited is The Intersection of Task-based Interaction, Task Complexity and Working Memory (article 16), which is cited 33 times. Writing to learn via text chat: Task implementation and focus on form (Article 20) and Measuring Cognitive Task Demands Using Dual-Task Methodology, Subjective Self-Ratings, and Expert Judgement (article 12) are cited at 27 and 26 times respectively. The remaining articles are cited not more than 20 times (Table 1).

Table 1. Most Cited Atlas

Title	Cited by
The role of task complexity, modality, and aptitude in narrative task performance	45
The intersection of task-based interaction, task complexity, and working memory	33
Writing to learn via text chat: Task implementation and focus on form	27
Measuring cognitive task demands using dual-task methodology, subjective self-ratings, and expert judgments	26
Effects of task complexity on L2 writing behaviors and linguistic complexity	20
Task complexity effects on the complexity and accuracy of writing via text chat	18
Similar prompts may not be similar in the performance they elicit: Examining fluency, complexity, accuracy, and lexis in narratives from five picture prompts	11
The use of conjunctions in cognitively simple versus complex oral L2 tasks	7
The role of task complexity and task motivation in language production	5
Learner attention to form in ACCESS task-based interaction	5
Time-on-task as a measure of cognitive load in TBLT	2
The effect of strategic planning time and task complexity on L2 written accuracy	2
On the effect of task-complexity-based instruction of incidental vocabulary on Iranian academic learners' vocabulary learning	2
L2 learners' and professionals' perceptions of cognitive task complexity: Towards developing an index of task difficulty	2
Effects of corrective feedback on EFL speaking task complexity in China's university classroom	2
The roles of recasts, task complexity, and aptitude in child second language development	1
Task complexity, language proficiency and working memory: Interaction effects on second language speech performance	1
Exploring the interplay of planning time, reasoning demands, and language learning aptitude in Iranian EFL learners' written production	1
The impact of task complexity on EFL learners' writing production across gender	
Task complexity and its implication for pedagogy	
Conditions and tasks: The effects of planning and task complexity on L2 speaking	
Cognitive function predicts listening effort performance during complex tasks in normally aging adults	
An error analysis of l2 writing: How does task complexity affect L2 errors?	

4.2 Year atlas — distribution of articles published from 2012 — 2020

Although the total number of the articles selected in this study is just 23, we believe these articles fulfil the criteria that we have determined, and that the number of articles would be adequate for us to answer the research question, without compromising the quality and outcome of the study. On average, 2.5 articles are published in the 9-year period that we examined. The highest number of publications on task complexity in language learning is in 2012 i.e. five articles, followed by 2017 and 2019 with 4 articles each. From 2013 to 2016, the interest in this area seems to slightly drop but regained its upward momentum in 2017. Only one article is published in 2018. The interest grew again in 2019 and 2020 (Table 2).

Table 2. Year atlas

Year	No. of articles published
2020	3
2019	4
2018	1
2017	4
2016	2
2015	2
2014	1
2013	1
2012	5

In general, the total number of the articles selected in this study is not in a great quantity. In 2012, most articles about the topic were published in SCOPUS, the number of which is 5. Then the quantity kept decreasing in 2013 and 2014. Then a slight growth was witnessed in the period from 2015 to 2017. Only 1 article is published in 2018. The interest grew again in 2019 and 2020.

4.3 Journal atlas — journals and the number of articles they publish

Journal of Asia TEFL has published the highest number of articles on task complexity in language learning, followed by Language Learning with 3 articles. Theory and Practice in Language Studies, Studies in Second Language Acquisition, Language Teaching Research, and Journal of Second Language Writing have published two articles each. The other journals have contributed 1 article each (Table 3).

Table 3. Source title

Source title	No. of articles they contribute
Journal of Asia TEFL	5
Language Learning	3
Journal of Second Language Writing	2
Language Teaching Research	2
Studies in Second Language Acquisition	2
Theory and Practice in Language Studies	2
Cogent Education	1
International Journal of Applied Linguistics and English Literature	1
International Journal of Engineering and Advanced Technology	1
IRAL - International Review of Applied Linguistics in Language Teaching	1
GEMA Online Journal of Language Studies	1
Modern Language Journal	1
Noise and Health	1

5. Findings

In this section, in our attempt to answer the research questions, we present the findings in terms of 'Theoretical Hypothesis', 'Task Complexity and Other Related Factors' and 'Task Complexity and Language Learning' .

1. What are the theoretical frameworks and methodologies used in recent task-complexity research?
2. What other factors are examined together and related with task complexity?
3. What language skills are significantly influenced by task complexity?

5.1 Theoretical frameworks and methodologies used in recent task-complexity research

Though Task-based theory has made outstanding contributions to language learning, there is still some disagreement among different experts, one of which is task complexity. There are also many different perspectives to measure task complexity (Zhai & Gao, 2018). The main theories about task complexity are the Limited Attention Capacity Hypothesis and the Cognitive Hypothesis. We examined these theories used in the studies and to what extent they have been effective in addressing the problems reported by the studies.

5.1.1 Cognition hypothesis

Recent research also considered tasks as a means of addressing learners' immediate, practical concerns and the complex, psycholinguistic dimensions in SLA (Jackson & Suethanapornkul, 2013). Proposed by Robinson, the framework of Cognition Hypothesis pays more attention to three factors: task complexity, task condition, and task difficulty, which influence task performance (Alwi et al., 2012). Cognitive factors were included in the aspect of task complexity, which contained resource-directing (e.g. ±elements, ±intentional reasoning) and resource-dispersing (e.g. ±planning time, ± task structure) elements (Salimi et al., 2012). This hypothesis of task-based and second language learning claims that pedagogic tasks be designed for language learners considerably based on growth in their cognitive complexity so as to increasingly approximate the demands of real-world target tasks (Robinson, 2003, 2007). It is expected in this hypothesis that if cognitive complexity of a task is increased along with intentional reasoning demands, the task performer would show more accuracy and complexity but not more in his language production (Sattarpour & Farrokhi 2017), and increase interaction and longer retention of input as well automaticity (Yousefi et al., 2012). Many studies selected tended to base their research on this hypothesis.

According to the hypothesis, ±planning time is one of the indicators of the resource-dispersing items in task complexity. Salimi et al. (2012) investigated how strategic planning time and task complexity affect L2 writing task performance by accuracy. A quantitative T-test study collected 50 English learners from an Iranian language institute. The findings were in line with the Cognition Hypothesis and some previous studies, which revealed that planning time could have positive effects in both complex and simple writing tasks. The study results also gave some implications on task manipulation for learners to achieve complexity, fluency, and accuracy (CFA).

It has been extensively studied how task complexity affects writing production of different genders by Mohammad and Alwi (2019) on the basis of the Cognitive Hypothesis. They selected 160 (80 males & 80 females) samples from a high school in Saudi Arabia. Four research questions were listed to test linguistic production, including complexity, accuracy and fluency in four dimensions which are gender and resource-dispersing factors. The findings indicated no gender differences and a negative effect on production by increasing resource-dispersing complexity by eliminating time and prior knowledge. The results of this quantitative study were significantly in line with the predictions of the Cognitive Hypothesis.

Besides the supportive findings of the previous studies, there were also studies that got different results with the ideas of the hypothesis. Michel (2013) explored the use of conjunctions in the argumentative task with different complexity on the basis of cognitive hypothesis by proceeding with a quantitative MANOVA study including 64 L2 adult learners and 44 L1 adult speakers. The study mainly listed two research questions. It aimed to determine the effect of increased cognitive task complexity on the use of conjunctions in L2 tasks and the differences in conjunction usage in L1 and L2 performance between complex and simple oral tasks. However, it was pretty different from previous expectations that the results detected only a more negligible effect, i.e., as a factor of measure, the use of conjunction didn't show a significant effect of increased task complexity, which called for a reconsideration of the hypothesis.

Révész et al. (2017) studied how cognitive complexity influences learners' writing fluency, pausing and revision and found that content support (a form of task complexity) could minimize the planning process but promote the effect of language encoding. In contrast, Lee (2019) concluded that time-on-task is a measure of cognitive load, which was also influenced by task complexity.

5.1.2 Limited capacity hypothesis

Proposed by Skehan, the Limited Capacity Hypothesis is another related model in Task-based language teaching. The hypothesis talks about and examines task complexity factors, task condition factors, and task difficulty (or learner) factors, each of which is further divided into two categories respectively (resource-directing versus resource dispersing; participation versus participant; affective versus ability variables) (Skehan, 2015). It is assumed that complexity can result in a trade-off between different aspects of language performance, i.e., complexity and accuracy due to learners' limited nature of attention. The reason is the total amount of attention a task needs from learners to fulfill a successful outcome with the presumption that increasing task complexity consumes limited available attentional resources (Awward, 2019). According to Skehan (2009, 2015), the Limited Capacity Hypothesis pays little attention to the linguistic basis for language production but focuses on the model of L1 generalizing to L2 learning and further the performance of complexity, area and fluency, which lies greatly on working memory involvement and attentional resources. Based on this trade-off hypothesis, Zhai anf Gao (2018) claimed that other changeable factors such as corrective feedback (CF) should be taken into consideration for task complexity in teaching EFL speaking in China. It is concluded that CF has an effect on EFL learners' speaking. However, different kinds of CF display different effects on the task complexity of speaking.

Some articles explored the roles of task complexity under both frameworks of Cognitive Hypothesis and Limited Capacity Hypothesis (Trade-off). They were able to mix the hypotheses because both had got some support from other

studies (Kormos & Trebits, 2012). de Jong and Vercellotti (2016) studied 25 adult English learners with different language backgrounds to examine whether similar prompts, including structure, element numbers, and complexity could achieve similar performance in CFA. The quantitative study found similar prompts could result in different task performances, which supported a multi-faceted view of narrative task complexity given resource-dispersing and task difficulty factors.

Inspired by the two theories, Sattarpour and Farrokhi (2017) detected whether L2 writing could benefit language learning via manipulating dimensions of task complexity and whether the interaction effect existed between task complexity factors and individual variables. This quantitative tested 226 intermediate EFL learners in Iran and found that 1) planning time significantly improved syntactic complexity; 2) increasing intentional reasoning demand could achieve higher lexical and syntactic complexity but not the same to accuracy; 3) accuracy was influenced actively by the interaction of planning time and reasoning demand; and 4) the interaction effect of planning time, reasoning demand and aptitude on accuracy was detected in the study. The results relatively supported the predictions of the two hypotheses and suggested further study of learner-related variables.

Awward (2019) explored how cognitive task complexity contributed to L2 learners' and language professionals' perceptions of task difficulty and concluded that learners had considered the task more problematic as it got more complex. All these studies explored task complexity through different lenses. However, these studies are not sufficient enough for the findings to be generalized. Hence, there should be more further studies mainly focusing on language skills.

Kim (2020) investigated the effect of planning and task complexity on vocal performance in terms of CFA motivated by the two models. The quantitative study selected 77 undergraduates and found that planning significantly influenced fluency and accuracy while task complexity affected phrasal complexity. Meanwhile, spoken performance was observed no interaction between planning and task complexity. It was concluded that the findings supported the Limited Attention Capacity Hypothesis predictions more than the Cognitive Hypothesis.

Kourtali and Révész (2020) investigated the effect of task complexity on 160 Greek EFL learners' language achievement, the relationship between aptitude and L2 development, and the extent to which task complexity influences this relationship when recasts are provided. It was found in this quantitative study that low-complexity tasks could minimize the differences of L2 learners' aptitudes and benefit them more in task-based contexts when feedback was available. The findings reflect some assumptions of Skehan's and Robinson's theories. The research novelty examined the relationship between task complexity and the effect of recasting on language learners with different aptitudes. However, aptitude is only one factor of the individual cognitive differences more other factors like working memory are also valuable to study.

Although these hypotheses study language learning under different lenses or perspectives, they give great emphasis on task complexity and linguistic performance measurement (Skehan, 2015). Besides their different understandings between task complexity and task difficulties, they shall further cultivate more on the construct of task complexity (Révész, 2014) and outcome measurement (Kourtali & Révész, 2020). At the same time, researchers have also studied the hypothesis in language learning. In second language learning, it is widely accepted that individual differences play an important role in pedagogical strategies selection theoretically and practically (Kormos & Trebits, 2012). Therefore, it is equally important to investigate various factors that work with task complexity. Cultivating the relationship and differences of these theories, the findings of these studies are meaningful and enlightening. However, to make these findings generalized, more and further studies needed to be done. Also, the further research may include but shall not be limited to these hypothetic frameworks. The cognitive task demands and task-generated cognitive processes are needed to be studied (Révész et al., 2016). What's more, the standard and measurement of task complexity are not accordant. Last but not least, many different factors of individual differences are tested and considered, but it could be more convincing to examine those major factors together.

5.2 Task complexity and other factors

Language learning achievements can be greatly different due to various factors. According to Robinson (2003), individual differences in the rate and level of ultimate attainment achieved are obviously more evident in L2, compared with L1 learning. Learner differences include factors classified under the following three areas: 1) learning styles; 2) learning strategies; and 3) affective variables (Ehrman et al., 2003). Aptitude and working memory are the factors that researchers mostly examined together with task complexity (Table 4).

Kourtali and Révész (2020)'s study on the significance of aptitude as a predictor in L2 development concluded that although relatively small in size, it seems reasonable that a positive relationship between aptitude components and L2 development could be found. Language learners with different levels of aptitude can show the same development in lexical and syntactic complexity in written tasks (Sattarpour & Farrokhi, 2017). However, in the case of accuracy, learners with better aptitudes perform more accurately.

Working memory can be considered as a flexibly allocated resource supporting cognitive capacity to engage in a

series of complex tasks including language learning (Archibald, 2017). In terms of the interaction between task complexity and working memory, although Kim, Payant and Pearson (2015) explores the intersection of task-based interaction, task complexity and working memory in oral tests and Awwad and Tavakoli (2019) demonstrated that working memory might play a different role in speech performance on tasks of varying task complexity, more research is needed since the relation between working memory and language proficiency is not investigated sufficiently in different tasks of language skills learning but only speaking. The findings suggest that it is important to take working memory into consideration in both task complexity and interaction research. These studies support the statement that individual differences shall be given attention in the research of task complexity and further research on various language skills is suggested.

Due to the development of technology, computer-mediated communication also has enriched ways of language learning and introduced a new learning need (Adams et al., 2015). The potential of text chat as a context for writing to learn a language has been highlighted in the studies. However, the results of the studies are not entirely valid to generalize because of the small sample. Future research is suggested considering the gap between language practice and language learning (Adams et al., 2015; Alwi et al., 2012).

Table 4. Factors co-tested

Title	Co-tested factors with task complexity
An error analysis of l2 writing: How does task complexity affect l2 errors?	/
Conditions and tasks: The effects of planning and task complexity on L2 speaking	/
The Roles of Recasts, Task Complexity, and Aptitude in Child Second Language Development	recasts and aptitude
Time-on-task as a measure of cognitive load in TBLT	time on task
L2 learners' and professionals' perceptions of cognitive task complexity: Towards developing an index of task difficulty	perception of task difficulty
The impact of task complexity on EFL learners' writing production across gender	gender
Task complexity, language proficiency and working memory: Interaction effects on second language speech performance	language proficiency and working memory
Effects of corrective feedback on EFL speaking task complexity in China's university classroom	corrective feedback
Cognitive function predicts listening effort performance during complex tasks in normally aging adults	age
Learner attention to form in ACCESS task-based interaction	learner attention
Effects of Task Complexity on L2 Writing Behaviors and Linguistic Complexity	/
Measuring cognitive task demands using dual-task methodology, subjective self-ratings, and expert judgments	dual-task methodology, self- ratings, and expert judgments
Similar prompts may not be similar in the performance they elicit: Examining fluency, complexity, accuracy, and lexis in narratives from five picture prompts	/
Task complexity effects on the complexity and accuracy of writing via text chat	text chat
The role of task complexity and task motivation in language production	motivation
The intersection of task-based interaction, task complexity, and working memory	working memory
The use of conjunctions in cognitively simple versus complex oral L2 tasks	/
Exploring the interplay of planning time, reasoning demands, and language learning aptitude in Iranian EFL learners' written production	planning time, reasoning demands and aptitude
The Role of Task Complexity, Modality, and Aptitude in Narrative Task Performance	modality and aptitude
Writing to learn via text chat: Task implementation and focus on form	text chat
Task complexity and its implication for pedagogy	/
On the effect of task-complexity-based instruction of incidental vocabulary on Iranian academic learners' vocabulary learning	incidental vocabulary instruction
The effect of strategic planning time and task complexity on L2 written accuracy	planning time

5.3 Task complexity and language learning

According to the analysis of task types fulfilled in the articles selected, it is apparent that researchers focus their studies on speaking and writing rather than reading and listening. According to Révész et al. (2017), researchers have initially been concerned with examining the effect of task complexity on speaking skills because communicative tasks have high face validity in combining meaning and form assessment. However, it is only relatively recently that the issue of task complexity and L2 writing has begun to attract researchers' attention since they found that task complexity could also influence the behaviors and cognitive process in writing. As seen from Table 5, nearly all the studies are focusing on speaking and writing. According to Skehan (2009), it is necessary to systematize the discussion of the relevant model and find the factors that influence the second language performances. Hence, it is reasonable to believe that studies should explore the relationships

between task complexity and reading or listening. Speaking, listening, reading and writing are four key abilities in language performance assessment. Also, Listening is closely related to speaking and reading to writing, which could stimulate learners' overall language abilities and make them competent language users (Sadiku, 2015).

From the articles reviewed, we can gather that task complexity and speaking are categorized into two types. The first one is that task complexity could affect varied aspects of speaking or oral tasks obviously, such as phrasal complexity, planning time, task difficulty and language proficiency etc. (Awwad & Tavakoli, 2019; Kim, 2020; Kourtali & Révész, 2020; Lee, 2019;). The second one is that task complexity works with other factors in speaking tasks like working memory, corrective feedback and aptitude (Awwad & Tavakoli, 2019; Zhai & Gao, 2018; Kormos & Trebits, 2012). However, although there are agreements on the relationship between task complexity and speaking production quality, there are quite a number of different perspectives to measure task complexity (Zhai & Gao, 2018). Therefore, it is quite practical to find out the most significant factors and establish a more authoritative method to investigate the relation between task complexity and speech performance.

Other studies also show some implications in language learning. Lee (2020) found that with the increase of task complexity, writing errors increase too. Results of some research reveals that learners benefited more in the simple condition involving mere information transmission rather than in more complex, decision-making tasks that impose greater reasoning demands (Kourtali & Révész, 2020; Révész et al., 2017;). According to Sattarpour & Farrokhi (2017), increasing task complexity about reasoning demands resulted in better gains of lexical and syntactic complexity, but not in accuracy. Masrom et al. (2015) found that varied levels of task complexity could affect the complexity of language production.

Results of these studies are fruitful and thought-provoking, however, they are not without limitations. The standard measurement of task complexity shall be developed. On the other hand, due to the small sample, further studies are needed to generalize the results. Last but not the least, most studies focus their research on speaking and writing, which leaves the requirement that reading and listening should be explored.

Table 5. Task types

Title	Task types
An error analysis of l2 writing: How does task complexity affect l2 errors?	writing
Conditions and tasks: The effects of planning and task complexity on L2 speaking	speaking
The Roles of Recasts, Task Complexity, and Aptitude in Child Second Language Development	written and oral, elicited imitation
Time-on-task as a measure of cognitive load in TBLT	speaking
L2 learners' and professionals' perceptions of cognitive task complexity: Towards developing an index of task difficulty	oral task
The impact of task complexity on EFL learners' writing production across gender	writing
Task complexity, language proficiency and working memory: Interaction effects on second language speech performance	narrative tasks
Effects of corrective feedback on EFL speaking task complexity in China's university classroom	speaking
Cognitive function predicts listening effort performance during complex tasks in normally aging adults	listening
Learner attention to form in ACCESS task-based interaction	/
Effects of Task Complexity on L2 Writing Behaviors and Linguistic Complexity	writing
Measuring cognitive task demands using dual-task methodology, subjective self-ratings, and expert judgments	oral tasks
Similar prompts may not be similar in the performance they elicit: Examining fluency, complexity, accuracy, and lexis in narratives from five picture prompts	narrative tasks
Task complexity effects on the complexity and accuracy of writing via text chat	writing
The role of task complexity and task motivation in language production	writing
The intersection of task-based interaction, task complexity, and working memory	interactive task
The use of conjunctions in cognitively simple versus complex oral L2 tasks	oral task
Exploring the interplay of planning time, reasoning demands, and language learning aptitude in Iranian EFL learners' written production	writing
The Role of Task Complexity, Modality, and Aptitude in Narrative Task Performance	narrative tasks
Writing to learn via text chat: Task implementation and focus on form	writing
Task complexity and its implication for pedagogy	pedagogy
On the effect of task-complexity-based instruction of incidental vocabulary on Iranian academic learners' vocabulary learning	vocabulary
The effect of strategic planning time and task complexity on L2 written accuracy	writing

6. Conclusion

It is of pedagogic importance that task complexity can be manipulated to match with learners' developmental sequences and their proficiency levels (Yousefi et al., 2012). However, gaps exist in summarizing theoretical frameworks used and practiced in conducting language learning. This study attempts to fill these gaps by conducting a systematic literature review between 2012 and 2020. It aims to draw a map of the recent literature studying task complexity. This study certainly isn't without any limitations. Firstly, only the SCOPUS database is used. Other databases shall also be included in future studies. Secondly, only open-access articles are selected. It can be extended to books, chapters or reports. Last but certainly not least, review studies in the future could further cultivate the listing questions: (1) What new theoretical framework or practical model of task complexity is proposed? (2) How exactly do the found factors like working memory or new ones work with task complexity in language learning? (3) How does task complexity influence various language skills including reading, writing, listening and speaking with other factors?

References

[1] Adams, R., Alwi, N. A. N. M., & Newton, J. (2015). Task complexity effects on the complexity and accuracy of writing via text chat. *Journal of second language writing*, 29, 64-81. doi:10.1016/j.jslw.2015.06.002

[2] Alwi, N. A. N. M., Adams, R., & Newton, J. (2012). Writing to learn via text chat: Task implementation and focus on form. *Journal of second language writing*, 21(1), 23-39. doi:10.1016/j.jslw.2011.12.001

[3] Archibald, L. M. (2017). Working memory and language learning: A review. *Child Language Teaching and Therapy*, 33(1), 5-17. doi:10.1177/0265659016654206

[4] Attarzade, S., & Farahani, E. (2014). The effect of task complexity on Iranian EFL learners' listening comprehension across aptitude. *Procedia-Social and Behavioral Sciences*, 98, 314-323. doi:10.1016/j.sbspro.2014.03.422

[5] Awwad, A. (2019). L2 Learners' and Professionals' Perceptions of Cognitive Task Complexity: Towards Developing an Index of Task Difficulty. *Journal of Asia TEFL*, 16(2), 468. doi:10.18823/asiatefl.2019.16.2.2.468

[6] Awwad, A., & Tavakoli, P. (2019). Task complexity, language proficiency and working memory: Interaction effects on second language speech performance. *International Review of Applied Linguistics in Language Teaching*, 1. doi:10.1515/iral-2018-0378

[7] Bryfonski, L., & McKay, T. H. (2019). TBLT implementation and evaluation: A meta-analysis. *Language Teaching Research*, 23(5), 603-632. doi:10.1177/1362168817744389

[8] Calvert, M., & Sheen, Y. (2015). Task-based language learning and teaching: An action-research study. *Language Teaching Research*, 19(2), 226-244. doi:10.1177/1362168814547037

[9] Cho, M. (2018). Task complexity, modality, and working memory in L2 task performance. *System*, 72, 85-98. doi:10.1016/j.system.2017.10.010

[10] de Jong, N., & Vercellotti, M. L. (2016). Similar prompts may not be similar in the performance they elicit: Examining fluency, complexity, accuracy, and lexis in narratives from five picture prompts. *Language Teaching Research*, 20(3), 387-404. doi:10.1177/1362168815606161

[11] Dybå, T., & Dingsøyr, T. (2008). Empirical studies of agile software development: A systematic review. *Information and software technology*, 50(9-10), 833-859. doi:10.1016/j.infsof.2008.01.006

[12] Ellis, R. (2009). Task-based language teaching: Sorting out the misunderstandings. *International journal of applied linguistics*, 19(3), 221-246. doi:10.1111/j.1473-4192.2009.00231.x

[13] Ehrman, M. E., Leaver, B. L., & Oxford, R. L. (2003). A brief overview of individual differences in second language learning. *System*, 31(3), 313-330. doi:10.1016/S0346-251X(03)00045-9

[14] Jackson, D. O., & Suethanapornkul, S. (2013). The cognition hypothesis: A synthesis and meta-analysis of research on second language task complexity. *Language Learning*, 63(2), 330-367. doi:10.1111/lang.12008

[15] Kang, S., & Lee, J. H. (2019). Are two heads always better than one? The effects of collaborative planning on L2 writing in relation to task complexity. *Journal of Second Language Writing*, 45, 61-72. doi:10.1016/j.jslw.2019.08.001

[16] Kim, N. (2020). Conditions and Tasks: The Effects of Planning and Task Complexity on L2 Speaking. *Journal of Asia TEFL*, 17(1), 34. doi:10.18823/asiatefl.2020.17.1.3.34

[17] Kim, Y., Jung, Y., & Tracy-Ventura, N. (2017). Implementation of a Localized Task-Based Course in an EFL Context: A Study of Students' Evolving Perceptions. *TESOL Quarterly*, 51(3), 632-660. doi: 10.1002/tesq.381

[18] Kim, Y., Payant, C., & Pearson, P. (2015). The intersection of task-based interaction, task complexity, and working memory: L2 question development through recasts in a laboratory setting. *Studies in Second Language Acquisition*, 37(3), 549-581. doi:10.1017/S0272263114000618

[19] Khatib, M., & Farahanynia, M. (2020). Planning conditions (strategic planning, task repetition, and joint planning), cognitive task complexity, and task type: Effects on L2 oral performance. *System*, 93, 102297. doi:10.1016/j.sys-

tem.2020.102297
[20] Kourtali, N. E., & Révész, A. (2020). The roles of recasts, task complexity, and aptitude in child second language development. *Language Learning*, 70(1), 179-218. doi:10.1111/lang.12374
[21] Kormos, J., & Trebits, A. (2012). The role of task complexity, modality, and aptitude in narrative task performance. *Language Learning*, 62(2), 439-472. doi:10.1111/j.1467-9922.2012.00695.x
[22] Kuiken, F., & Vedder, I. (2008). Cognitive task complexity and written output in Italian and French as a foreign language. *Journal of second language writing*, 17(1), 48-60. doi:10.1016/j.jslw.2007.08.003
[23] Lee, J. (2019). Time-on-task as a measure of cognitive load in TBLT. *Journal of Asia TEFL*, 16(3), 958. doi:10.18823/asiatefl.2019.16.3.12.958
[24] Lee, J. (2020). An Error Analysis of L2 Writing: How Does Task Complexity Affect L2 Errors? *The Journal of AsiaTEFL*, 17(3), 954-965. doi:10.18823/asiatefl.2020.17.3.13.954
[25] Long, M. H. (2016). In defense of tasks and TBLT: Nonissues and real issues. *Annual Review of Applied Linguistics*, 36, 5-33. doi:10.1017/S0267190515000057
[26] Mao, Z. (2012). The Application of Task-based Language Teaching to English Reading Classroom. *Theory & Practice in Language Studies*, 2(11). doi:10.4304/tpls.2.11.2430-2438
[27] Masrom, U. K., Alwi, N. A. N. M., & Daud, N. S. M. (2015). The role of task complexity and task motivation in language production. *GEMA Online® Journal of Language Studies*, 15(2). doi:10.17576/gema-2015-1502-03
[28] Michel, M. C. (2013). The use of conjunctions in cognitively simple versus complex oral L2 tasks. *The Modern Language Journal*, 97(1), 178-195. doi:10.2307/23361745
[29] Mohammad, M. K. M., & Alwi, N. A. (2019). The impact of task complexity on EFL learners' writing production across gender. *International Journal of Engineering and Advanced Technology*, 8(5), 1218-1220. doi:10.35940/ijeat.E1172.0585C19
[30] Monteiro, K., & Kim, Y. (2020). The effect of input characteristics and individual differences on L2 comprehension of authentic and modified listening tasks. *System*, 94, 102336. doi:10.1016/j.system.2020.102336
[31] Navidinia, H., Ozhan, A. R., & Younesi, A. (2018). Using pictures in EFL classrooms: Exploring its potential contribution for developing students' writing skill. *Asia Pacific Journal of Educators and Education*, 33, 1-17. doi:10.21315/apjee2018.33.1
[32] Prabhu, N. (1987). Second language pedagogy: a perspective. Oxford: Oxford University Press.
[33] Révész, A. (2014). Towards a fuller assessment of cognitive models of task-based learning: Investigating task-generated cognitive demands and processes. *Applied Linguistics*, 35(1), 87-92. doi:10.1093/applin/amt039
[34] Révész, A., Kourtali, N. E., & Mazgutova, D. (2017). Effects of task complexity on L2 writing behaviors and linguistic complexity. *Language Learning*, 67(1), 208-241. doi:10.1111/lang.12205
[35] Révész, A., Michel, M., & Gilabert, R. (2016). Measuring cognitive task demands using dual-task methodology, subjective self-ratings, and expert judgments: A validation study. *Studies in Second Language Acquisition*, 38(4), 703-737. doi:10.1017/S0272263115000339
[36] Richard, J. C., & Rodgers, T. S. (2014). Approaches and methods in language teaching. Cambridge university press.
[37] Robinson, P. (2003). The cognitive hypothesis, task design, and adult task-based language learning. *University of Hawai'I Second Langauge Studies Paper* 21 (2).
[38] Robinson, P. (2007). Task complexity, theory of mind, and intentional reasoning: Effects on L2 speech production, interaction, uptake and perceptions of task difficulty. *International Review of Applied Linguistics in Language Teaching*, 45(3), 193-213. doi:10.1515/iral.2007.009
[39] Robinson, P. (2011). Task-based language learning: A review of issues. *Language learning*, 61, 1-36. doi:10.1111/j.1467-9922.2011.00641.x
[40] Robinson, P., & Gilabert, R. (2007). Task complexity, the Cognition Hypothesis and second language learning and performance. *International Review of Applied Linguistics in Language Teaching*, 45(3), 161-176. doi:10.1515/IRAL.2007.007
[41] Ellis, R. (2000). Task-based research and language pedagogy. *Language teaching research*, 4(3), 193-220. doi:10.1177/136216880000400302
[42] Sadiku, L. M. (2015). The importance of four skills reading, speaking, writing, listening in a lesson hour. *European Journal of Language and Literature*, 1(1), 29-31. doi:10.26417/ejls.v1i1.p29-31
[43] Salimi, A., Alavinia, P., & Hosseini, P. (2012). The Effect of Strategic Planning Time and Task Complexity on L2 Written Accuracy. *Theory & Practice in Language Studies*, 2(11). doi:10.4304/tpls.2.11.2398-2406
[44] Salimi, A., & Dadashpour, S. (2012). Task complexity and SL development: Does task complexity matter? *Procedia-Social and Behavioral Sciences*, 46, 726-735. doi:10.1016/j.sbspro.2012.05.189
[45] Sasayama, S. (2016). Is a 'complex' task really complex? Validating the assumption of cognitive task complexity. *The Modern Language Journal*, 100(1), 231-254. doi:10.1111/modl.12313
[46] Sattarpour, S., & Farrokhi, F. (2017). Exploring the Interplay of Planning Time, Reasoning Demands, and Language

Learning Aptitude in Iranian EFL Learners' Written Production. *Journal of Asia TEFL*, 14(4), 736. doi:10.18823/asiatefl.2017.14.4.10.736
[47] Skehan, P. (2015). Limited attention capacity and cognition. In M. Bygate (Ed.), *Domains and directions in the development of TBLT* (Vol. 8, pp. 123-155). Amsterdam: John Benjamins Publishing. Doi:10.4324/9781315629766-5
[48] Skehan, P. (2009). Modelling second language performance: Integrating complexity, accuracy, fluency, and lexis. *Applied linguistics*, 30(4), 510-532. doi:10.1093/applin/amp047
[49] Torres, J. (2018). The effects of task complexity on heritage and L2 Spanish development. *Canadian Modern Language Review*, 74(1), 128-152. doi:10.3138/cmlr.3770
[50] Qureshi, M. I., Khan, N., Hassan Gillani, S. M. A., & Raza, H. (2020). A Systematic Review of Past Decade of Mobile Learning: What we Learned and Where to Go. *International Journal of Interactive Mobile Technologies*, 14(6). doi:10.3991/ijim.v14i06.13479
[51] Yousefi, M. H., Mohammadi, E. G., & Koosha, M. (2012). Task Complexity and Its Implication for Pedagogy. *Theory & Practice in Language Studies*, 2(7). doi:10.4304/tpls.2.7.1436-1444
[52] Zhai, K., & Gao, X. (2018). Effects of corrective feedback on EFL speaking task complexity in China's university classroom. *Cogent Education*, 5(1), 1485472. doi:10.1080/2331186X.2018.1485472