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Research Article

Task sequencing on oral performance in Portuguese as a foreign language

Sara Santos*
Universidade de Macau

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Abstract: This empirical study examined Robinson's (2010, 2015, 2022) Simplify, Stabilise/ Automatise/ Restructure, Complexify (SSARC) instructional design model of task sequencing. Thirty-four university learners of Portuguese as a foreign language participated in the research. The analysis employed a monologic narrative task and two independent variables: "± here-and-now" and "± planning time". Measures of syntactic complexity, lexical diversity, accuracy, and fluency were selected to analyse the learners' output. A between-subjects design was adopted. Participants were divided into two groups: (i) sequencing group, in which the students (n=15) performed three tasks with different levels of cognitive complexity (simple task – complex task – more complex task); (ii) individual performance group (n=19), in which the students performed only one task (simple task, complex task, or more complex task). The inferential statistical tests showed gains in fluency and syntactic complexity (coordination index) regarding the complex task in the sequencing group, and increased accuracy and fluency for the more complex task, as compared to individual group performance. The SSARC model was considered to have pedagogical merit, which can help teachers design task-based syllabuses. To the best of our knowledge, this is the first study to fully test the SSARC model applied to oral task sequencing in Portuguese as a foreign language.

Keywords: Simplify, Stabilise/ Automatise/ Restructure, Complexify (SSARC), task sequencing, complexity, accuracy, and fluency, task-based syllabus design, Portuguese as a foreign language

Resumos: Como o objetivo de testar o modelo de desenho instrucional Simplificação, Estabilização/ Automatização/ Reestruturação, Complexificação (SEARC) de Robinson (2010, 2015, 2022) para a sequenciação de tarefas pedagógicas, este trabalho empírico contou com a participação de 34 estudantes universitários de português como língua estrangeira (PLE). Foi usada uma tarefa narrativa monológica e as variáveis independentes foram os fatores "± aqui-e-agora" e "± tempo de planeamento". A produção oral foi quantificada, usando medidas de complexidade sintática, diversidade lexical, correção e fluência. Foram constituídos dois grupos para realizar uma comparação intersujeitos: (i) grupo de sequenciação, no qual os alunos (n=15) realizaram três tarefas com diferentes níveis de complexidade cognitiva (tarefa simples – tarefa complexa – tarefa mais complexa); (ii) grupo de desempenho individual (n=19), no qual os alunos realizaram apenas uma das tarefas (tarefa simples, tarefa complexa ou tarefa mais complexa). Os resultados dos testes de estatística inferencial mostraram que no grupo de sequenciação, houve ganhos na fluência e complexidade sintática (índice de coordenação) no desempenho da tarefa complexa e um aumento da fluência e da correção no desempenho da tarefa mais complexa. A validade da proposta teórica SEARC foi demonstrada e a sua aplicação poderá ajudar os professores na preparação do programa de um curso de PLE baseado em tarefas. Não tendo sido encontrada investigação anterior nesta área, este é o primeiro estudo a testar a aplicação integral do modelo SEARC na sequenciação de tarefas orais em PLE.

Keywords Portuguese: Simplificação, Estabilização/ Automatização/ Reestruturação, Complexificação (SEARC), sequenciação de tarefas pedagógicas, complexidade, correção e fluência, programa de um curso baseado em tarefas

***Corresponding author:** Sara Santos, E-mail: saras@um.edu.mo

1 Introduction

Task-based language teaching (TBLT) has drawn the attention of teachers and researchers in recent decades. Several studies have shown that using tasks can enhance students' interlanguage development and promote language acquisition. As such, employing tasks as the unit of analysis in foreign language syllabuses is advocated, and issues such as task design and sequencing assume particular relevance, both in the implementation of these courses and in TBLT research. Assuming tasks as a valid alternative to the traditional linguistic units of the structural syllabus, Robinson (2005, 2011a) distinguishes pedagogical tasks (classroom activities) from target tasks (real-world activities). He further claims that the cognitive demands of pedagogical tasks can be gradually increased in order to approximate target task complexity.

Pedagogical tasks are designed to help learners develop the necessary communicative competence in target task performance, i.e., for students to accomplish tasks outside the instructional setting, using language effectively and appropriately in real situations. Designing versions of pedagogical tasks that progressively increase the demands imposed by target tasks is a challenge for many teachers working within the TBLT approach, and research in this area has endeavoured to analyse what kind of pedagogical interventions may benefit students' performance.

The literature provides some evidence that manipulating cognitive task complexity may enhance the development of students' language skills. Several studies have found that an increase in the cognitive demands of the task (in certain variables) results in improved oral production (Gilabert, 2005; Levkina, 2008; Levkina & Gilabert, 2012; Malicka, 2014a; Malicka & Levkina, 2012; Michel, 2011; Michel et al., 2019; Révész, 2011; Santos, 2018, 2021, 2023; Sasayama, 2015; Sasayama & Izumi, 2012; Vasylets, 2017). In recent decades, various theories have emerged regarding task sequencing (see some examples in Baralt et al., 2014), but the question of how pedagogical tasks should be sequenced remains unsolved (Abdi Tabari & Cho, 2022; Faruji & Kharaghani, 2019; Gilabert & Malicka, 2022; Kim, 2020). Associated with processing demands (which can be more or less challenging), task complexity may affect the way learners allocate their attentional and memory resources during task performance (Robinson, 2001, 2015). This means that manipulating task features may direct (or disperse) learners' attention towards the language. Therefore, there is a need for more empirical research that can test theoretical models and provide guidance to teachers on how tasks should be selected and sequenced to promote language acquisition.

Robinson (2010, 2015, 2022) proposed an instructional design theory for pedagogical task sequencing, in which he included the Simplify, Stabilise/ Automatise/ Restructure, Complexify (SSARC) model. Recent studies have tested the SSARC model, having been considered a theoretically motivated and operationally feasible taxonomy (Abdi Tabari & Cho, 2022; Abdi Tabari & Miller, 2021; Allaw & McDonough, 2019; Lambert & Robinson, 2014; Levkina & Gilabert, 2014; Malicka, 2014b, 2020; Romanko & Nakatsugawa, 2010; Santos, 2023).

In line with the instructional design theory of task sequencing, this paper explores the premises proposed by Robinson (2015, 2022), aiming to empirically ground teachers' decisions in designing a task-based syllabus for Portuguese as a foreign language (PFL). Following the three steps defined in the SSARC model, this study analyses the effect of grading and sequencing pedagogical tasks on the oral production of Chinese university learners of PFL. Task complexity was manipulated along two variables, "± planning time" and "± here-and-now".

2 The Simplify, Stabilise/ Automatise/ Restructure, Complexify (SSARC) model of pedagogical task sequencing

2.1 Theoretical assumptions

In his theoretical framework for the instructional design of pedagogical task sequencing, Robinson (2022) integrates three components: the Cognition Hypothesis (CH), the Triadic Componential Framework (TCF), and the SSARC model. The basic assumption of the CH establishes that task design and sequencing should depend on the cognitive complexity of the task and not on the notion of linguistic complexity. According to the CH, pedagogical tasks should be sequenced based on their cognitive demands, because such sequences allow learners to access and develop their interlanguage resources (Robinson, 2011a, 2015). Thus, teachers can design and sequence pedagogical tasks starting from a simple version of the task to more complex versions. The operationalisation of the task's cognitive demands can be manipulated according to the TCF, in which universal variables are presented. Robinson (2001, 2005, 2010, 2015) argues that increasing the complexity of certain task characteristics will produce more accurate and complex outputs. It will also benefit interaction and the assimilation of salient forms in the input, as well as encourage more depth of processing and the long-term retention of the input (Robinson, 2022). In the TCF and CH, Robinson (2001, 2003, 2005, 2007, 2010, 2011b, 2015, 2022) distinguishes three task categories: task complexity (cognitive factors), task conditions, (interactive factors), and task difficulty (learner factors).

According to Robinson's theoretical framework, the variables that contribute to the cognitive complexity of the task are the basis for the grading and sequencing of tasks and can be classified into two dimensions: (i) "resource-dispersing" and (ii) "resource-directing". The "resource-dispersing" variables (± planning time; ± single task; ± task structure; ± few steps; ± independence of steps; ± prior knowledge) are performance factors and relate to access to the students' current interlanguage system. Therefore, the complexification of these variables will disperse the learners' attentional and memory resources, which negatively affects their oral production in terms of linguistic complexity, accuracy, and fluency. The "resource-directing" variables (± here-and-now; ± few elements; ± spatial reasoning; ± causal reasoning; ± intentional reasoning; ± perspective-taking) are considered developmental variables because they can promote the acquisition of linguistic knowledge, i.e., learners direct their attentional and memory resources towards the language. Consequently, increasing the task's cognitive demands will have a beneficial effect on the quality of the output regarding linguistic complexity and accuracy, but the learners' speech will be less fluent.

Considering this distinction between "resource-dispersing" and "resource-directing" variables, the CH establishes two instructional principles for task-based syllabus design. The first principle claims that "only the cognitive demands of tasks contributing to their intrinsic conceptual and cognitive processing complexity are sequenced" (Robinson, 2015, p.92). Robinson (2010, 2015) argues that the interactive demands of the tasks should be held constant when more cognitively complex versions of the pedagogical tasks are performed. Besides, the CH states that task sequencing based on cognitive factors helps ensure a greater depth of processing, rehearsal, and incorporation in memory, and elaboration and transfer of specific schemas for interactive or monologic task performance to real-world situations (Malicka, 2020; Robinson, 2001, 2003, 2010, 2015). The second principle proposes increasing the "resource-dispersing" dimensions of complexity first, and then increasing "resource-directing"

dimensions" (Robinson, 2015, p. 93). Associated with the CH, Robinson describes the three stages of the SSARC model (2010, 2015, 2022) for pedagogical task sequencing. In the first stage, students perform a simple task along the "resource-dispersing" and "resource-directing" dimensions (SS: simplify tasks, stabilise the developing interlanguage system) (Robinson, 2022). In the second stage, the cognitive complexity of the task is increased only along the "resource-dispersing" dimension, while the simple version is maintained on the "resource-directing" dimension, resulting in automatisation (A) and faster access to current language knowledge. The third stage involves increasing the cognitive demands of the task along both variables ("resource-dispersing" and "resource-directing" dimensions) to foster the restructuring of the current interlanguage system and the development of new form-meaning relationships (RC - restructure and complexify the interlanguage system) (Robinson, 2022). Language learning thus follows a cumulative process, as each version of the task presents only small differences from the previous version, encouraging progressive learning (Robinson, 2010, 2015, 2022).

2.2 Previous studies on Robinson's instructional design theory of pedagogical task sequencing

Although some studies (Malicka, 2014b, 2020; Santos, 2023) have explored Robinson's (2010, 2015, 2022) SSARC pedagogical model in oral language production, the analysis of the variables did not exactly follow the assumptions as he defined them. In these studies, task complexity was manipulated only along the "resource-directing" dimension. Therefore, the instructional design theory of pedagogical task sequencing has not been fully tested. It is worth noting that in the extensive literature review conducted, some studies (Abdi Tabari & Cho, 2022; Abdi Tabari & Miller, 2021; Allaw & McDonough, 2019; Lambert & Robinson, 2014; Romanko & Nakatsugawa, 2010) manipulated both "resource-dispersing" and "resource-directing" variables in the order proposed by the SSARC model. However, most of these studies examined the impact of task sequencing on the written production of English (Abdi Tabari & Cho, 2022; Abdi Tabari & Miller, 2021; Lambert & Robinson, 2014), and French language learners (Allaw & McDonough, 2019), whereas Romanko and Nakatsugawa (2010) presented a case study on the oral production of a Japanese English learner.

Abdi Tabari and Cho (2022) and Abdi Tabari and Miller (2021) examined the "± few elements resource-directing" variable and the "± planning time resource-dispersing" factor. In the first study, 100 participants were divided into three groups: the first and second groups performed three tasks, but with different sequencing orders: (i) simple-to-complex, (ii) complex-to-simple. In the third group, only one task was performed with a different level of complexity (simple task, complex task, or more complex task). The results showed a positive effect on the learners' syntactic complexity and accuracy in both sequencing conditions, with an advantage for the simple-to-complex sequence. However, the two groups' progression was not linear. Abdi Tabari and Miller's (2021) experimental design involved only comparing two conditions: (i) performance of three tasks in simple-to-complex sequencing, and (ii) individual performance task. This study included 90 learners and the results confirmed the positive impact of sequencing on the learners' syntactic complexity, accuracy, and lexical diversity. In two longitudinal studies, Allaw and McDonough (2019) employed the variables "± task structure" ("resource-dispersing") and "± spatial reasoning" ("resource-directing"), while Lambert and Robinson (2014), manipulated four "resource-dispersing" variables ("± planning time," "±

prior knowledge," "± few steps," and "± single task") and two "resource-directing" variables ("± few elements" and "± intentional reasoning"). In Allaw and McDonough's research (2019), the comparison between two sequencing conditions (simple-to-complex *vs.* complex-to-simple) identified a positive effect on the written production (in terms of lexical diversity, accuracy, and fluency) of both groups, but the simple-to-complex sequencing group revealed greater gains over time (with higher results in both post-tests). Although Lambert and Robinson (2014) did not find significant effects between the experimental and control groups (possibly due to the high number of selected variables), gains in the learners' written production were observed over time in the sequencing group.

With respect to oral production, no studies were identified in the literature that had fully tested the SSARC model of pedagogical task sequencing. As mentioned previously, in the studies related to oral task sequencing (Malicka, 2014b, 2020; Santos, 2023), the cognitive demands of the task were increased only along the "resource-directing" dimension. In two studies, Malicka (2014b, 2020) explored the impact of oral task sequencing, having manipulated task complexity along two "resource-directing" variables ("± reasoning demands" and "± few elements"). The participants were L1 Spanish and Catalan learners of English as a foreign language (Malicka, 2014b: n = 50; Malicka, 2020: n = 87). Malicka (2014b) compared differences in oral production regarding two conditions: (i) a simple-complex condition (n = 25), i.e., learners performed a simple task first, followed by a version of intermediate complexity and, finally, the most complex task, and (ii) a randomised condition (n= 25) (n= 5 for each sub-condition). No effects of task sequencing were found on the learners' oral production. In the second study (Malicka, 2020), a group of learners (n = 30) performed three tasks in the same sequence (simple-intermediate-more complex), and another group performed only one task (simple: n = 18; intermediate: n = 19; more complex: n = 20). Task sequencing had a positive effect on accuracy (between the simple task and the intermediate task), syntactic complexity (in the more complex task), and fluency (between the simple task and the more complex task). Santos (2023) analysed the impact of increasing the reasoning demands of a narrative task and task sequencing on the oral production of Chinese learners of Portuguese as a foreign language. To test the effects of task sequencing, a between-subjects comparison was conducted: the sequencing group (n=16) performed two tasks (simple and complex), and the individual performance group (n=20) performed one task (simple: n=10 or complex: n=10). Task sequencing had significant positive effects on accuracy only, and the author considered that perhaps the results were not as robust because the SSARC model had not yet been completely explored. Therefore, to the best of our knowledge, this is the first study to fully test Robinson's (2010, 2015, 2022) theoretical instructional design framework for task sequencing in the oral mode.

It should be noted that modality may affect language production differently as the nature of language use and the psycholinguistic processes involved are different in speaking and writing (Kormos, 2014). Beyond the scope of this study, current models of speech (Levelt, 1989) and written production (Kellogg, 1996) describe the cognitive mechanisms involved in both modes (see Tavakoli, 2014). While the production of a given message goes through similar stages in speaking and writing, there are significant differences between these two modalities (Kormos, 2014; Tavakoli, 2014). Oral discourse is a linear process and subject to greater time pressure, whereas the writing process may be less affected, as it allows for online planning that is not possible in oral production (Kormos, 2014). Therefore, given that the psycholinguistic mechanisms underlying oral production are not exactly the same as those for written production, it is important to explore the impact of task sequencing on both modes, as the students' attention

allocation may be affected differently with consequences on their production. Thus, examining the SSARC model in full in terms of oral performance, i.e., following all the steps described by Robinson (2010, 2015, 2022), may bring new insights to the limited research available in this area.

The present study focused on the oral production of Chinese learners of PFL, and the two variables selected were the "± planning time" factor ("resource-dispersing") and the "± here-and-now" variable ("resource-directing"). Given that in the oral production of Chinese learners of PFL, the variables along the "resource-directing" dimension studied to date were the factors "± few elements" (Santos, 2018, 2020, 2021) and "± reasoning demands" (Santos, 2023), it seemed relevant to examine the effects of manipulating the "± here-and-now" variable. According to Robinson (2022), performing tasks manipulated along this variable may direct students' attention to morphological forms and expressions that can be used to express the present ("+here-and-now") vs. the past ("-here-and-now"). Considering the acquisitional difficulty of verbal forms to express the past by Chinese learners of PFL, increasing the cognitive complexity of the task in this factor may facilitate noticing and direct learners' attentional and memory resources towards the language, with positive effects on accuracy and linguistic complexity, as predicted by the CH. Similarly, Robinson (2005, 2010, 2015) predicted that tasks that require justifying beliefs or giving reasons (i.e., are high in reasoning demands), compared to tasks with no reasoning demands, introduce more complex syntactic complementation, grammaticalisation, and lexicalisation, as they require expressions such as logical subordinators, and the use of psychological, cognitive state verbs. Following the same perspective, increasing task complexity along "±few elements" may direct the learners' attentional and memory resources to language, because they will have to distinguish and refer to more elements. It is assumed that manipulating the functional and cognitive demands of communicative tasks, i.e., increasing task complexity along "resource-directing" dimensions, may promote greater analysis, causing a shift from the pragmatic to the syntactic mode (Robinson, 2005, 2015). Thus, the CH proposes a multiple attentional model and predicts that "resource-directing" factors may allocate the learners' attentional and memory resources to linguistic complexity and accuracy simultaneously. As Sweller et al. (1998) claim, instructional designs may direct the learners' attention toward processes that are relevant to learning, namely toward the construction of schemas (increasing germane cognitive load), because according to the authors, teaching materials may include several elements that have to be assimilated. If the materials are low in element interactivity, it is possible to learn them serially (i.e., individually) as they do not impose a heavy working memory load. However, materials high in element interactivity require working memory to process many elements simultaneously resulting in a high intrinsic cognitive load.

The research question for this study was: What is the effect of task sequencing on the oral production of Chinese learners of PFL? Based on claims of the SSARC model (Robinson, 2010, 2015, 2022) and previous studies on task sequencing, the following hypothesis was formulated to answer the research question: Sequencing tasks along the "resource-dispersing" and "resource-directing" dimensions will improve the quality of learners' oral production, with increased syntactic complexity, greater lexical diversity, more accuracy and fluency in the sequencing group (simple task – complex task – more complex task) than in the individual task performance group (simple task, complex task, or more complex task).

3 Methodology

3.1 Participants

This study involved thirty-four undergraduate Chinese learners majoring in Portuguese at the University of Macau, and their participation was voluntary. Students had received approximately 630 hours of formal PFL instruction. The participants had a mean age of 19.76 (SD=1). Among the informants, 35.3% spoke Cantonese as their native language, 55.9% were native Mandarin speakers, and 8.8% were bilingual. Regarding gender, 85.3% of the students were female, and 14.7% were male. The test *Teste Diagnóstico de Português Europeu para Falantes de Outras Línguas* (Pascoal, final version in preparation for publication) was used to assess the participants' proficiency level. This test included 30 multiple-choice questions related to vocabulary and syntax. Due to the test's characteristics (written, closed-ended questions without free production in different skills), a comprehensive definition of the proficiency level was adopted. Therefore, learners' proficiency was defined between the A2 and B1 levels of the Common European Framework of Reference for Languages (Council of Europe, 2020). Considering the usual difficulty in recruiting Chinese learners for this type of study, a small monetary compensation (equivalent to five Euros) was offered to all informants for each oral task. Thus, after completing the three tasks, participants in the experimental group received about 15 Euros, while the remaining informants received the amount corresponding to the performance of one task.

3.2 Independent variables and operationalisation of task complexity

The independent variables were the factors "± planning time" ("resource-dispersing") and "± here-and-now" ("resource-directing"). The selection of these variables was carefully made because, according to the SSARC model, task grading and sequencing have to follow a certain order; task complexity should be increased initially along a "resource-dispersing" variable and only afterwards along a "resource-directing" variable. The choice to use the "± here-and-now" variable was justified because, as mentioned earlier, we were unable to find any other studies in the PFL literature regarding the impact of increasing cognitive task complexity along this dimension. Considering the morphological differences between Portuguese, English, and Chinese, this research is expected to bring new perspectives to TBLT. Following the studies of Malicka (2020) and Abdi Tabari and Miller (2021), the students were divided into two groups: (i) sequencing group (simple task – complex task – more complex task); and (ii) individual performance group. Therefore, a between-subjects comparison was made.

In the experimental group, participants (n=15) performed three pedagogical tasks: in the first stage, they performed a simple task along the two independent variables ("+ planning time"; "+ here-and-now"); then, in the second stage, the task was complexified along the "resource-dispersing" factor ("- planning time"). The manipulation of the "± planning time" variable offered learners five minutes initially to plan the task (simple version) *vs.* removing the planning time ("- planning time"), meaning learners performed the same task without time to plan what they wanted to say (complex version) (they were only given one minute to observe the story). In the third stage, cognitive task complexity was increased along the "resource-dispersing" ("- planning time") and "resource-directing" ("- here-and-now") dimensions. The manipulation of the "± here-and-now" variable followed the work of Ishikawa (2006, 2007), i.e., employing a

set of images with a narrative ["*O supermercado*" ("The supermarket")] as proposed by Yule (1997, p.67). When performing the simple version of the task ("+ here-and-now"), learners were asked to tell a story with reference to the present, and in the complex version ("- here-and-now") the story had to be told in the past. Therefore, regarding the "± here-and-now" variable, two versions of the narrative tasks were prepared, and the more complex version was performed in the last stage of the sequence without planning time. Participants in the second group (control group) performed one of the three tasks [simple task (*n*=7), complex task (*n*=6), or more complex task (*n*=6)].

3.3 Tasks

Three monologic tasks were prepared: simple, intermediate (complex), and more complex, which (as mentioned) involved describing a narrative (Yule, 1997, p.67) based on images. The input was mostly visual but accompanied by brief instructions, translated and adapted from Ishikawa's work (2006, 2007). Thus, the instructions included useful vocabulary [*carrinho de supermercado* (shopping cart), *garrafa* (bottle), *prateleira* (shelf), *roubar* (to steal), *caixa* (supermarket cashier)]. Lexical items were provided in all task versions and were translated into English and Chinese because, according to the learners' comments regarding a small pilot study conducted to test the design of the tasks, these items were considered problematic. In tasks with fewer cognitive demands in the "± here-and-now" variable (simple task and intermediate task), students were asked to start the story with reference to the present time. In the more complex version, the cognitive complexity of this variable was increased, and the instructions asked for the use of the past. As an example, the instructions for the simple task and the more complex task are presented below. The original instructions (in Portuguese) are in Appendix 1.

SIMPLE TASK	MORE COMPLEX TASK
At the supermarket Look at the pictures and tell the story. First, you have **five minutes** to plan the task. Think about what you want to say and how you can say it. You can look at the pictures while you tell the story. Begin the story like this: **Today, Mrs. Ana goes to the supermarket. She is wearing a black blouse and a long skirt.**	**At the supermarket** Look at the pictures for one minute. Then tell the story. Tell the story without looking at the pictures. Begin the story like this: **Yesterday, Mrs. Ana went to the supermarket. She was wearing a black blouse and a long skirt.**

3.4 Unit of analysis

Following previous research on the oral performance of narrative tasks in monologic conditions (Santos, 2023; Sasayama, 2015; Sasayama & Izumi, 2012), the unit of analysis used was the terminal minimum unit (T-unit), defined by Hunt (1965, p.49) as "a main clause plus all subordinate clauses and non-clausal structures attached or embedded in it." According to Wolfe-Quintero et al. (1998), the T-unit is the smallest unit that can be considered a grammatical sentence. The T-unit was chosen to analyse oral data because the learners were asked to perform a monologic narrative task, which did not elicit a markedly oral discourse, i.e. the production of repetitions, elliptical utterances, etc.

3.5 Dependent variables

The learners' oral performance was measured in terms of linguistic complexity (syntactic complexity and lexical diversity), accuracy, and fluency. Considering the multicomponential nature of oral language production (Housen et al., 2012; Michel, 2017; Norris & Ortega, 2009), measures were selected to quantify different subdimensions of these components. Thus, regarding syntactic complexity, the number of clauses per T-unit was calculated to measure subordination, the number of coordinated clauses per T-unit was adopted as an index of coordination, and the number of words per clause quantified clause length. Lexical diversity was analysed using the *Guiraud* index (number of different words divided by the square root of the total number of words). For accuracy, two general measures were used (percentage of error-free clauses per total clauses and number of errors per 100 words) as well as two specific measures (lexical errors per T-unit and morphosyntactic errors per T-unit). Two measures of speech rate were used to analyse fluency (rate A, i.e., the ratio of words per minute in unpruned speech, and rate B, i.e., the ratio of words per minute in pruned speech) and one measure of fluency repair (number of self-repairs, reformulations, repetitions, and false starts per minute). All measures are listed below (see Table 1 and Table 2).

3.6 Transcription, coding, and statistical treatment of data

The learners' oral production was recorded using the Audacity software. The CLAN program – *Computerised Language Analysis* (MacWhinney, 2000) was used to transcribe and code the data. Transcriptions were performed in CHAT format – Codes for the Human Analysis of Transcripts – a complementary tool to CLAN. An EXCEL spreadsheet was used to quantify the dependent variables based on CLAN's output. Statistical analysis of the data was computed using the SPSS (Statistical Package for the Social Sciences) program, version 27.0 for Windows. Furthermore, a non-parametric Mann-Whitney U test was used to detect significant differences between the simple-complex sequencing group and the individual task performance group. The use of non-parametric statistics was justified because some dependent variables did not meet the assumptions regarding the normality (Shapiro-Wilks test) and homogeneity of variances (Levene's test) (Martins, 2011; Phakiti, 2014), and also due to the small sample size. The descriptive statistics measures reported were the median (Mdn) and the interquartile range (IQR), as they are considered non-parametric measures and, consequently, more appropriate indicators when the distribution is not normal (Field, 2009; Loewen & Plonsky, 2016). The effect size (r) was calculated, and $r = .10$ to .29, $r = .30$ to .49, and $r = .50$ to 1 were considered, respectively, small, medium, and large sizes (Cohen, 1988).

4 Results

This section reports and interprets the descriptive and inferential statistics data, considering Robinson's (2010, 2015, 2022) instructional design theory of pedagogical task sequencing, i.e., the SSARC model. Table 1 presents the results of the descriptive statistics for three tasks (simple task, complex task, and more complex task) in two groups (the group that performed the three tasks in the simple – complex – more complex sequence and the group that performed only one task—simple, complex, or more complex). Table 2 shows the results of the non-parametric statistics (Mann-Whitney U test).

The results of the inferential statistics (Table 2) showed differences between the sequencing group (simple task – complex task – more complex task) and the individual task performance group (simple task, complex task, or more complex task) regarding fluency, syntactic complexity, and accuracy in the performance of the complex task and the more complex task. No significant effects were detected in both groups for the simple task.

For the complex task, there was a positive impact of increased task demands on syntactic complexity (U = 17.00, z = -2.191, p < .05, r = .48), as students in the sequencing group (*Mdn* = .27) produced more coordinated clauses per T-unit than students who performed only one task (*Mdn* = .11). Fluency was also positively affected in the two speech rate measures (U = 17.00, z = -2.180, p < .05, r = .48). Thus, in the complex task, the speech of the sequencing group was more fluent than the individual task group (Rate A: sequencing group *Mdn* = 73.13; individual task performance group *Mdn* = 54.09; Rate B: sequencing group *Mdn* = 62; individual task performance group *Mdn* = 45.36).

Regarding the more complex task, there was statistical significance in two dimensions of oral production: accuracy and fluency. Concerning accuracy, the effects of increased task complexity were identified in both general measures and a specific measure (lexical errors per T-unit). The sequencing group's results showed a significant increase in the percentage of error-free clauses (U = 18.00, z = -2.102, p < .05, r = .46) when performing the more complex task (*Mdn* = 44.44) compared to the individual task performance group (*Mdn* = 25.84). Regarding the number of errors per 100 words, a positive impact was also detected (U = 73.00, z = 2.180, p < .05, r = .48), with a higher median for the group that performed only one task (*Mdn* = 20.05) than the sequencing group (*Mdn* = 11.52). In other words, the sequencing group produced more accurate work in the more complex task than the individual performance group. Similarly, a specific accuracy measure (lexical errors per T-unit) improved in the sequencing group (U = 80.00, z = 2.730, p < .01, r = .60), as the number of lexical errors decreased (*Mdn* = .33) compared to the speech produced by the individual task performance group (*Mdn* = .64). Finally, in the task with higher cognitive demands (more complex task), the two speech rate measures confirmed increased fluency in the task sequencing condition (Rate A: U = 18.00, z= -2.102, p < .05, r = .46; Rate B: U = 15.00, z = -2.335, p < .05, r = .51). It is noteworthy that no significant differences were found in syntactic complexity in performing the more complex task by both groups, but the effect size was medium for the subordination index (r = .32), small for both the coordination index (r = .25) and words per clause (r = .10).

Table 1

Descriptive statistics of the measures of linguistic complexity, accuracy, and fluency

		Simple Task				Complex Task				More Complex Task			
		Sequencing Group (*n*=15)		Individual Performance Group (*n*=7)		Sequencing Group (*n*=15)		Individual Performance Group (*n*=6)		Sequencing Group (*n*=15)		Individual Performance Group (*n*=6)	
	Measures	***Mdn***	***IQR***	***Mdn***	***IQR***	***Mdn***	***IQR***	***Mdn***	***IQR***	***Mdn***	***IQR***	***Mdn***	***IQR***
Linguistic Complexity	Words per clause	7.06	1.23	7.46	1.52	6.92	.88	7.14	1.46	7.00	1.09	6.71	1.91
	Clauses per T-unit	.40	.31	.43	.53	.40	.37	.42	.34	.50	.30	.40	.18
	Coordinate clauses per T-unit	.21	.24	.20	.18	.27	.20	.11	.15	.25	.22	.16	.33
	Guiraud index	5.79	.41	5.72	1.6	5.78	.33	5.59	1.37	6.01	.45	5.99	.82
Accuracy	% of error-free clauses per total clauses	50	26.67	30	56.92	47.62	24.79	41.00	21.54	44.44	27.73	25.84	17.09
	Errors per 100 words	11.11	8.88	18.55	17.65	10.77	10.86	11.05	10.85	11.52	10.39	20.05	6.15
	Lexical errors per T-unit	.33	.30	.60	.49	.38	.25	.42	.45	.33	.23	.64	.48
	Morphosyntactic errors per T-unit	.75	.47	.67	.98	.91	.72	1.04	.42	1.06	.88	1.10	.81
Fluency	Speech rate A	62.88	31.68	46.72	41.87	73.13	20.48	54.09	14.85	70.96	32.85	43.56	25.51
	Speech rate B	54.23	22.94	38.47	27.02	62.00	14.94	45.36	14.25	57.95	30.95	33.37	22.48
	Fluency repair	6.86	3.44	6.16	12.03	5.56	6.75	5.27	4.49	6.18	4.99	8.26	3.66

Table 2

Inferential statistics (Mann-Whitney U test) of the measures of linguistic complexity, accuracy, and fluency

		Simple Task				Complex Task				More Complex Task			
	Measures	***U***	***Z***	***p***	***Effect size***	***U***	***Z***	***p***	***Effect size***	***U***	***Z***	***p***	***Effect size***
Linguistic Complexity	Words per clause	53.50	.071	.945	.02	55.50	.818	.424	.18	51.00	.467	.677	.10
	Clauses per T-unit	47.00	-.388	.731	.08	50.50	.431	.677	.10	26.00	-1.482	.154	.32
	Coordinate clauses per T-unit	54.50	.141	.891	.03	17.00	-2.191	.029*	.48	30.50	-1.134	.267	.25
	Guiraud index	50.50	-.141	.891	.03	36.50	-.662	.519	.14	46.00	.078	1.000	.02
Accuracy	% of error-free clauses per total clauses	43.50	-.635	.535	.14	41.00	-.312	.791	.07	18.00	-2.102	.036*	.46
	Errors per 100 words	64.00	.811	.447	.17	55.00	.778	.470	.17	73.00	2.180	.029*	.48
	Lexical errors per T-unit	73.50	1.483	.142	.32	54.00	.702	.519	.15	80.00	2.730	.005**	.60
	Morphosyntactic errors per T-unit	45.50	-.494	.630	.11	47.50	.195	.850	.04	57.50	.974	.340	.21
Fluency	Speech rate A	39.00	-.952	.368	.20	17.00	-2.180	.029*	.48	18.00	-2.102	.036*	.46
	Speech rate B	31.00	-1.516	.142	.32	17.00	-2.180	.029*	.48	15.00	-2.335	.018*	.51
	Fluency repair	53.00	.035	1.000	.01	35.00	-.778	.470	.04	62.50	1.363	.178	.30

Note: *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

5 Discussion

This study tested Robinson's SSARC model (2010, 2015, 2022) of pedagogical task sequencing in the oral performance of Chinese students learning PFL. The cognitive demands of the task were manipulated according to the three steps defined by this theoretical framework. In the first step, a simple task was used in the two dimensions ("resource-dispersing" and "resource-directing") of task complexity. In the second version, the task was made more complex in the "resource-dispersing" dimension. In the last stage, the demands were increased in both variables ("-planning time" and "-here-and-now"). A comparison was made between the two groups, with the experimental group (*n*=15) performing the three tasks in the sequence proposed by Robinson's instructional design, and the control group students (*n*=19) performing only one task (simple task: *n*=7; complex task: *n*=6; more complex task: *n*=6). The results confirmed that the group that performed the three tasks in the simple – complex – more complex sequence improved their production in comparison to the group that performed only one task (simple, complex, or more complex). More specifically, gains were observed in terms of fluency and syntactic complexity (namely, the number of coordinate clauses per T-unit) in the complex task, and the more complex task, accuracy and fluency increased for the sequencing group.

Regarding fluency, in line with Malicka (2020), a positive impact was detected on the speech rate of the sequencing group in the two levels of increased cognitive complexity (complex task and more complex task). In the complex task and in the more complex task, the learners who performed the three tasks under the sequence condition produced more fluent speech than learners in the individual task performance group. These findings suggest that performing the subsequent task facilitated the message conceptualisation process, leading to greater automatisation and, therefore, faster output. Performing tasks in sequence may have facilitated the learners' interlanguage access because they could transfer their knowledge and deliver their message in a more automatised way. Since the participants had to tell the same narrative following the same procedures in each version of the task, they could retrieve from their memory the formulas they had used in the previous performance. Following Malicka (2020), perhaps these results are due to task sequencing, task repetition, or a combination of both.

Concerning syntactic complexity, gains were also identified in the production of the sequencing group when students performed the intermediate complexity task (complex task). In this case, the increase in the task's cognitive demands seems to have positively impacted the measure of coordination, given the higher occurrence of coordinated clauses per T-unit. Performing the simple version of the task (with planning time) may have served as a practice for the subsequent version (without planning time), helping the sequencing group learners to expand their interlanguage, but only at the level of coordination. On the contrary, the individual task performance group, who did not benefit from performing the task in its simpler version, produced a less complex speech in the intermediate task. Theoretically, Robinson (2015) claims that performing increasingly complex versions of tasks on "resource-dispersing" dimensions promotes access to existing interlanguage resources. He further argues that simple tasks along the "resource-directing" dimensions elicit the pragmatic mode (associated with coordination) in contrast to complex task demands, which elicit more complex syntactic structures (associated with subordination) (Robinson, 2011a). In line with this perspective, the results of the intermediate (complex) task may be due to the fact that learners had already internalised the information and found the relevant language to convey it. Hence, they could attempt to use more complex language but only at the level of coordination, as they did not move to deeper

levels of complexification (subordination). In the more complex task, the increase in cognitive complexity did not affect syntactic complexity, as no significant effects were found when comparing the performance of the two groups. Therefore, not all assumptions of the HC (which is associated with the SSARC pedagogical model) were confirmed. According to Robinson (2001, 2003, 2005, 2007, 2010, 2011a, 2011b, 2015, 2022), the HC predicts that both accuracy and linguistic complexity will be positively impacted due to increased cognitive task demands along the "resource-directing" dimension, as students can focus their attentional and memory resources on language code, demonstrating greater grammaticalisation and syntacticisation of output. As a structurally more complex speech was not produced when the task demands were higher along the "resource-directing" variable, this premise was not fully confirmed. However, as mentioned previously, the effect size was medium for one measure (subordination) and small for the others (coordination and words per clause), so these results should be interpreted with caution. Further research with a larger sample size may help clarify this issue. Perhaps the learners' speech was not significantly more sophisticated (at the level of subordination and clause length) due to their proficiency level and/or due to individual differences. More studies with more participants are needed to properly assess these effects.

Regarding accuracy, the sequencing group showed higher quality of production in the performance of the more complex task. As with the other dimensions of oral performance, the effect of sequencing (simple task – complex task – more complex task) resulted in improved production (both at the general and specific levels). The speech produced by the sequencing group students was more accurate than the output of the individual task performance group, which is in line with Santos' (2023) study. Confirming the CH's assumptions (Robinson, 2010, 2015, 2022), increasing cognitive demands along "resource-directing" dimensions induced more target-like structures, and learners could allocate their attention towards the language, avoiding errors and stretching their linguistic resources.

These research findings support the claims of the SSARC model for pedagogical task sequencing. The significant differences found in the oral production of the sequencing group *vs.* the individual task performance group partially confirmed Robinson's (2022) instructional design theory of pedagogical task sequencing. Although the CH's assumptions were not totally confirmed because increasing task complexity along "resource-directing" dimensions did not lead to more linguistic complexity (perhaps due to the small sample size and the proficiency level of the learners), these results support the merit of Robinson's (2022) theory for task sequencing. As mentioned by Abi Tabari and Cho (2022), the SSARC model seems to have a facilitative function for language production development. In this PFL study, the relevance of this pedagogical proposal was confirmed: the manipulation of task variables within the proposed stages fostered the development of automation and the students' interlanguage system. By adopting the SSARC model and the task characteristics taxonomy, i.e., the TCF, teachers may have a theoretical and empirical basis for designing and sequencing pedagogical tasks, providing learners with cumulative and meaningful learning.

6 Conclusion

This empirical study explored the effects of sequentially performing tasks based on their cognitive complexity, in accordance with the SSARC model of pedagogical task sequencing (Robinson, 2022). Task demands were operationalised following the three steps proposed in this theoretical framework. The first step consisted of performing the simple version of the task along the "resource-dispersing" and "resource-directing" dimensions; then, task complexity

was increased along the "resource-dispersing" dimension but kept simple in the "resource-directing" one; and finally, the more complex version of the task was performed (i.e., higher cognitive demands along both "resource-dispersing" and "resource-directing" variables). The results of this research showed that learners who performed the tasks in the proposed sequence (simple task – complex task – more complex task) revealed greater improvement in production than learners who completed only one task, with gains in fluency, syntactic complexity, and accuracy. This study has several limitations, namely the small sample size, the fact that only a short sequence was tested, and the lack of think-aloud protocols or stimulated recalls (to collect information related to cognitive processes) (Allaw & McDonough, 2019). However, the findings presented here suggest the SSARC model is a valid pedagogical proposal that teachers can use in the design and sequencing of tasks in the classroom, as it can facilitate automatisation and promote the development of learners' language skills. Bearing in mind that this was the first study to fully analyse the effects of task sequencing on the oral production of PFL learners within the SSARC model, future studies with more participants should be conducted. Furthermore, future research can test the SSARC model by manipulating other "resource-directing" and "resource-dispersing" variables. With regard to PFL, future work related to the impact of sequencing on written production with different proficiency levels can inform teachers and help them plan and design task-based syllabuses, thus giving students experiential and meaningful learning.

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Appendix 1

SIMPLE TASK

No supermercado
Vai contar uma história, mas antes tem **cinco minutos** para planear a tarefa. Pense no que quer dizer e como dizer. Pode observar as imagens enquanto conta a história.

Vocabulário útil:
carrinho de supermercado (shopping cart) 购物推车
garrafa (bottle) 瓶子
prateleira (shelf) 货架
roubar (to steal) 偷窃
caixa (supermarket cashier) 收银台

Comece a história assim:
Hoje, a D. Ana vai às compras ao supermercado. Ela está vestida com uma blusa preta e uma saia comprida.

COMPLEX TASK

No supermercado
Tem um minuto para observar as imagens. De seguida, conte a história. Pode observar as imagens enquanto conta a história.

Vocabulário útil:
carrinho de supermercado (shopping cart) 购物推车
garrafa (bottle) 瓶子
prateleira (shelf) 货架
roubar (to steal) 偷窃
caixa (supermarket cashier) 收银台

Comece a história assim:
Hoje, a D. Ana vai às compras ao supermercado. Ela está vestida com uma blusa preta e uma saia comprida.

MORE COMPLEX TASK

No supermercado
Tem um minuto para observar esta história. Veja todas as imagens. De seguida, conte a história sem a visualizar, ou seja, sem as imagens.

Vocabulário útil:
carrinho de supermercado (shopping cart) 购物推车
garrafa (bottle) 瓶子
prateleira (shelf) 货架
roubar (to steal) 偷窃
caixa (supermarket cashier) 收银台

Comece a história assim:
Ontem, a D. Ana foi às compras ao supermercado. Ela estava vestida com uma blusa preta e uma saia comprida.