

REVIEW

Factors Contributing to Second Language Speaking Development: Cognitive Aspects and Theoretical Models

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ABSTRACT

This paper reviews some cognitive factors and theoretical models influencing second language (L2) speaking development, focusing on the role of memory types, psychological factors, and affective filter of second language (L2) speaking. While working memory, with its central executive, phonological loop, and visuospatial sketchpad, is essential for managing and processing linguistic information, attention mechanisms, including selective and flexible attention, support effective language speaking process. In addition, psycholinguistic aspects such as lexical access, grammatical encoding, and phonological processing are crucial for fluent L2 speech production. Motivation types (e.g., integrative and instrumental) have also been discussed and their role in second language speaking development. On the other hand, theoretical models such as the speech production model and the interaction hypothesis provide explanation of the stages of speech production and stress the role of verbal interaction in L2 speaking development. At the end of the paper, some practical implications have been presented for both researchers and instructors. Among these are experimental studies to investigate the relationship between cognitive processes and L2 speaking performance. Overall, this paper presents a review of these cognitive and psychological dimensions that significantly contribute to effective L2 speaking and development. It also translates the theoretical concepts of cognitive aspects of L2 speaking into practical applications by proposing research studies and L2 speaking activities.

Keywords: Second Language Speaking; Cognitive Aspects; Psycholinguistics; Speaking Development

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1. Introduction

Speaking a second language (L2) fluently and accurately is one of the most challenging cognitive tasks for L2 learners, especially adults, as it requires the engagement of multiple mental systems at the same time, including memory, attention, psycholinguistic processing, and affective filters. However, L2 speaking development has received less attention when it comes to cognitive and psychological perspectives. That is, despite the extensive research done on the neurolinguistic processes and psycholinguistic aspects of second language development in the recent decades^[1], little attention has been paid to systematically synthesizing the cognitive and psychological dimensions that shed light on L2 speaking performance.

The main goal of this review paper is to provide a comprehensive overview that captures the cognitive and psycholinguistic aspects underlying second language speaking processes and development. This paper is divided into four main sections that are related to L2 speaking proficiency: (1) the cognitive aspects of L2 speaking, including the role of working memory and long-term memory, and the psycholinguistic factors of L2 speaking, such as lexical access, grammatical encoding, and the different types of L2 learning motivation; (2) the theoretical models of the L2 speaking process, including the speech production model and the interaction hypothesis; (3) suggested L2 speaking studies and classroom activities for L2 researchers and instructors focusing on the cognitive and psycholinguistic aspects of L2 speaking reviewed above; and (4) interactive language tasks for L2 speaking development, which provides L2 instructors with a number of L2 classroom activities that can be used to employ cognitive tasks for L2 speaking development.

The cognitive aspects of L2 speaking involve brain plasticity that is related to the critical period of language learning^[2]. These cognitive aspects are also related to the role of planning and attention, which are crucial factors for the L2 speaking process. They are also related to the cognitive control that enables L2 speakers to accurately retrieve and use the second language and reduce cross-linguistic transfer^[3]. These cognitive aspects provide understanding of the interaction between brain structure and L2 speech production, including the effect of age on L2 learning. On the other hand, the role of long-term memory and working memory

is indispensable for L2 speaking, especially when it comes to adult L2 learners. Explicit and implicit memories, which are part of the long-term memory, play a significant role in word retrieval and correct use of syntactic structures. While more advanced L2 learners rely on implicit memory when using L2, beginner L2 speakers rely more on explicit memory for L2 production and comprehension^[4]. Studies have found that verbal working memory is noticeably related to L2 speaking performance^[5].

Empirical studies with tasks like the Reading Span^[6] have demonstrated that individual differences in verbal working memory capacity are a predictor of significant variance in L2 speaking complexity and fluency^[7], while automatic recall of language chunks from long-term memory (e.g., formulaic phrases) reduces cognitive load and frees mental resources for the processing of more abstract speech^[8]. These memory systems operate side by side with psycholinguistic processes that take place during L2 speech production, like quick lexical retrieval (lexical access) and the correct use of syntactic structure (grammatical encoding), in order to reduce cross-language transfer^[9]. Hence, speaking a second language requires more cognitive control in order to deal with cross-linguistic interference^[3].

Alongside these cognitive and psycholinguistic factors, affective factors such as speaking anxiety^[10] and motivation types of L2 learning^[11] also contribute to L2 learners' speaking performance. For example, it was found that L2 learners' purpose of learning a second language plays a significant role in L2 development, including L2 speaking performance. Some of these types of motivation are integrative and instrumental. In addition to these cognitive and psycholinguistic factors, this paper sheds light on two of the L2 speech production models that explain how second language speakers produce language: (1) the speech production model and (2) the interaction hypothesis.

Understanding these cognitive and psycholinguistic factors contributes to a better understanding of the challenges that L2 learners go through when speaking a second language. They explain some of the major internal mechanisms that can help L2 instructors can consider when designing/creating materials and/or activities for L2 speaking skills, especially for adult L2 learners.

In addition, this paper suggests some study ideas that can be done to examine the relationship between certain

cognitive aspects and L2 speaking performance. These suggested studies can provide further understanding and explanation of the mental processes and/or psychological factors of L2 learners compared to native speakers.

2. Cognitive Aspects of Second Language Speaking

2.1. Cognitive Structure

The cognitive aspects of second language speaking refer to mental processes and interactions such as planning, memory, and attention involved in producing speech. Second language learners are required to balance speaking fluency, accuracy, and complexity while managing limitations such as working memory and processing speed in real-time communication. These processes are influenced by a number of factors, which are briefly described below.

2.1.1. Brain Plasticity

Brain plasticity, or neuroplasticity, refers to the ability of the nervous system to change its activity in response to intrinsic or extrinsic stimuli by reorganizing its structure, functions, or connections^[12]. Research has shown that speaking more than one language can lead to significant neural changes or neuroplasticity^[13]. Green and Abutalebi^[14] explain that this plasticity supports the learning of new languages, especially in early stages. Brain plasticity is shaped by a number of factors, among which are:

- **Critical Period:** This was suggested by Lenneberg^[2] as the Critical Period hypothesis, which posits that there is a window of time during which language learning is natural and effortless. That is, a person can only achieve a native-like proficiency, especially in terms of speaking fluency, in a language before a certain age if presented with adequate external input. Due to higher brain plasticity, children are often more successful at acquiring a new language compared to adults. Older L2 learners usually have difficulty achieving near-native fluency, and many studies suggest this is due to their being beyond this critical period. However, research shows that adult L2 speakers can also develop high levels of L2 proficiency in some aspects of the target language but not others^[15,16]. The effect of the critical

period is especially noticeable when it comes to second language pronunciation (i.e., accent and/or dialect). This non-native accent lead to incomprehensibility and conversation breakdowns.

- **Neural Adaptation:** This refers to the notion that the human brain adapts to accommodate new L2 linguistic structures and patterns. Evidence has shown systematic modifications of brain and cognitive systems that can be attributed to bilingualism^[17]. For example, Korenar, Treffers-Daller & Pliatsikas^[18] found that speaking more than one language increases the size of certain brain regions. The results also show that such increases tend to grow as L2 speakers become more proficient in L2. That is, learning a new language brings noticeable and, at the same time, complex changes in brain structure similar to any other cognitively demanding task.
- **Speaking and Cognitive Control:** Speaking two or more languages demands a language control system that enables L2 speakers to accurately retrieve and use the target language and be ready to make adjustments for possible interference from the non-target language, also called cross-language transfer^[3]. Bilingual speakers often show enhanced cognitive control and executive functions, such as task switching and inhibition of lexical representation of non-target language. These cognitive benefits are attributed to the brain's adaptation to managing multiple languages^[19].

Understanding brain plasticity provides insights on the significant role of L2 interaction and continuous practice. Acquiring new vocabulary and engaging in complex L2 conversations are examples of L2 activities that can enhance brain plasticity and, thus, L2 speaking development.

2.1.2. Long-Term Memory

Long-term memory (LTM) plays a critical role in storing linguistic knowledge and experiences. Long-term memory can be divided into explicit and implicit memory^[4,20], both of which are essential for second language speaking and L2 performance in general.

- **Explicit Memory:** Also known as declarative memory, explicit memory stores factual knowledge, such as vocabulary, grammatical rules, and language patterns.

Explicit memory consists of the episodic memory and the semantic memory. Second language speakers rely more on explicit memory to recall L2 vocabulary and to detect syntactic violations in L2^[4].

- **Implicit Memory:** Also known as procedural memory, implicit memory supports the automatic and unconscious retrieval of language skills, such as pronunciation and speaking fluency. Implicit memory enables L2 speakers to retrieve target vocabulary and apply language rules in real-time communication.

Ullman's^[4] declarative/procedural (DP) model suggests a greater role of adult L2 speakers' declarative memory in processing L2 vocabulary as well as syntactic structures during the early stage of L2 learning. In other words, L2 learners rely on their declarative (or explicit) memory even when detecting a grammatical violation in L2, which is known to be processed by the procedural memory in L1 speakers, at least during the early stages of L2 learning. Long-term memory is crucial for L2 performance, as the coordination between the two types of long-term memory enables L2 speakers to retrieve the required L2 linguistic properties and put them into action to form a coherent and comprehensible spoken product.

Regarding L2 speaking, automatic retrieval of lexical and syntactic structures from LTM plays a significant role in improving L2 accuracy and fluency by reducing cognitive load on L2 speakers^[8,21]. DeKeyser^[22] posits that well-consolidated memories of linguistic patterns enable L2 speakers to produce faster and more accurate responses. On the other hand, retrieval failures might result in more errors, simplified output, and/or disfluencies^[23] Therefore, excellent encoding, consolidation, and retrieval processes of linguistic information are necessary for proficient L2 speaking.

2.1.3. Working Memory

Working memory (WM) is a mechanism involved in the temporary storage and manipulation of linguistic information, characterized by executive attention. It is a limited-capacity system that is crucial for managing, manipulating, and performing different linguistic and conceptual tasks^[24]. According to Baddeley^[25], working memory consists of multiple components, including the central executive, phonological loop, and visuospatial sketchpad. These components work together to support language tasks. Working memory

is essential not only for L2 speaking, but for many other cognitive tasks. Components of WM include:

- **Central Executive:** It supervises the entire working memory system, directing attention and coordinating the flow of information. The Central Executive is assumed to be responsible for the control and coordination of the different processes involved in short-term storage and more general processing tasks^[26]. When it comes to second language speaking, the central executive is responsible for resolving the conflict between competing mental representations of the bilingual's two languages^[5].
- **Phonological Loop:** It temporarily holds verbal and auditory information and it is crucial for rehearsing and maintaining linguistic elements, such as phonemes and syllables, during speech production. The phonological loop has a limited phonological store that holds information only for a short duration and an articulatory rehearsal process that rehearses the acquired information, preventing it from decaying^[27].
- **Visuospatial Sketchpad:** It handles visual and spatial information, and it has been found to have a positive correlation with second language comprehension^[28]. While its role in L2 speaking is less direct, it supports activities such as reading and writing, which are vital to language development.

Working memory plays a significant role in L2 processing, especially in real-time processing (i.e., under pressure). For example, L2 speakers may have difficulty producing grammatically complex sentences or retrieving specific (especially uncommon) words quickly. Research by Baddeley and Hitch^[29] suggests that working memory capacity varies among individuals, influencing their language learning abilities. Support for this comes from the study of Osaka and Osaka^[30] who found, in their study of Japanese native participants who were learning English as an L2, a positive correlation between these learners' L2 proficiency level and their reading span scores (a measurement of verbal WM).

In terms of L2 speaking, working memory has been found to correlate with L2 verbal fluency when it comes to adult L2 speakers in tasks such as verbal picture describing and reading out loud^[31]. In addition, studies involving working memory have found that L2 speakers' working memory

plays a significant role in second language word processing and text comprehension, which are essential when it comes to L2 speaking^[32].

2.1.4. Attention and Control

Attention and control mechanisms are critical for language processing, providing the ability to choose what to pay attention to and what to ignore from the presented input. Gass and Selinker^[33] highlight the importance of selective attention, which allows L2 learners to focus on important linguistic input and filter out irrelevant or less important input. Furthermore, effective attention control allows L2 speakers to manage the simultaneous demands of language production, such as selecting the appropriate words, forming sentences, and monitoring speech. It has been found that an individual's performance in speed of attention control tasks is significantly correlated with their proficiency level in L2 speaking^[34]. That is, shifting attention is crucial for L2 performance in general, and especially for L2 speaking when it comes to real-time communication. Thus, bilingual speakers need to switch between different aspects of language use, such as syntax and semantics, to produce coherent and meaningful speech. Bialystok and Viswanathan^[35] found that young L2 speakers performed better than native speaker participants in tasks that required inhibitory control and switching. However, attention control strategies, such as mindfulness training and metacognitive awareness, can help L2 speakers improve their attentional skills and enhance their speaking performance^[36].

2.2. Psycholinguistic Processes

Psycholinguistic processes of L2 speaking refer to the mental processes that are involved when someone speaks in the second language, including real-time lexical access and grammatical formulation. It examines the brain mechanisms relate to how someone thinks and produces speech in a second language.

2.2.1. Lexical Access

Lexical access refers to the process of retrieving words/phrases from memory quickly and accurately. De Bot^[37] explains that lexical access can be more challenging and slower in a second language due to less familiarity and practice. There is a number of factors that are involved to ef-

ficient lexical access, which is crucial for fluent and coherent speech, including:

- **Frequency Effects:** High-frequency words (i.e., words that are commonly used in everyday communication) are accessed more quickly than low-frequency words^[38]. Recognition times are faster for high-frequency words than for words seen less frequently^[39]. This word frequency effect occurs in both L1 and L2^[40].
- **Semantic Networks:** Words are organized in the mental lexicon based on their meanings and associations. This represents the conceptual relation between words, which is explained by the spreading activation theory^[41]. This theory posits that semantic concepts or memories (e.g., apple) are represented as nodes within a larger conceptual network (e.g., fruits). Strong semantic networks facilitate quicker lexical access and accurate word retrieval.
- **Cross-Linguistic Interference:** L2 speakers may experience cross-linguistic interference or co-activation, where words from their first language (L1) influence lexical access in the L2 and vice versa. For example, a French speaker learning English may unintentionally retrieve the French meaning of the word "coin" (meaning "corner" in French) instead of the English meaning "money." This occurs frequently with cross-language homographs^[42].

Lexical retrieval is essential in L2 speaking, as some studies^[43] found that L2 speakers have slower lexical access due to the weaker semantic and phonological connections in their mental lexicon compared to native speakers. However, more practice of and exposure to L2 leads to better lexical connections, which improves both speed and accuracy of word retrieval^[21]. Extensive reading, vocabulary drills, and practicing word retrieval in context are some of the strategies used to improve the process of lexical access. In addition, engaging in activities that require fast and accurate word retrieval, such as timed reading, speaking/listening exercises, or language games, can enhance lexical access skills. Discussing L2 lexical access leads to another factor in psychological process, which is grammatical encoding.

2.2.2. Grammatical Encoding

Grammatical encoding refers to the ability to formu-

late sentences that follow grammatical rules. It involves both the activation of appropriate vocabulary and combining the appropriate syntactic structure^[44]. Hartsuiker et al.^[45] note that L2 speakers may struggle with different syntactic structures compared to their native language. Yet, effective grammatical encoding is essential for producing accurate and comprehensible speech. Among the processes that play a significant role in L2 grammatical encoding are:

- **Syntactic Priming:** The phenomenon where exposure to a specific syntactic structure increases the likelihood of using that structure in subsequent sentences^[46]. For example, hearing the sentence “The cat chased the mouse” (i.e., in the active voice) will likely prime a speaker to produce a similar linguistic structure, such as “The dog chased the ball.”
- **Transfer Effects:** Second language speakers often transfer grammatical structures from their native language to their L2. While positive transfer (similar structures) can facilitate learning, negative transfer (different structures) can lead to errors and misunderstandings^[47].

It is essential for L2 speakers to practice L2 sentence construction, engage in grammar-focused activities, and receive corrective feedback in order to improve their grammatical encoding. Additionally, exposure to varied syntactic structures through L2 reading and listening can enhance L2 learners’ ability to use diverse sentence patterns.

2.3. Affective Factors

Affective factors refer to the emotional elements that can influence learning, decision-making, or behavior. These factors encompass a range of emotions and attitudes towards the topic or task at hand, as they play a critical role in many aspects of L2 learning and development. Among these factors are:

2.3.1. Motivation

Motivation plays a significant role in L2 learning where many studies have been done exploring the different types of L2 learning motivation and the effect of each type. For example, Gardner and Lambert^[48] suggested two types of L2 learning motivation; (1) Integrative motivation, where the L2 learners’ goal is to become part of the second language com-

munity and culture, and (2) Instrumental motivation, where L2 learners’ goal of learning an L2 is for practical benefits, such as better job opportunities or academic requirements.

Based on this study, integrative motivation leads to more success as it leads to more meaningful interactions than instrumental motivation, which is more incentive-based and, subsequently, has a short-term commitment.

In line with this, Dörnyei^[11] differentiates between intrinsic motivation, which comes from within a person (e.g., an interest in the culture or literature), and extrinsic motivation, which is driven by external causes (like finding a job or pass an L2 exam). Dörnyei^[11] posits that intrinsic motivation keeps L2 learners engaged longer in L2 learning, while extrinsic motivation helps L2 learners achieve their specific objectives. However, L2 success often depends on a blend between these types of motivations as no one single type guarantees L2 learning success.

2.3.2. Anxiety

Language anxiety refers to the feeling of fear, worry, or nervousness that can occur when learning or using a second/foreign language, especially in public speaking. It occurs especially during the early stages of L2 learning^[49]. According to Horwitz^[50], there are three types of language anxiety: (1) communication apprehension, (2) test anxiety, and (3) fear of negative evaluation. Anxiety negatively affects L2 speaking fluency, confidence, and overall communication performance^[51]. It is likely caused by the fear of making a mistake or being judged or misunderstood by others^[52].

Most L2 speakers, especially beginners, experience anxiety when trying to speak in a second language, particularly when they are required to speak in front of many people. However, a number of strategies can be used by L2 teachers to reduce speaking anxiety of L2 learners, including creating a supportive learning environment, gradually introducing speaking tasks, and reinforcing L2 learners’ confidence^[53,54]. Managing anxiety is essential not only for successful L2 speaking development, but also for engagement with L2 native speakers.

The cognitive and psychological aspects of L2 speaking development have led to the emergence of theoretical models explaining the cognitive route of L2 speech production. Two of the most common theoretical models of the L2 speaking process are presented in the following section.

3. Theoretical Models of L2 Speaking Process

A theoretical model is a conceptual framework that represents relationships and variables of a particular aspect or process. In L2 speaking processes, a number of models have been proposed to explain how second language speakers produce language, including:

3.1. Speech Production Model

One of the most popular models explaining speaking processes is Levelt's^[8] speech production model. It provides a framework explaining the stages of speech production, which include conceptualization, formulation, and articulation.

- **Conceptualization:** In this stage, a speaker generates the intended message or idea that he/she intends to express. This process involves the activation of relevant concepts and knowledge, during which the linguistic information is determined as well.
- **Formulation:** In this stage, a speaker selects appropriate words and syntactic structures that enable him/her to convey the intended message. That is, matching the conceptual representation (i.e., the intended message) to the appropriate linguistic representation (i.e., choosing the appropriate words and arranging words/phrases into meaningful sentences). This step is challenging for L2 speakers when speaking in real-time communication, as it requires determining the semantic, syntactic, and pragmatic properties of the linguistic output that appropriately represent the target message.
- **Articulation:** This stage involves producing the speech sounds. It requires the coordination of the vocal apparatus, including the tongue, lips, and vocal cords, to make clear and accurate speech. Speaking is particularly challenging for L2 speakers, especially at the early stages of L2 learning, as it involves creating the phonological form of the target words in order to make a comprehensible speech.

The speech production model sheds light on the complex cognitive processes of speech production in general, whether in the native or the second language. This can ex-

plain the complexity of L2 speaking production and the importance of continuous practice and automation of these processes to achieve speaking fluency and accuracy in L2.

3.2. Interaction Hypothesis

The interaction hypothesis, proposed by Long^[55] suggests that interaction with other speakers enhances L2 development (including L2 speaking ability) is enhanced, leading to higher language proficiency. Through oral interaction and conversational exchanges, L2 speakers negotiate meaning and receive (direct or indirect) feedback, which subsequently paves the way for them to modify their output. These interactive activities take a number of forms, including:

- **Negotiation of Meaning:** This involves clarifying and resolving misunderstandings and/or breakdowns during communication. It is a process where speakers work together to reach a mutual understanding. This includes adjustments of syntactic structures, replacing words with others, changing the pronunciation, and so on. This interaction helps L2 speakers correct their grammar and/or word choice in order to improve their speech comprehensibility.
- **Output Modification:** It occurs when speakers adjust their speech based on corrective feedback provided by other interlocutors. Modifications to the structure of language that take place in the process of meaning negotiation provide comprehensible input to an L2 learner. This process reinforces more accurate language use and assist L2 speaking development.
- **Feedback:** Corrective feedback plays a crucial role in second language learning. Positive feedback reinforces correct language use, while corrective feedback helps learners identify and correct language errors. Second language speakers can receive feedback through interaction with native speakers or more proficient peers. In addition, corrective feedback is provided in formal settings such as the feedback given on a classroom assignment.

The interaction hypothesis underlines the importance of communicative interaction and practice for L2 speaking. Interaction is crucial that second language learners engage in authentic conversations, participate in group discussions,

and collaborate on language tasks in order to significantly improve their L2 skills in general, and L2 speaking in particular. Gass and Mackey^[56] indicated that through interaction, L2 speakers' selective attention is directed to problematic features L2 speech.

4. Suggested Research Topics for Academic Studies

This section presents a number of empirical study ideas that L2 researchers can use to investigate the effect of various cognitive processes on L2 speaking development. These experimental studies can assess which cognitive factors significantly influence L2 speaking performance. Some of these are:

4.1. The Role of Verbal Working Memory in Second Language (L2) Speaking Performance

This study is based on the Reading Span Task (RSPAN), developed by Daneman and Carpenter^[6]. It is a measure that assesses verbal working memory in both storage (holding information) and processing (simultaneous comprehension) of the target language. This WM task mimics real-world demands like reading while remembering key details.

In order to measure verbal working memory (VWM) using the Reading Span Task (RSPAN), L2 participants read sentences (and answer a comprehension question after each sentence) while remembering target words (e.g., the last word of each sentence). The number of sentences gradually increases in each set (i.e., 2 to 6 sentences), and recall accuracy of the target words at the end of the task reflects VWM capacity. This WM task balances storage (remembering words) and processing (comprehending sentences), making it ecologically valid for language speaking study.

The idea of this study is to investigate whether VWM capacity (measured via RSPAN in L2) correlates with L2 speaking proficiency. In this study, L2 learners complete an RSPAN and a spontaneous speaking task (e.g., story retelling). The hypothesis is that higher VWM scores positively correlate with better L2 fluency, syntactic complexity,

and reduced pauses in L2 speech.

4.2. Anxiety and L2 Speaking Fluency and Accuracy

This study can assess how language anxiety affects L2 speaking performance using the Foreign Language Classroom Anxiety Scale (FLCAS) proposed by Horwitz et al.^[10]. In this study, L2 participants complete the FLCAS and then perform a speaking task (e.g., role-play) in the L2. The hypothesis is that those L2 learners with higher scores on the anxiety scale would show lower L2 speaking performance. This study can compare beginner to more advanced L2 learners and the effect of anxiety on each group when it comes to L2 speaking.

This study could also compare anxiety effects in, for example, oral presentation vs. interactive tasks to test whether role-play reduces anxiety.

4.3. Motivation and L2 Oral Proficiency

This study can be done to investigate how different motivation types (e.g., instrumental or integrative) influence L2 speaking performance. This study could adapt Dörnyei's^[11] L2 Motivational Self System framework, where L2 learners would complete a motivation questionnaire (i.e., measuring L2 learners' goal of learning the second language) and then perform a structured speaking task (e.g., video retelling or picture description) to evaluate these learners speaking fluency, accuracy, and complexity.

The hypothesis is what a specific type of motivation correlates with better speaking performance. That is, whether a specific type of motivation leads to better L2 speaking skills. The study could also compare beginner and advanced L2 learners in terms of the type of L2 learning motivation of each group.

5. Interactive Language Tasks for L2 Speaking Development

The following are a number of L2 classroom activities that can be used to employ cognitive tasks for L2 speaking development:

5.1. Working Memory Task for L2 Speaking Activity

This classroom activity aims to help L2 learners develop their verbal working memory (VWM) capacity. In this activity, L2 learners perform a popular task called Jumbled Story Retelling Test, where they (1) listen to a short L2 story (e.g., 3 sentences), (2) perform a brief distractor activity to prevent rehearsal (e.g., counting backward), and then (3) retell the story they listened to (storage test). This activity is based on the working memory span task^[6], combining listening (processing) and speaking (storage) under time pressure.

Speaking performance is assessed based on the storytelling accuracy, including keyword recall and coherence.

5.2. 4-3-2 Task (Fluency-Focused)

The goal of this task is to enhance speaking performance, where L2 learners retell the same story under time pressure. In this task, L2 learners are asked to prepare a short talk on a familiar topic (e.g., hobbies or daily routines) and deliver it three times to three different classmates. However, the first time is 4 minutes, then 3 minutes, and finally 2 minutes.

This activity requires time planning, which forces L2 learners to rely on automated lexical and syntactic chunks, which reduces hesitations and improves speech rate. De Jong and Perfetti^[56] found that this activity encourages speaking performance and reduces cognitive load. This activity can increase engagement and interactive speaking environments.

5.3. Dictogloss (Accuracy + Collaborative Output)

This task combines collaborative speaking, listening, and note-taking, focusing on improving L2 grammatical accuracy and correct word choice. In this activity, L2 learners listen to a story and take notes at the meantime. Then, L2 learners work in pairs to rewrite the story based on their notes. Through this collaborative work, L2 learners notice the gaps in their knowledge (e.g., verb tenses, articles), which encourages negotiation of form and meaning^[57]. Based on feedback, L2 learners can compare their version of the story to the original one. Wajnryb^[58] showed that this type of ac-

tivity enhances L2 grammatical awareness and spoken output complexity. This activity, however, is suitable for advanced L2 learners as it requires oral interactive communication and a high proficiency level.

6. Conclusions

As noted in the above review, the cognitive aspects of second language speaking cover a broad range of processes and factors that interact to shape L2 speaking processes and development. Cognitive structure, psycholinguistic processes, and affective factors are crucial in influencing L2 speaking performance. Brain plasticity and cognitive control reveal the significant advantages of speaking a second language, including enhanced cognitive functions and delayed cognitive decline. On the other hand, psycholinguistic processes such as lexical access and grammatical encoding further explain the complexity of real-time L2 speech production. Some affective filter factors, like motivation and anxiety, are also involved in the L2 speaking process, adding additional layers of complexity to the L2 speaking process. This review also includes two common theoretical models (i.e., the Speech Production Model and the Interaction Hypothesis) that explain the stages of speech production and the importance of oral interaction in achieving higher proficiency in L2 speaking. A number of empirical study ideas are suggested at the end of the paper providing researchers with practical steps on conducting studies measuring the effect of cognitive processes and L2 speaking performance. These suggestions include exploring the role of verbal working memory in L2 speaking fluency. In addition, the paper provides a number of classroom activities that L2 instructors can use to help their L2 learners improve their L2 speaking skill.

Together, these aspects illustrate that second language speaking development is a multifaceted mental activity involving complex interactions between cognitive processes and psycholinguistic factors. Addressing these aspects and their influence on L2 speaking development can lead to more effective strategies for enhancing L2 speaking proficiency.

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The authors declare no conflict of interest.

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