Research Article

The Effect of 4/3/2 Technique on Iranian EFL Learners' Speaking Fluency: The Moderating Role of Working Memory

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Abstract

This study examined the effect of the 4/3/2 technique on Iranian EFL learners' speaking fluency by considering the moderating role of working memory (WM). The study involved sixty EFL learners attending a language institute in Shiraz. The participants, aged 14 to 18, all shared Persian as their first language and were pre-intermediate learners of English. A pretest-posttest control group design was employed, with participants randomized into experimental and control groups. The 4/3/2 technique was implemented in the experimental group (EG), where learners performed a monologue task three times, each under increasing time constraints. The control group (CG) received teacher-fronted sessions. The pre- and post-test measures of L2 oral fluency were administered using syllables per minute, with WM span assessed using a reading-span test. Compared to the CG, the results demonstrated a substantial improvement in oral fluency in the EG. Furthermore, learners with higher WM demonstrated more significant gains in fluency following the intervention. The findings suggest that the 4/3/2 technique holds promise for enhancing speaking fluency in EFL learners, with individual differences in WM span influencing the effectiveness of the intervention. These findings have implications for language teaching pedagogy and underscore the importance of considering cognitive factors in language learning interventions.

Keywords: 4/3/2 technique, communication skills, individual differences, speaking fluency, working memory

Introduction

Practical communication skills, mainly speaking proficiency (SP), are fundamental in teaching English. Acquiring speaking skills empowers language learners to express themselves fluently and facilitates meaningful interaction and engagement within diverse linguistic contexts (Sun et al., 2017). In this globalized world, the cultivation of proficient speaking abilities is paramount. Language educators recognize the pivotal role of SP in fostering language acquisition and nurturing learners' confidence and intercultural competence (Celce-Murcia et al., 2014). Moreover, the significance of speaking skills extends beyond individual learners to encompass broader educational objectives, including promoting effective communication in various societal domains and enhancing global interconnectedness (Tsou, 2005). Therefore, exploring innovative pedagogical approaches to enhance EFL learners' speaking skills is imperative for addressing the evolving demands of English language education in Iran and beyond.

In second language acquisition (SLA), there is a growing interest in enhancing fluency development. This interest is particularly relevant in EFL contexts where learners often lack opportunities to utilize the target language beyond the classroom (Leeming & Harris, 2020). Given this context, pedagogical interventions that foster fluency within the classroom are vital in assisting learners improve their communication skills, as advocated by the Four Strands framework (Nation, 2007). However, in many language classrooms, teachers prioritize general speaking practice over specific fluency-related aspects such as pauses, corrections, and speaking rates (Tavakoli & Hunter, 2018). Consequently, activities targeting a narrower definition of fluency are frequently overlooked in language instruction (Segalowitz, 2010; Tavakoli & Skehan, 2005) despite their potential benefits.

Various methods exist to improve speaking fluency (Foster, 2020; Tavakoli & Hunter, 2018). One popular technique is the 4/3/2 task, which involves repeating a speech under decreasing time constraints (Boers, 2014; Coutinho dos Santos, 2022; De Jong & Perfetti, 2011; Tran & Saito, 2024). Widely utilized in EFL/ESL classes, this task enhances L2ers' ability to articulate their thoughts more effectively, rapidly, and smoothly. Another practical approach is teaching formulaic language (Boers et al., 2006; Pellicer-Sánchez & Boers, 2018). Proficiency in formulaic language aids fluency by enabling learners to retrieve expressions more quickly than generating sentences verbatim in real-time situations (Boers et al., 2006; Chie, 2021; Rafieyan, 2018).

As a known individual cognitive feature, working memory (WM) is essential for transiently storing and processing information required for sophisticated cognitive processes, including learning, thinking, and language comprehension (Baddeley, 1992). It is a crucial conduit between perception, behavior, and long-term memory (Baddeley, 2003). WM is significantly correlated with several language skills, such as writing proficiency (Abu-Rabia, 2003), reading comprehension (Daneman & Merikle, 1996), listening (Daneman & Carpenter, 1980), and vocabulary acquisition (Kargar Behbahani & Rashidi, 2023; Kargar Behbahani & Razmjoo, 2023). However, some L2 researchers argue otherwise, suggesting that WM's impact on language learning is limited (see Benati, 2023; Crossley & Kim, 2019; Kormos & Trebits, 2011).

Building upon the comprehensive overview of the significance of SP and fluency enhancement techniques in EFL contexts, the current investigation seeks to address a crucial gap in the existing literature. While previous research has extensively explored the effectiveness of methodologies such as the 4/3/2 task on improving speaking fluency (SF) among EFL learners, there remains a notable lacuna in understanding the moderating role of WM in this process. Despite the established importance of WM in various language-related cognitive tasks, including listening, reading, and vocabulary acquisition, the direct impact of WM on speaking fluency has not been thoroughly investigated in EFL instruction. Furthermore, divergent perspectives exist within the field regarding the extent to which WM influences language performance, with some scholars positing a limited role for WM in language learning (Benati, 2023; Crossley & Kim, 2019; Kormos & Trebits, 2011). Consequently, this study's objective is to bridge this gap by examining the potential moderating effect of WM on the efficacy of the 4/3/2 technique in enhancing SF among Iranian EFL learners. By elucidating the interplay between WM capacity and fluency development, this research provides valuable insights into optimizing language instruction strategies to accommodate individual learner differences better and promote more effective language learning outcomes.

This study also holds significant implications for theory and practice in English language teaching. The investigation into the moderating role of WM on the effectiveness of the 4/3/2 technique in improving SF among Iranian EFL learners can contribute to advancing our theoretical understanding of language learning processes. By elucidating the interplay between WM and SF development, this research extends the existing knowledge based on the cognitive mechanisms underlying language acquisition, particularly in EFL instruction. Additionally, the findings could have practical implications for

language educators and curriculum developers. Understanding how individual differences in WM capacity may influence the efficacy of fluency-enhancing pedagogical techniques can inform the design and implementation of tailored instructional interventions that better cater to learners' diverse cognitive profiles. Moreover, by identifying the potential moderating role of WM, this study can offer insights into optimizing language teaching methodologies to foster more effective and efficient language learning experiences for EFL learners in Iran and beyond. Furthermore, the study's outcomes may inform policy decisions regarding language education curricula and assessments, highlighting the importance of considering cognitive factors in instructional planning and evaluation. Ultimately, the potential implications of this research extend beyond the classroom, contributing to broader discussions on enhancing educational practices and outcomes in diverse linguistic and cultural contexts globally.

Theoretical Framework

The term "task repetition," which refers to the practice of doing the same task or a task that has been modified somewhat, either in its whole or sections, has been recognized as beneficial for enhancing students' L2 speech skills (Bygate & Samuda, 2005). While much attention has been given to the specifics of task repetition, such as content or procedure, studies have varied in their approach. Research has delved into repeating the task process with varying content (Pinter, 2005), while others have repeated both the content and procedure of the task (Boers, 2014; Coutinho dos Santos, 2022; Lambert et al., 2016; Nation, 1989; Tran & Saito, 2021). Additionally, some research has evaluated the efficacy of these various forms of task repetition (De Jong & Perfetti, 2011; Gass et al., 1999). Collectively, previous studies have shown the value of task repetition in improving L2 fluency (Bygate, 2001).

Many researchers have attributed task repetition's effects to Levelt's (1989) Speech Production Model (e.g., Ahmadian & Tavakoli, 2011). The three steps that speakers do before actually speaking are "conceptualization," "formulation," and "articulation," as outlined by Levelt's (1989) paradigm. Students organize the ideas that will make up their speeches in the conceptualization phase. They encode phonological, grammatical, and lexical components during the formulation step to convey their message. At last, they make the speech during the articulation stage. According to Bygate (2001), task repetition improves language performance because learners can recall and apply some cognitive processes during the primary attempt's ideation, formulation, and articulation to future tries.

Using a specific kind of task repetition, the 4/3/2 task requires students to act out a speech three times, with time constraints reducing gradually (4 → 3 → 2 minutes). Three crucial pedagogical advantages are inherent in this activity (Nation, 1989): A) Participants reiterate the identical monologue three times which minimizes the requirement for elaborate preparation and instills confidence in oral expression; B) The allotted time decreases with each repetition, intensifying time pressure, which is believed to enhance fluency; and C) Students are tasked with repeating the activity with different conversation partners.

Studies on the Efficacy of the 4/3/2 Technique on Oral Fluency

Several researchers have empirically explored the impacts of the 4/3/2 tasks. De Jong and Perfetti (2011) aimed to determine if repeating the same topic in the 4/3/2 task would lead to a sustained enhancement in oral fluency among 24 adult ESL learners classified as repetition, no-repetition, and CGs randomly. While the repetition group discussed the same topics, the second group spoke on three topics during the 4/3/2 task. Oral data from 2-minute personal-story monologues on various topics were collected at the pretest, post-test, and delayed post-test. Results indicated that repeating the same issues in the 4/3/2 tasks was more effective than discussing different topics for improving oral fluency and maintaining these gains over four weeks. The increases in fluency witnessed during the 4/3/2 task were attributed to proceduralization among participants who practiced the same topic (De Jong & Perfetti, 2011).

To examine the impact of time constraints on syntactic accuracy, Boers (2014) assessed learners' performance under two conditions: one with a constant time frame and another with a decreasing time frame. Ten adult ESL learners were tasked with selecting two topics they were comfortable discussing. Five participants first engaged in the 4/3/2 task to counterbalance task sequencing, while the remaining five started with the 3/3/3 activity. Mean quantitative changes in Complexity, Accuracy, and Fluency (CAF) indices between the initial and final deliveries were calculated for both task conditions. Boers (2014) subsequently juxtaposed the mean variations in CAF indices between the initial and concluding renditions, indicating that learners in the time-compressed condition demonstrated considerably more enhancements in fluency. A similar outcome was observed in a case study involving an L2 learner in Singapore (Bui, 2020).

Thai and Boers (2016) undertook a similar investigation, exploring the impact of time pressure on the 4/3/2 speaking task. The study involved 20 tenth-grade EFL students in Vietnam, all tasked with discussing their favorite movies. Half of the participants were assigned to the 3/2/1 condition, while the remaining half were placed in the 2/2/2 condition. The researchers analyzed all 60 speeches (three deliveries per participant) using CAF indices.

The findings revealed a significant improvement in oral fluency (measured in syllables per minute) under the time-shrinking condition (3/2/1), whereas no significant changes were observed under the 2/2/2 condition.

Prior research (Boers, 2014; Bui, 2020; De Jong & Perfetti, 2011; Coutinho dos Santos, 2022) did not explore supplementary interventions alongside the 4/3/2 task. However, Tran and Saito (2024) delved into the accuracy enhancement (AE) efficacy during the 4/3/2 task. They divided thirty-six Vietnamese EFL learners into three groups (3/3/3, 4/3/2, 4/3/2+AE). Participants in the 4/3/2+AE group received corrective feedback on past tense accuracy. In line with earlier investigations (Boers, 2014; Coutinho dos Santos, 2022), results indicated that engagement in the 4/3/2 task fostered enhanced fluency but did not improve accuracy. Conversely, participants in the 4/3/2+AE group improved fluency and accuracy across three sessions of the 4/3/2 task. This study is notable for being among the first to explore supplementary interventions within the 4/3/2 task framework.

Working memory

WM operates as a cognitive mechanism with finite capacity, enabling us to temporarily retain diverse information while perceiving, thinking, speaking, and acting (Baddeley, 2003). Groundbreaking research by Harrington and Sawyer (1992) and Mackey et al. (2002) has explored WM's role in SLA, investigating its impact on text comprehension and L2 interaction, respectively. Baddeley (2017) proposes a multi-componential model of WM, suggesting it consists of four distinct elements: the central executive, the phonological loop, the visual-spatial sketchpad, and the episodic buffer. The central executive functions as a domain-general attention control system without inherent storage capacity. The phonological loop, essential for passive storage and rehearsal of auditory data, plays a crucial role in vocabulary acquisition. Conversely, the visuospatial sketchpad retains and rehearses information in visual form. Lastly, the episodic buffer is a temporary storage hub for linking discrete information pieces, integrating data from various sources and formats, and connecting short-term with long-term memory.

While WM is recognized as crucial for language processing (Baddeley, 2017; Linck et al., 2014), not all studies have consistently supported its role in L2 acquisition. For instance, Kormos and Trebits (2011) suggest that WM capacity may only impact L2 syntactic production in oral proficiency. In their view, WM's influence on language processing is primarily limited to syntactic production. Furthermore, recent research findings do not consistently demonstrate a strong correlation between WM capacity and L2 listening comprehension, even with multiple WM measures (Satori, 2021; Shahnazari, 2023).

Task repetition, particularly in the 4/3/2 activity, has been extensively studied for its efficacy in enhancing L2 speaking fluency (dos Santos, & Ramírez-Ávila, 2022; Macalister, 2014; Yufrizal, 2018, among others). However, while numerous investigations have studied task repetition's effect on SF, including variations in time constraints and topic repetition, to the best of the researchers' knowledge, no researcher has explored the potential moderating role of WM in this process. Existing research on task repetition has primarily focused on its procedural benefits and the cognitive mechanisms underlying its effectiveness, drawing upon Levelt's model (1989) of speech production. Yet, despite the theoretical rationale suggesting that WM plays a crucial role in speech planning and execution, empirical evidence regarding its direct influence on language learning remains inconclusive. Moreover, while some studies have examined the relationship between WM and different aspects of language processing (Kargar Behbahani et al., 2024; Kargar Behbahani & Rashidi, 2023; Kargar Behbahani & Razmjoo, 2023; Shahnazari, 2023, among others), including syntactic production and listening comprehension, findings have been inconsistent, with some scholars questioning the extent of WM's impact on language learning. Thus, the degree to which individual variations in working memory capacity may attenuate the benefits of task repetition strategies, such as the 4/3/2 exercise, in improving L2 speaking fluency among EFL learners is not well-documented in the literature. Researchers in the current experiment aim to tackle this gap by examining the potential moderating role of WM in the context of the 4/3/2 technique and its implications for EFL instruction. Accordingly, the following research questions have been raised:

1. To what extent does the 4/3/2 technique lead to L2 oral fluency among Iranian EFL learners?

2. How does working memory moderate the effect of the 4/3/2 technique on L2 oral fluency?

Method
Participants
This study was conducted with 60 learners from four intact classes, each consisting of 15 learners, enrolled in a language institute in Shiraz. Two classes served as the EG and two as the CG. Both groups underwent a pretest to establish SF and WM capacity baseline levels. Subsequently, the EG received instruction using the 4/3/2 technique, while the CG received traditional speaking instruction without using the method. After the intervention period, both groups underwent a post-test to assess changes in SF. Gender distribution was the same among both conditions. The participants' ages ranged from 14 to 18 years old, none of whom

were bilingual. Persian served as the participants' L1, and an Oxford Quick Placement Test (OQPT) indicated that all learners were pre-intermediate learners of English. This homogeneous profile of participants ensures consistency in language proficiency levels and minimizes potential confounding variables related to prior exposure to English-speaking environments. By drawing participants from a language institute setting, the study captures a representative sample of Iranian EFL learners engaged in formal language instruction, thus providing insights relevant to language education practices in similar contexts.

Instruments

The study employed a multifaceted approach to assess the participants' oral fluency in L2 English. Initially, the OQPT was administered to ascertain the participants' overall English proficiency levels. Subsequently, the syllables-per-minute metric was utilized to establish the participants' baseline L2 oral fluency (Tavakoli & Skehan, 2005). This measure was operationalized by developing a rubric, which delineated distinct levels of fluency based on syllable count and qualitative descriptors of speech coherence, variety, and fluidity. It is important to mention that three PhD holders in TEFL verified the validity of the rubric. The rubric provided detailed criteria for each fluency level: A) Very Low Fluency (0-4): Fewer than 50 syllables per minute; The speech lacks coherence and is challenging to follow. B) Low fluency (5-8): 50-100 syllables per minute; The speech is somewhat coherent but lacks variety and fluidity. C) Moderate fluency (9-12): 100-150 syllables per minute; The speech is generally coherent, with some variety and flow. D) High fluency (13-16): 150-200 syllables per minute; The speech is coherent, varied, and flows well, with few interruptions or hesitations. And E) Very High Fluency (17-20): More than 200 syllables per minute; The speech is coherent, varied, and fluid, with minimal interruptions or hesitations.

The participants' oral presentations were recorded, and the number of syllables produced per minute was quantified and scored according to the researchers' developed rubric's criteria. Furthermore, the coursebook "Top Notch 2A" was employed for instructional purposes, ensuring consistency and alignment with the curriculum. The post-treatment, the same instrument and rubric were utilized to measure the participants' L2 oral fluency, facilitating direct comparison and evaluation of any changes in fluency levels following the intervention. This comprehensive approach to instrument selection and rubric development ensures the validity and reliability of the study's measurements, thereby enabling an accurate assessment of the 4/3/2 technique's effectiveness in enhancing the participants' L2 oral fluency.

Furthermore, Shahnazari's (2013) reading-span test was utilized to measure the WM span of the learners. A reading-span test is a test in which test takers read a series of sentences and are required to memorize the last word of each sentence. The number of final words they can recall represents their WM span. This test identified 16 learners in the EG and 15 in the CG as high-WM learners, while the remaining participants were classified as low-WM learners. This classification allowed for the examination of the potential moderating role of WM in the effectiveness of the 4/3/2 technique in enhancing SF among Iranian EFL learners.

Procedures

The data analysis procedures encompassed several steps to examine the effectiveness of the 4/3/2 technique and explore potential differences between high- and low-WM learners. Given the presence of the two groups and the focus on comparing two means (pre- and post-test differences), independent samples t-tests were conducted. Pallant (2020) outlined that these statistical analyses allowed for measuring differences in the SF scores between the EG and CG at both the pretest and post-test stages. Specifically, the independent samples t-tests were employed to assess whether there were significant changes in SF within each group over time and to determine if these changes differed significantly between the EG and CG.

Furthermore, another t-test was conducted to investigate potential variations in performance based on WM capacity. This analysis aimed to compare the SF scores of high- and low-WM learners within each group, providing insights into the differential impact of the intervention based on individual cognitive profiles. By conducting these additional t-tests, the study sought to elucidate any differences in fluency improvement between high- and low-WM learners and to assess the moderating role of WM in the effectiveness of the 4/3/2 technique.

Overall, we employed a rigorous statistical approach to measure the pre-and post-test differences between the EG and CG and assess potential performance variations based on WM capacity. These analyses were essential for drawing meaningful conclusions regarding the effectiveness of the intervention and its differential impact on the learners with varying levels of WM capacity.

Treatment

The 4/3/2 technique was meticulously integrated with the EG to enhance the participants' SF. Throughout the twelve sessions, the participants were systematically guided through monologue tasks, each adhering to the structured format of repeating a given topic three times, with time constraints progressively

decreasing: initially for 4 minutes, followed by 3 minutes, and culminating in 2 minutes. For instance, the participants might begin discussing a topic such as "My Favorite Holiday Destination," where they would initially articulate their thoughts for 4 minutes, then repeat the same topic for 3 minutes, and finally condense their speech into a concise 2-minute presentation. This sequential approach aimed at incrementally building the participants' speaking speed and fluency while nurturing their ability to produce coherent and varied speech spontaneously.

Within each session, the participants were encouraged to maintain coherence, fluency, and lexical variety in their discourse while adhering to the progressively shrinking time constraints. Moreover, the intervention design ensured that the participants had ample opportunities to engage with various topics and interact with multiple conversation partners. This deliberate exposure to different linguistic contexts and communication scenarios aimed at fostering adaptability and versatility in the participants' oral communication skills. Concurrently, the instructors provided continuous corrective and constructive feedback of diverse kinds and personalized guidance to address individual challenges and facilitate ongoing progress throughout the intervention.

In contrast, the CG underwent conventional teacher-fronted instruction, characterized by structured speaking activities led by the instructor. Class sessions typically featured teacher-led discussions, role-plays, and presentations, where the participants engaged in structured communication tasks under the instructor's guidance. While the speaking practice was embedded within the curriculum, the emphasis was laid on guided activities and teacher-directed communication tasks rather than the systematic repetition and time-bound nature of the 4/3/2 technique observed in the experimental group. It is also important to mention that the CG only received metalinguistic feedback as opposed to the EG that received a variety of feedback types.

Design

The study utilizes a pretest-posttest control group design to examine the moderating role of WM in the effectiveness of the 4/3/2 technique on enhancing SF among Iranian EFL learners. Participants were randomly assigned to either an experimental group (EG) or a control group (CG) in this design. Including a CG allowed for comparing outcomes between the experimental and control conditions, enabling a more rigorous examination of the impact of the intervention.

Results
The Effect of the 4/3/2 Technique on L2 Oral Fluency
First, to confirm data normality, Kolmogorov-Smirnov (K-S) was conducted

to ascertain the technique's leverage on L2 oral fluency. As the p-value was higher than 0.05, the normality of the data was confirmed, and parametric statistics were safe to use. Table 1 shows the results.

Table 1
Group Statistics on the Pretest and Post-test

	Group	N	Mean	SD	SEM
Pretest Scores	EG	30	7.066	2.504	.457
	CG	30	6.333	2.509	.458
Posttest Scores	EG	30	11.966	3.398	.620
	CG	30	6.533	2.577	.470

In Table 1, the mean pretest score showed minimal variation between the EG ($N = 30$, $M = 7.066$, $SD = 2.504$) and the CG ($N = 30$, $M = 6.333$, $SD = 2.509$). On the other hand, Table 1 demonstrates a colossal difference in the post-test between the EG condition ($N = 30$, $M = 11.966$, $SD = 3.398$) and the CG ($N = 30$, $M = 6.533$, $SD = 2.577$). This means that, in the posttest, the EG outperformed the CG. Table 2 represents the results of the independent samples test.

Table 2
Independent Samples Test on the Pretest and Post-test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Pretest Scores	Equal variances assumed	.034	.853	1.133	58	.262	.733	.647
	Equal variances are not assumed.			1.133	58	.262	.733	.647
Post-test Scores	Equal variances assumed	1.726	.194	7.234	58	.000	5.633	.778
	Equal variances are not assumed.			7.234	54	.000	5.633	.778

Regarding the pretest, Table 2 does not show a significant difference between the two conditions on the pretest, $t = 1.133$, $df = 58$, $p > .05$. Considering the post-test, Table 2 indicates a significant difference between the two conditions, with a large effect size (.474) calculated through Cohen's (1988)'s formula, $t = 7.234$, $df = 58$, $p = .001$.

The Moderating Role of Working Memory in the Influence of the 4.3.2 Technique on L2 Speaking Fluency

To determine the effect of WM on the process, another t-test was conducted. As the control group's performance did not change from baseline to time 2 ($p > .05$), the inferential statistics were only run to measure the differences between high- and low-WM spanners in the experimental condition (Ary et al., 2019). Before conducting the t-test, a K-S test substantiated the data normality ($p > .05$). Group statistics are presented in Table 3.

Table 3
Group Statistics on the Pretest and Post-test

	Group	N	Mean	SD	SEM
Pretest Scores	EG High	16	7.187	2.786	.696
	EG Low	14	6.928	2.234	.597
Post-test Scores	EG High	16	13.375	3.117	.779
	EG Low	14	10.357	3.053	.816

Table 3 shows that the high-WM ($N = 16$, $M = 7.187$, $SD = 2.786$) and low-WM learners ($N = 14$, $M = 6.928$, $SD = 2.234$) performed similarly on the pretest. Regarding the post-test, as shown in Table 3, high-WM spanners ($N = 16$, $M = 13.375$, $SD = 3.117$) outperformed their low-WM peers ($N = 14$, $M = 10.357$, SD 3.053). The results of the independent samples t-test are illustrated in Table 4.

Table 4
Independent Samples Test on the Pretest and Post-test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig	Mean Difference	Std. Error Difference
Pretest Scores	Equal variances assumed	1.117	.3	.278	28	.78	.258	.931
	Equal variances are not assumed.			.282	27	.78	.258	.917
Post-test Scores	Equal variances assumed	.000	.99	2.671	28	.01	3.017	1.130
	Equal variances are not assumed.			2.674	27	.01	3.017	1.128

As presented in Table 4, no significant difference existed between the high- and low-WM learners on the pretest ($t = .278$, $df = 28$, $p > .05$). In terms of the post-test, Table 4 reveals a significant difference between the two groups with a large effect size (.203) calculated through Cohen's (1988) formula, $t = 2.671$, $df = 28$, $p = .012$.

Discussion

In this experiment, the effectiveness of the 4/3/2 technique in enhancing L2 oral fluency among Iranian EFL learners and the moderating role of WM in this process was studied. The 4/3/2 technique was employed to train the EG while the CG received conventional instruction led by the teacher. Statistical analyses divulged a significant enhancement in oral fluency among the participants in the EG post-intervention, as evidenced by significantly higher fluency scores than the CG. A prominent difference was observed between the high- and low-WM learners in the EG post-intervention, with the high-WM learners demonstrating more significant fluency gains.

The results enrich the current literature by offering novel insights into the effectiveness of the 4/3/2 technique in enhancing L2 oral fluency and the moderating role of WM in this process. While previous research has extensively explored the 4/3/2 technique and its impact on fluency development, our study extends this investigation by incorporating a nuanced examination of individual cognitive factors, specifically WM, in fluency outcomes. By integrating WM as a moderating variable, we illuminate the complex interplay between cognitive mechanisms and instructional interventions in language learning. Additionally, our study expands upon prior research by exploring supplementary interventions within the 4/3/2 task framework, offering a multifaceted approach to fluency enhancement. This multidimensional perspective enhances our awareness of the factors affecting language learning outcomes and underscores the importance of considering individual differences in cognitive and linguistic profiles when designing effective instructional interventions. Overall, this study's novel combination of methodological approaches and theoretical insights advances knowledge in SLA and pedagogy.

The observed improvements in L2 oral fluency among the participants in the EG can be attributed to several factors. Firstly, the structured and repetitive nature of the 4/3/2 technique likely facilitated fluency development by providing learners with ample opportunities for practice and feedback. The repetition of monologue tasks under progressively decreasing time constraints encouraged learners to articulate their thoughts more rapidly and coherently, thereby enhancing fluency. Moreover, the time pressure inherent

in the technique may have stimulated learners to rely less on extensive planning and more on spontaneous speech production, thereby promoting fluency. Additionally, the engagement with diverse topics and conversation partners within the technique fostered adaptability and versatility in communication skills, contributing to overall fluency improvement.

Furthermore, the moderating role of WM in the effectiveness of the 4/3/2 technique highlights individual cognitive factors' importance in language learning outcomes. The high-WM learners demonstrated greater fluency gains after intervention than low-WM learners, suggesting that cognitive capacity plays a crucial role in fluency development. High-WM individuals possess greater cognitive resources to effectively manage the cognitive demands of the technique, such as retrieving and integrating linguistic elements during speech production (see Ellis, 2015). Conversely, low-WM learners may struggle to allocate cognitive resources efficiently, resulting in less pronounced fluency gains. These outcomes mirror the conclusions reached in prior studies highlighting the effect of WM on language processing and acquisition, emphasizing the need to consider individual cognitive profiles when designing instructional interventions to enhance speaking fluency.

The findings resonate with previous research on task repetition and its impact on L2 fluency. Task repetition, a pedagogical strategy recognized for enhancing language skills (Bygate & Samuda, 2005), has been extensively explored. Prior studies have demonstrated that repeating the same or slightly modified tasks contributed significantly to the development of L2 fluency (Bygate, 2001). Specifically, the 4/3/2 technique, characterized by repetitive monologue tasks under increasing time constraints, has emerged as a prominent approach to fluency development (Boers, 2014; Coutinho dos Santos, 2022; De Jong & Perfetti, 2011). Consistent with previous findings, our study revealed a significant improvement in oral fluency among the participants who underwent training using the 4/3/2 technique, underscoring the efficacy of task repetition in fostering L2 speaking fluency. Tran and Saito (2024) also found that the participants who received corrective feedback on accuracy alongside the 4/3/2 task improved fluency and accuracy, suggesting the potential benefits of integrating supplementary interventions to enhance language learning outcomes. This underscores the importance of adopting a multifaceted approach to language instruction, considering various cognitive and linguistic factors contributing to proficiency development. Overall, our study contributes to the existing literature by elucidating the complex interplay between task repetition, mental characteristics, and language

learning outcomes, offering valuable insights for both theory and practice in language education.

Moreover, our investigation contributes to understanding WM and its role in language learning outcomes. While WM has been recognized as a critical cognitive mechanism underlying language processing (Baddeley, 2017), its exact influence on L2 acquisition remains debated. Some studies have suggested that WM capacity may primarily impact specific aspects of language production, such as syntactic production (Kormos & Trebits, 2011). However, our findings underscore the moderating role of WM in the effectiveness of the 4/3/2 technique. The high-WM learners demonstrated greater fluency gains after intervention than their low-WM counterparts, indicating that cognitive capacity influences how much learners benefit from instructional interventions. These findings align with the multi-componential model of WM proposed by Baddeley (2017), emphasizing the importance of considering individual cognitive profiles in language instruction.

This study offers significant implications for various stakeholders in language teachers and pedagogy. This study provides valuable insights for language teachers seeking to enhance their instructional practices. By demonstrating the efficacy of the 4/3/2 technique in improving L2 oral fluency, teachers can incorporate this pedagogical approach into their classrooms to foster oral fluency among their students. Additionally, the findings highlight the importance of considering individual differences in WM capacity when designing instructional interventions. Language teachers can use this knowledge to tailor their teaching methods to accommodate their learners' cognitive profiles, maximizing their instruction's effectiveness.

This study offers language learners valuable insights into practical strategies for improving their speaking skills. By demonstrating the effectiveness of the 4/3/2 technique in enhancing L2 oral fluency, learners can adopt this technique as a valuable tool for self-directed language practice. Moreover, the findings highlight the importance of developing and maintaining strong WM skills, as individuals with higher WM capacity demonstrated greater gains in fluency following the intervention. Language learners can use this knowledge to prioritize activities that enhance their cognitive abilities and language proficiency. Additionally, the current investigation emphasizes the importance of engaging in varied and structured speaking practice, underscoring the benefits of repetitive task-based activities in fluency development.

Our study's findings align with previous research on the efficacy of the 4/3/2 technique for improving L2 oral fluency. Similar to De Jong and Perfetti (2011) who found that task repetition significantly enhanced and sustained

oral fluency, our results showed substantial improvements in the EG's fluency compared to the CG. This supports the notion that task repetition aids proceduralization, enhancing fluency. Additionally, our study corroborates Boers (2014) and Thai and Boers (2016), who emphasized that time constraints positively impact fluency, as our EG also showed considerable improvements under shrinking time constraints. A novel aspect of our research is the integration of WM, revealing that high-WM learners exhibited greater fluency gains than low-WM peers, highlighting the cognitive factors in language learning. While Tran and Saito (2024) found that combining the 4/3/2 task with AE improved grammatical precision, our study, which did not include an AE component, still demonstrated significant fluency improvements. This suggests that while fluency can be effectively enhanced through repeated practice and time constraints, future research could benefit from exploring the integration of accuracy-focused interventions with the 4/3/2 technique to assess comprehensive language development. Our study confirms the 4/3/2 technique's efficacy for fluency enhancement and underscores the importance of considering individual cognitive differences for more personalized language teaching strategies.

Our study's findings regarding the influence of WM on language acquisition align with and extend the current understanding in the literature. Similar to the work of Harrington and Sawyer (1992) and Mackey et al. (2002), which emphasized WM's significant role in text comprehension and L2 interaction, our research found that high-WM learners outperformed their low-WM peers in L2 oral fluency, supporting Baddeley's (2017) multi-componential model of WM. However, our findings contribute to the ongoing debate about WM's impact on different aspects of language acquisition. While Kormos and Trebits (2011) suggested that WM primarily affects syntactic production in oral proficiency, our study indicates a broader influence, evidenced by significant fluency gains in high-WM learners. This contrasts with recent studies by Satori (2021) and Shahnazari (2023), which did not find a strong correlation between WM capacity and L2 listening comprehension, possibly due to different aspects of language skills being measured or variations in research design. Our study underscores the importance of considering individual cognitive differences, particularly WM capacity, in language learning, suggesting that high-WM learners might benefit more from fluency-focused interventions like the 4/3/2 technique. This highlights the necessity for further research to explore WM components' nuanced roles in various language acquisition contexts and identify strategies to support learners with varying WM capacities.

The findings have implications for materials developers creating instructional materials for language learning. By demonstrating the effectiveness of the 4/3/2 technique in improving L2 oral fluency, materials developers can integrate similar task-based activities into language learning materials and curricula. Additionally, the study underscores the importance of incorporating activities that target fluency and accuracy within instructional materials, providing learners with opportunities to develop comprehensive speaking skills. Furthermore, materials developers can use the insights gained from this investigation to design materials that accommodate the diverse cognitive profiles of language learners, ensuring that instructional materials are accessible and effective for learners with varying levels of WM capacity.

This study has implications for syllabus designers developing language curricula and syllabi. By highlighting the effectiveness of task-based approaches, such as the 4/3/2 technique, in enhancing L2 oral fluency, syllabus designers can prioritize integrating task repetition activities within language curricula. Moreover, the findings emphasize the importance of incorporating activities that target fluency aligning with communicative language teaching (CLT) principles. Additionally, syllabus designers can use the insights gained from this examination to develop curricula that scaffold language learning experiences, providing learners with structured opportunities to develop their speaking skills while considering individual differences in cognitive abilities.

This study provides policymakers with insights into practical strategies for promoting language learning and proficiency among learners. Policymakers can advocate for integrating CLT methods within language education policies and initiatives by highlighting the effectiveness of task-based approaches. Moreover, the findings underscore the importance of supporting teacher professional development programs that equip educators with the knowledge and skills to implement innovative instructional strategies, such as the 4/3/2 technique. Additionally, policymakers can use our findings to inform funding priorities and resource allocation decisions, ensuring language education programs can access the materials and training necessary to support effective language learning outcomes.

Finally, the findings have significant implications for teacher educators who are responsible for preparing future language educators. Teacher educators can incorporate these insights into teacher training programs by demonstrating the effectiveness of the 4/3/2 technique in improving L2 oral fluency and the moderating role of WM in this process. Teacher educators can use this study to emphasize the importance of task-based approaches and repetitive practice in fostering SF among language learners. Moreover,

teacher educators can integrate discussions on individual differences in cognitive abilities, such as WM, into their curriculum to raise awareness among future language teachers. By equipping pre-service teachers with effective instructional strategies and understanding the cognitive factors influencing language learning, teacher educators can empower them to design and implement engaging and effective language instruction in their future classrooms. Additionally, teacher educators can use these findings to develop training materials and resources that support pre-service teachers in implementing task-based activities and addressing the diverse learning needs of their students. Overall, this study provides valuable insights for teachers seeking to prepare language educators equipped to facilitate meaningful language learning experiences for their students.

To sum up, this study investigated the effect of the 4/3/2 technique on Iranian EFL learners' SF, focusing on the moderating role of WM. The findings prove that implementing the 4/3/2 technique significantly improved L2 oral fluency among the participants. Moreover, the results underscore the importance of considering individual differences in WM capacity when designing language instruction, as the learners with higher WM demonstrated greater gains in fluency following the intervention. These findings contribute to our understanding of practical pedagogical approaches for enhancing speaking skills in language learners, emphasizing the value of task-based repetition and the importance of cognitive factors in language acquisition. The implications of this study extend to various stakeholders in language education, including language teachers, learners, materials developers, syllabus designers, policymakers, and teacher educators. By integrating these insights into language instruction and teacher training programs, educators and policymakers can work towards fostering more effective and engaging language learning experiences for learners. Moving forward, further research is warranted to explore the long-term effects of the 4/3/2 technique and to investigate additional factors that may influence L2 speaking fluency.

It is imperative to recognize the limitations. Firstly, the study focused solely on Iranian EFL learners, limiting the findings' generalizability to other language learner populations. Future studies should seek to reproduce the study's results with diverse learner groups to assess the robustness of the results across different contexts. Additionally, the study employed a pretest-posttest design with a CG, which may have limitations in controlling for external factors that could influence the outcomes. Future studies could consider alternative research designs, such as longitudinal or mixed-methods approaches, to provide a more comprehensive understanding of the effects of the 4/3/2 technique on L2 speaking fluency.

Furthermore, while we measured the moderating role of WM in the effectiveness of the intervention, other cognitive and conative differences, such as motivation, anxiety, and language aptitude, were not explored. Future research could explore the interplay between these factors and their impact on language learning outcomes. Additionally, the current investigation focused exclusively on the immediate effects of the intervention on SF without considering potential long-term effects or transferability to other language skills. Longitudinal studies could provide insights into the sustainability of the observed improvements and their generalizability to real-world communication settings.

Moreover, the study utilized a 4/3/2 technique without comparing it to other task-based interventions or variations. Future research could examine the comparative effectiveness of different task-based approaches to speaking instruction and variations in task parameters such as topic complexity, task duration, and interactional contexts. Finally, the study relied on self-reported measures of WM capacity, which may not fully capture the complex nature of this cognitive construct. Future research could employ more robust measures of WM, such as neurocognitive tasks, to provide a more accurate assessment of its role in language learning.

Declaration of interest: none

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