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Investigating the Correlation between English Spoken Fluency and Working Memory Capacity in both Dialogic and Monologic Presentations

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Studies on second language (L2) speech fluency recommend studying fluency in a dialogic context. In response to the researchers' calls, this study introduced monologic and dialogic tasks to investigate the various aspects of speed, breakdown, and repair fluency in the oral performancemost L2 fluency studies have looked at oral fluency in a monologic task. Dialogue is the more authentic and natural way of communication, which is apparent in everyday language use. Currently, there is a scarcity of research examining dialogue fluency in non-native bilingual speakers who share the same L2. The existing body of research on language learning and processing has underscored significant connections between individual differences (IDs) in working memory capacity (WMC) and models of L2 speech production in both first language (L1). Nevertheless, it remains unclear whether variations in WMC are linked to dysfluency in L2 monologue and dialogue. Therefore, this study also aimed to fill this gap in the literature by investigating the correlation between utterance fluency in both monologue and dialogue and WMC. A total of 64 undergraduate Saudi students were given various tasks as part of the study. An

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argumentative task was presented as a monologue focused on a prevalent topic in the participants' country. In contrast, during a dialogic discussion task, 32 pairs engaged in exchanging opinions on a popular subject in their country. Additionally, participants underwent two challenging working memory (WM) tests: the Operation Span Test and the Backward Digit Span Test. The findings aligned with prior research, indicating that L2 participants demonstrated greater fluency in dialogue compared to monologue, as evident in speed and breakdown measures of utterance fluency. Interestingly, WMC did not emerge as a robust predictor for variations in L2 oral performances between monologue and dialogue.

Keywords: Working memory capacity; monologue; dialogue; second language fluency; oral tasks; conversation.

1. INTRODUCTION

Despite the importance of exploring L2 fluency in interactive tasks, there is a lack of conclusive evidence regarding the distinctions between monologic and dialogic L2 performances in terms of speed, breakdown, and repair. Previous studies (e.g., Michel, 2011 [1]; Witton-Davies, 2014 [2]; Tavakoli, 2016 [3]; Peltonen, 2017 [4]) have produced inconsistent findings regarding the differences in breakdown and repair measures between monologue and dialogue, necessitating further investigation.

Working Memory Capacity (WMC) plays a crucial role in L2 learning and processing, influencing L2 development and performance (Skehan, 2015 [5]). Learners' attentional resources, integral to language acquisition, processing, and performance, especially in lower proficiency speakers, are significant (Robinson, 2011 [6]). The conscious process of producing L2 speech relies on WMC, particularly in less proficient speakers (Kormos, 2006 [7]). Surprisingly, no prior study has explored the extent to which WMC can account for variations in L2 fluency performance in both modes using two complex WMC tests, representing another research gap this study aims to fill. The scarcity of research in this area is attributed to the time-consuming nature of calculating temporal variables of fluency in seconds using PRAAT software. L2 researchers (e.g., Tavares, 2008 [8]; Kormos and Sáfár, 2008 [9]; Gilabert and Muñoz, 2010 [10]; Ahmadian, 2012 [11]; Mojavezi and Ahmadian, 2014 [12]) have conducted various studies to explore the impact of Working Memory Capacity (WMC) on L2 oral processing and production. However, inconsistent results and a lack of consensus persist regarding the influence of WMC on L2 production and processing, especially in monologic and dialogic performances. Thus, in addition to exploring fluency in monologue and dialogue, the study examines the connection between WMC and utterance fluency in monologic and dialogic tasks. Investigating the productive power of WMC in the interactional context of dialogue is an original contribution sought by this study. Participants' speech performances are elicited through monologic and dialogic tasks, with different topics assigned to each task mode to prevent the potential impact of practice effects. A diverse set of speed, breakdown, and repair fluency measures are employed to analyze differences between the two modes. The instructions for WMC tests and oral tasks are provided in both Arabic and English to ensure participants' comprehension of the tasks.

2. REVIEW OF THE LITERATURE

2.1 Fluency

Defining fluency in the context of foreign language research presents challenges due to its various interpretations, making it a nuanced term (Chambers, 1997; Lahmann et al., 2015). It is essential to distinguish between fluency as an indicator of overall proficiency and fluency as a component of communicative competence. In communicative language teaching, fluency is evaluated based on how learners apply their knowledge to achieve linguistic and communicative goals (Chambers, 1997, p.537). Conversely, general proficiency fluency is commonly used when describing someone who speaks a language well, such as saying "she is a fluent speaker of English" (Chambers, 1997). In a subsequent study, Lennon (2000) categorized fluency into narrow/broad senses, denoting lower order and higher order fluency. The broader/higher order fluency in English, as described by Lennon (1990) [13], encompasses overall speaking proficiency, including correct grammar, syntax, a substantial vocabulary, and a native-like accent. Consequently, fluency is viewed as one element of oral proficiency, alongside accuracy and complexity.

Over the past 10–15 years, these three aspects have become the standard criteria for selecting oral fluency measures. Both Skehan (2003) and Segalowitz (2010) [14] adopted a framework consisting of three speech components to define utterance fluency. According to Segalowitz (2010) [14], utterance fluency encompasses acoustically measurable temporal features of speech, including (1) speed, such as syllable duration, articulation rate, and the length/number of syllables; (2) breakdown, including silent pauses, the length of silent pauses, filled/unfilled pauses, the length of filled pauses, mid/end silent pauses, and mid/end final pauses; and (3) repair, involving repetitions, reformations, hesitation, and false starts. The present investigation concentrated on what Lennon (1990) [13] referred to as the narrow aspect of fluency, the temporal features of utterance fluency as described by Segalowitz (2010) [14], and what Tavakoli and Hunter (2018) [15] termed a highly specific view of fluency involving objective measures.

2.2 Investigations into Spoken Fluency in Tasks Involving Dialogue and Monologue

Monologue involves a single speaker relying on their own resources to deliver a speech, while in dialogue, speakers take turns and switch roles, transitioning between being a speaker and a listener (McCarthy, 2010; Tavakoli, 2016 [3]). In dialogue, both participants aim to prevent overlapping turns by minimizing pauses between them (Garrod and Pickering, 2004 [16]). The objective of dialogue is for both the speaker and the interlocutor to establish a shared understanding; otherwise, the conversation may fail (Garrod and Pickering, 2004 [16]). In contrast, the goal of a monologue is to transform the preverbal message into grammatical and phonological structures, representing a direct and fixed process from message intent to articulation output (Levelt, 1989) [17]. Traditionally, it is believed that a monologue is a more explicit task than a dialogue. De Jong and Perfetti (2011) [18] and Tavakoli (2011) argue that monologues offer easier control over speakers' performances, including topic choice, leading to more predictable outcomes and less demanding pragmatic planning. On the other hand, there is an argument that measuring L2 fluency in dialogue is less controlled and yields less predictable outcomes. However, despite these considerations, dialogue is deemed more authentic due to its interactive nature, resembling everyday communication with friends, colleagues, or classmates (Garrod and Pickering, 2004 [16]; Tavakoli, 2016 [3]).

Some prior investigations into fluency primarily concentrated on dialogue tasks exclusively, such as Bortfeld et al. (2001), Davis (2003) [19], McCarthy (2010), and Peltonen (2017) [4]. Bortfeld et al. (2001) scrutinized disfluency rates in conversation tasks, considering various variables affecting L2 fluency, including age, gender, speaker relationship, task role, and topic complexity. Their findings revealed that older participants exhibited more disfluent speech than younger learners, and disfluency increased with tasks requiring high planning demand, like complex diagram tasks. Regarding gender differences, men produced more fillers and repetitions than women, with fillers serving to maintain speech fluidity and signal the speaker's intention to speak.

In a similar vein, Davis (2003) [19] contended that assessing speech in a paired test is intricate due to factors like partner interaction, interlocutor proficiency, task type, and rater judgment. Davis explored the impact of the interlocutor's proficiency on the speaker's score and word count in an opinion-pair task. Results indicated that the interlocutor's proficiency had minimal influence on the examinee's score, and tasks involving group picture discussions showed limited interaction impact on scores.

Researchers in second language acquisition, such as Tauroza and Allison (1990), Gilbert et al. (2011), Sato (2014) [20], Witton-Davies (2014) [2], Tavakoli (2016) [3], and Peltonen (2017) [4], delved into utterance fluency in dialogue tasks, suggesting that L2 speakers exhibit greater fluency in dialogues than monologues. Tauroza and Allison (1990) and Gilabert et al. (2011) endorsed the efficacy of dialogic tasks in measuring L2 fluency, revealing faster syllable rates in dialogue compared to monologue. Longitudinally, Witton-Davies (2014) [2] tracked English oral fluency development in narrative monologues and discussion dialogues among L1 Taiwanese students abroad, demonstrating superior dialogue performance over four years. Similarly, Tavakoli (2016) [3] found that L2 oral fluency, measured by various indicators, was higher in dialogue than monologue.

Peltonen's (2017) [4] mixed-methods study on Finnish learners examined oral monologue and dialogue fluency in problem-solving tasks, revealing that higher proficiency participants exhibited more fluent dialogic performances. Fluent speakers employed stalling mechanisms and communication strategies to compensate for dysfluencies in both monologue and dialogue. More recently, Os et al. (2020) explored turn-taking behavior's impact on perceived fluency ratings in native and non-native speech, considering factors like speech rate, dialogue gaps, and overlaps. Fast native speakers were perceived as more fluent, while slow non-native speakers were rated lower. Overlapping was rated differently based on speech rate, with fast native speech finding overlapping less fluent, and slow speech (both native and non-native) finding overlapping more fluent than gaps.

2.3 Working Memory and Second Language Fluency

Working memory, described as a mental workspace with limited capacity for temporarily storing and manipulating information, plays a crucial role in complex activities (Baddeley, 2001). Kormos and Sáfár (2008) [9] highlighted individual differences in the working memory (WM) system, impacting learning skills, comprehension, and production abilities in second language (L2) contexts, including writing, reading, speaking, and vocabulary.

The significance of working memory in L2 learning is emphasized due to its capacity to store, process, and retrieve linguistic information (Cho, 2017). Segalwitz (2010, 2016) suggested considering various individual factors such as first language (L1), working memory capacity (WMC), aptitude, age, and motivation in conjunction with cognitive processing to understand potential reasons for dysfluency in L2 speech. Research in second language acquisition (SLA) acknowledges the diversity in cognitive processes, particularly in the production of fluent and smooth speech, indicating variations in attention devoted to filling working memory with essential information (Cowan, 2010). These differences might be linked to the constraints within working memory that regulate information flow (Weissheimer and Mota, 2009) [21].

Fortkamp (2000) explored the correlation between working memory capacity, measured through tasks like the simple span task (SST) and the operation word span test (OWST), and L2 speech production. The study aimed to investigate whether this relationship is task-specific or a general capacity applicable to all tasks. L2 speech production was assessed in terms of fluency (speed, breakdown, and repair) and complexity (accuracy and lexical density). The findings revealed significant correlations between SST and fluency, accuracy, complexity, and lexical density in both narrative and descriptive tasks. However, no correlation was found between OWST and L2 speech production measures, suggesting that working memory's influence may be task-specific. It's important to note that the study's conclusions may be influenced by ceiling effects, as correlation tests are sensitive to maximum scores and small sample sizes.

2.4 Current Study and Research Questions

Currently, little is known about how fluency measures are operationalized in dialogue and monologue. The dearth of research in this area is attributed to the time-consuming nature of calculating temporal variables of fluency in seconds using PRAAT software. This research sought to explore variations in the oral proficiency of L2 learners when engaging in monologic and dialogic tasks, specifically focusing on L2 utterance fluency. The assessment of language oral performance involved evaluating L2 utterance fluency through dimensions such as speed, breakdown, and repair. Thus, this study aims to address this research gap by presenting a theoretical-methodological approach to fluency within an interactional context. The analysis of fluency measures in monologues and dialogues seeks to make original contributions to the fields of SLA and testing.

On the other hand, L2 researchers (e.g., Tavares, 2008; Kormos and Sáfár, 2008 [9]; Gilabert and Muñoz, 2010 [10]; Ahmadian, 2012 [11]; Mojavezi and Ahmadian, 2014 [12]) have conducted various studies to explore the influence of WMC on L2 oral processing and production. However, inconsistent results and a lack of consensus persist regarding the impact of WMC on L2 production and processing, especially in monologic and dialogic performances. The second objective of the present study is to fill the gaps in previous research by examining the relationship between individual differences in WMC and various aspects of L2 fluency performance in monologues and dialogues. This study aimed to investigate, in an innovative manner, the extent to which the predictive capability of WMC, gauged by Backward Digit Span and Operation Span tests, can elucidate the observed differences in the performance of L2 utterance fluency in monologic and dialogic tasks Thus, the currant study aimed to answer the following research questions:

1-Are there variances in the utterance fluency of L2 learners when engaging in monologues compared to dialogues?

2-To what degree can the working memory capacity of L2 learners forecast their utterance fluency in both monologues and dialogues?

3. METHODOLOGY

3.1 Design

This study utilizes a within-participants repeated-measures design, as tests, measures, and tasks were conducted with the same participants (Cohen et al., 2017; Rogers and Revesz, 2019). The focus is on utterance fluency measures within the L2 context, specifically examining one group of participants across two task conditions: L2 monologue and L2 dialogue. The study incorporates two independent variables, OST and BDST, as working memory capacity tests, and three dependent variables, namely speed, breakdown, and repair in L2 utterance fluency. The primary objective is to explore distinctions between L2 oral dialogic and monologic performances, investigating potential relationships between these performances and WM capacity in different task modes.

Regression analyses and correlation tests were employed to address the second research question. Correlation research, a quantitative method, is utilized to examine relationships between variables without establishing cause-and-effect connections (Mackey and Gass, 2005). In this study, correlational analysis investigates the connections between L2 utterance fluency in monologue and dialogue, as well as WM capacity measured by the backward digit span test and the operation span test.

3.2 Participants

The research comprised 64 female students who willingly volunteered to take part. These individuals were third-year undergraduate students enrolled in the Department of English Language and Translation at The University of Jeddah in Saudi Arabia. Their ages ranged from 20 to 22 years, with an average age of 20.93 and a standard deviation of 0.78. Arabic served as their first language (L1), while English was their second language (L2). All participants were residents of Saudi Arabia during the study. Despite sharing the same educational level (third-year bachelor students), their proficiency in English as a second language was evaluated to ensure consistency among the participants.

3.3 Instruments and Procedures

Beyond examining fluency in both monologues and dialogues, the study delves into the correlation between Working Memory Capacity (WMC) and fluency in monologic and dialogic tasks. Participants' verbal performances were prompted through monologic and dialogic tasks, each addressing distinct topics to avoid a practice effect.

All measures (tests and tasks) were administered in the following sequence: the Oxford Quick Placement Test and a background questionnaire; Backward Digit Span Test (BDST) and Operation Span Test (OST); and the monologue and dialogue tasks. To ensure participants' comprehension of all tasks, instructions in both L1 and L2 were provided for each task, along with a practice example.

As Working Memory (WM) is a multi-dimensional construct, the current study employed two complex WM tasks, Backward Digit Span Test (BDST) and Operation Span Test (OST), to gauge participants' performance in comprehension and production.

3.4 Monologue Task

The monologic task involved an argumentative topic familiar to L2 participants. Cucchiarini et al. (2010) posit that responding to questions spontaneously can enhance fluency more than a picture description task. Each participant received a task card containing a statement and keywords, akin to the structure of the IELTS test. Participants were instructed to express their opinion with justifications on the statement: "Social media (e.g., Twitter, Instagram, Snapchat, and WhatsApp) is the current and future of marketing in Saudi Arabia."

3.5 Dialogue Task

The instructions for the dialogue task required participants to exchange opinions and discuss statements with a partner, deciding whether they agreed or disagreed, supported by justifications. An example statement was: "Do you agree/disagree with allowing women to drive in Saudi Arabia?" This statement was accompanied by several short statements and guiding questions on a prompt card to provide participants with additional ideas about what to express regarding this particular topic (e.g., advantages vs disadvantages).

3.6 Data Analysis

Seventeen metrics were employed to define the three facets (speed, breakdown, and repair) of spoken fluency. Each participant provided scores for all L2 fluency measures during both monologue and dialogue sessions. IBM SPSS 25 was utilized for data analysis, conducting descriptive and inferential assessments for each aspect of utterance fluency: speed (including speech rate, articulation rate, MLS, PTR), breakdown (covering SPs, FPs, mean length of silent/filled pauses, end-clause SPs, and mid-clause silent/filled pauses), and repair (involving reformations, repetitions, false starts). Mean and standard deviation descriptive analyses were employed to initially discern significant differences in L2 oral fluency between monologic and dialogic performances. Non-parametric tests (Friedman's ANOVA and Wilcoxon signed Ranks) were chosen due to violations of normality assumptions, which were evaluated through skewness, kurtosis values, and tests like Kolmogorov-Smirnov and Shapiro-Wilk's (Pallant, 2007).

Addressing the primary research question, Friedman's ANOVA was employed to ascertain if there were statistically significant variations in mean scores between dialogic and monologic performances in terms of utterance fluency. Friedman's ANOVA, an alternative to repeated measures ANOVA, was chosen, alongside Wilcoxon's signed-rank test, an alternative to a paired/dependent sample t-test (Field, 2013) [22]. Cohen's (1988) effect size definitions were also incorporated. Throughout all analyses, a significance level of $p < 0.05$ was considered. Additionally, regression analysis was conducted to explore the predictive role of working memory capacity in L2 utterance fluency during both monologue and dialogue.

The inter-rater reliability assessments for the segmented, coded, and scored fluency measures, encompassing speed, breakdown, and repair dimensions in both monologue and dialogue, exhibited values ranging from 0.68 to 0.78. Similarly, the inter-rater reliability for WMC tests ranged from 0.65 to 0.76. According to the criterion outlined by Cohen [23], it can be inferred that the inter-rater reliability for our variables was substantial.

4. RESULTS

Each participant's score was subjected to descriptive statistical analysis using IBM SPSS 26. Subsequently, the researcher conducted a series of tests, including a normality test, Friedman's ANOVA test, Wilcoxon's signed ranks test, regression analysis, and correlation test. Cohen's d (1988) effect sizes were incorporated to assess the significance of the findings.

As previously mentioned, the independent variables were OST and BDST, while the dependent variables encompassed monologue and dialogue tasks. Seventeen measures were employed to operationalize the three facets of L2 utterance fluency in both monologue and dialogue, specifically focusing on speed, breakdown, and repair. According to the Common European Framework of Reference (CEFR), the 64 participants exhibited an intermediate level of language proficiency (B1) with a mean (M) of 37.9 and a standard deviation (SD) of 4.22.

4.1 RQ1: Differences between monologue and Dialogue in Terms of Utterance Fluency

To address the primary research inquiry on potential disparities between monologue and dialogue regarding utterance fluency measures, Friedman's ANOVA and Wilcoxon signed ranks tests were employed. This overarching question was subdivided into three sub-questions and corresponding hypotheses to examine variations in speed, breakdown, and repair fluency measures between monologue and dialogue tasks.

Initially, the Friedman test was conducted to ascertain if there were statistically significant differences in oral performances (e.g., speed, breakdown, and repair) across both modes. The Friedman test serves as a non-parametric counterpart to the One-Way repeated measures ANOVA test, suitable for examining the same participants multiple times (Larson-Hall, 2015) [24]. This test is particularly useful for comparing mean scores of three or more dependent variables. As the results of Friedman's ANOVA indicated significant differences, a post-hoc test, the Wilcoxon signed ranks test, was subsequently employed to pinpoint the specific areas of significance between dependent variables. The Wilcoxon test, utilized for comparing repeated measurements on a single sample, aimed to detect whether the mean ranks of the sample exhibited statistically significant variations (Larson-Hall, 2015) [24].

4.2 Differences between Monologue and Dialogue in Speed Fluency Measures

The Friedman test was employed to assess whether there were any statistical variances in speed fluency measures between monologues and dialogues. The results of the statistical analysis presented in Table 1 indicate significant differences in speed fluency measures between the two modes, with a chi-square value of 58.23 and a p-value of 0.00, signifying that the p-value was less than 0.05. Additionally, the mean ranks scores reveal that these differences were consistently statistically significant, demonstrating that participants were more fluent in dialogue compared to monologue. The only exception to this trend was observed in MLS, where the fluency score was slightly higher in monologue (M = 1.66) than in dialogue (M = 1.34).

The significant findings from the Friedman test did not offer sufficient details regarding the specific locations of the differences within the ranges. Consequently, a series of Wilcoxon signed rank tests were conducted on all the dependent measures of utterance fluency to pinpoint the precise variations between variables, as recommended by Pallant (2007) and Field (2013) [22] (refer to Table 2). It's important to note that the utilization of the Wilcoxon signed ranks test has the potential to inflate the Type 1 error rate, implying a rejection of the null hypothesis even if it is likely true. Therefore, the probability value (alpha < 0.05) required adjustment through the Bonferroni correction to minimize Type 1 errors, following the guidelines of Pallant (2007) and Field (2013) [22].

The results of the Wilcoxon test analysis are outlined in Table 2, revealing statistically significant differences between the two task modes (monologue and dialogue) with varying effect sizes in participants' performances across the monologue and dialogue tasks. To account for multiple comparisons, the Bonferroni adjustment was applied, resulting in a new alpha value of $\alpha = 0.008$ (0.05 divided by 6, where 6 represents the number of target variables in the analysis). This adjustment implies that the p-values for the speed fluency measures should be less than 0.008 to be considered statistically significant.

Table 2 displays the p-values corresponding to the speed fluency measures. Noteworthy statistical differences were observed between the two modes in terms of length of samples (Z = -3.89, p = .00) with a moderate effect size (r = 0.34); number of syllables (Z = -5.25, p = 0.00) with a moderate effect size (r = 0.43); speech rate (Z = -3.10, p = 0.00) with a small effect size (r = 0.27); and PTR (Z = -3.09, p = 0.00) with a small effect size (r = 0.27).

Consequently, participants exhibited significantly longer speech samples (MED = 85.84), a greater number of syllables (MED = 211), faster speech rates (MED = 16.05), and higher PTR (MED = 83.52) in dialogues as opposed to monologues.

4.3 Breakdown Fluency Measures in Monologue and Dialogue

The outcomes of the statistical analyses outlined in Table 3 reveal significant differences between monologue and dialogue in breakdown fluency measures, $\chi2(15) = 765.96$, p = 0.00. Further details, including mean ranks and Friedman test results, can be found in Table 4. The findings indicate notable distinctions in breakdown fluency measures between monologue and dialogue tasks, with L2 participants achieving significantly higher scores in monologue compared to dialogue.

According to Table 5, there were statistically significant distinctions between the two modes in terms of silent pauses per 60 seconds (Z = -5.190, p = .000) with a moderate effect size (r = 0.46), end-clause silent pauses (Z = -6.380, p = .000) with a large effect size (r = 0.56), mean length of mid-clause silent pauses (Z = -2.960, p = .003) with a small effect size (r = 0.26), and mid-clause filled pauses (Z = -2.759, p = .006) with a small effect size (r = 0.24).

Table 1. Mean ranks for dependent variables of speed fluency

Speed Fluency Measures	Mean Rank		Chi-Square	df	Asymp. Sig.
	Monologue	Dialogue			
Length of sample	4.34	5.48			
Syllables	8.88	10.69			
Speech rate	7.47	8.28	58.23	11	0.00
Articulation rate	9.98	10.42			
Phonation time and ratio	4.44	5.02			
Mean length of syllables	1.66	1.34			

Table 2. Test statistics for differences in speed fluency between dialogue and monologue

Speed fluency	Pairs	Z	Asymp.Sig.2-tailed	Effect size
Length of samples	Monologue vs dialogue	-3.89[b]	0.00	-0.34
Syllables	Monologue vs dialogue	-5.25[b]	0.00	-0.43
Speech rates	Monologue vs dialogue	-3.10[b]	0.00	-0.27
Articulation rates	Monologue vs dialogue	-2.40[b]	0.02	-0.21
PTR	Monologue vs dialogue	-3.09[b]	0.00	-0.27
MLS	Monologue vs dialogue	-2.23[c]	0.03	-0.20

Note. *b* is based on negative ranks; *c* is based on positive ranks.

Table 3. Mean ranks for breakdown fluency

Breakdown Fluency	Mean Rank		Chi-Square	df	Asymp. Sig.
	Monologue	Dialogue			
Silent Pauses/60	15.35	13.62			
Mid-clause SPs/60	10.05	10.09			
End-clause SPs/60	12.34	8.38	765.96	15	00
Mean length Mid-CSPs	3.43	4.37			
Mean length End-CSPs	3.76	4.12			
Filled Pauses/60	11.98	11.51			
Mid-CFPs/60	9.98	11.18			
Mean length Mid-CFPs	3.04	2.80			

Table 4. Test statistics for monologue and dialogue differences in breakdown fluency

Breakdown fluency	Pairs	Z	Asymp. Sig.(2-tailed)	Effect size
SPs/60	Dialogue vs monologue	-5.190[b]	0.000	-0.46
Mid-CSPs/60	Dialogue vs monologue	-0.796[c]	0.426	-0.07
End-CSPs/60	Dialogue vs monologue	-6.380[b]	0.000	-0.56
M length Mid-CSPs	Dialogue vs monologue	-2.960[c]	0.003	-0.26
M length End-CSPs	Dialogue vs monologue	-1.164[c]	0.245	-0.10
FPs/60	Dialogue vs monologue	-0.298[b]	0.766	-0.03
Mid-CFPs/60	Dialogue vs monologue	-2.759[c]	0.006	-0.24
M length Mid-CFPs	Dialogue vs monologue	-1.265[b]	0.206	-0.11

Note. b is based on positive ranks; c is based on positive ranks

Conversely, no statistically significant differences were observed between monologues and dialogues in mid-clause silent pauses (Z = -0.796, p = .426) with a very small effect size (r = 0.07), mean length of end-clause silent pauses (Z = -1.164, p = .245) with a very small effect size (r = 0.04), filled pauses per 60 seconds (Z = -0.298, p = .766) with a very small effect size (r = 0.03), and the mean length of mid-clause filled pauses (Z = -1.265, p = .206) with a small effect size (r = 0.11).

4.4 Differences between monologue and Dialogue in Repair Fluency Measures

To measure repair fluency, five metrics were employed: total repairs per 60 seconds, repetitions per 60 seconds, reformations per 60 seconds, replacements per 60 seconds, and false starts per 60 seconds. To address the sub-question of whether there are differences between monologue and dialogue in terms of repair fluency measures, the Friedman test was conducted to compare the scores of repair fluency in both monologues and dialogues.

The statistical analyses displayed in Table 5 indicate noteworthy distinctions in repair fluency measures between the two modes, with a chi-square value of $\chi 2(9) = 371.03$ and a p-value of 0.00. Furthermore, based on the mean ranks and results of the Friedman test, the average scores for reformations (RF) and repetitions (RP) were slightly higher in dialogue (RF, M = 4.80; RP, M = 7.36) compared to monologue (RF, M = 4.04; RP, M = 6.95).

Table 6 indicates that there were no statistically significant differences between the two modes in all repair measures.

4.5 Research Question 2 (RQ2): What is the extent to which variations in Working Memory Capacity (WMC) scores predict utterance fluency in both monologue and dialogue?

Multiple regression analysis was employed to assess the degree to which differences in WMC scores could account for the variance in L2 fluency measures in both monologue and dialogue. WMC was evaluated using OST and BDST, providing distinct estimates of WMC. The OST scores ranged from 22 to 54 (M = 40.84, SD = 6.71), while BDS scores ranged from 3 to 6 (M = 4.10, SD = 1.02). The dependent variables consisted of composite measures encompassing speed fluency, breakdown fluency, and repair fluency in both monologue and dialogue.

To ensure the reliability of the results obtained from the regression analysis, the residuals were examined for normality, a crucial aspect of validation. The independence of residuals is vital for confirming the outcomes of regression analysis, and as per the standard, there should be no values falling outside the range of ±3 (Tabachnick and Fidell, 2013). In adherence to this criterion, there were no concerns related to the residuals, as all values fell within the ±3 range (refer to Fig. 1).

A correlation analysis was conducted to investigate the linear association between Working Memory Capacity (WMC) and utterance fluency measures. The outcomes of this analysis are outlined in Table 7, revealing that OST and BDST exhibited no statistically significant correlation with the composite measures of utterance fluency in both monologue and dialogue. The correlation coefficients, as indicated in Table 7, ranged from r = 0.00 to r = 0.18.

The final assumption in regression analysis pertains to multicollinearity, with a requirement that there be no issues of multicollinearity among the independent variables (Field, 2013 [22]; Pallant, 2013). Multicollinearity was evaluated through Variance Inflation Factor (VIF) and tolerance tests, yielding results of VIF (1.03) and tolerance (0.97).

Subsequently, after confirming all assumptions of the regression analysis, WMC assessments were established as predictors, while the outcomes comprised utterance fluency in both monologue and dialogue. Six distinct multiple regression analyses were conducted (refer to Table 8). To gauge the effect size (R^2) eta square, Cohen's (1988) criteria were adopted, where $r^2 = 0.14$ indicates a small effect size, $r^2 = .39$ indicates a medium effect size, and $r^2 = .59$ and above indicates a large effect size.

Table 5. Mean ranks for the dependent variables of repair fluency measures

Repair Fluency Measures	Mean Ranks		Chi-Square	df	Asymp. Sig.
	Monologue	Dialogue			
Total repairs/60	8.95	9.07			
False starts/60	3.56	3.53			
Reformations/60	4.04	4.80	371.03	9	0.00
Repetitions/60	6.95	7.36			
Replacements/60	3.58	3.16			

Table 6. Test statistics for monologue and dialogue differences in repair fluency

Repair fluency	Pairs	Z	Asymp. Sig.(2-tailed)	Effect size
Repairs/60	Dialogue vs monologue	-0.264[b]	0.792	0.02
False Starts/60	Dialogue vs monologue	-0.317[c]	0.751	0.03
Reformations/60	Dialogue vs monologue	-0.832[b]	0.405	0.07
Repetitions/60	Dialogue vs monologue	-0.806[b]	0.420	0.07
Replacements/60	Dialogue vs monologue	-1.738[c]	0.082	0.15

Note. b is based on positive ranks; c is based on positive ranks

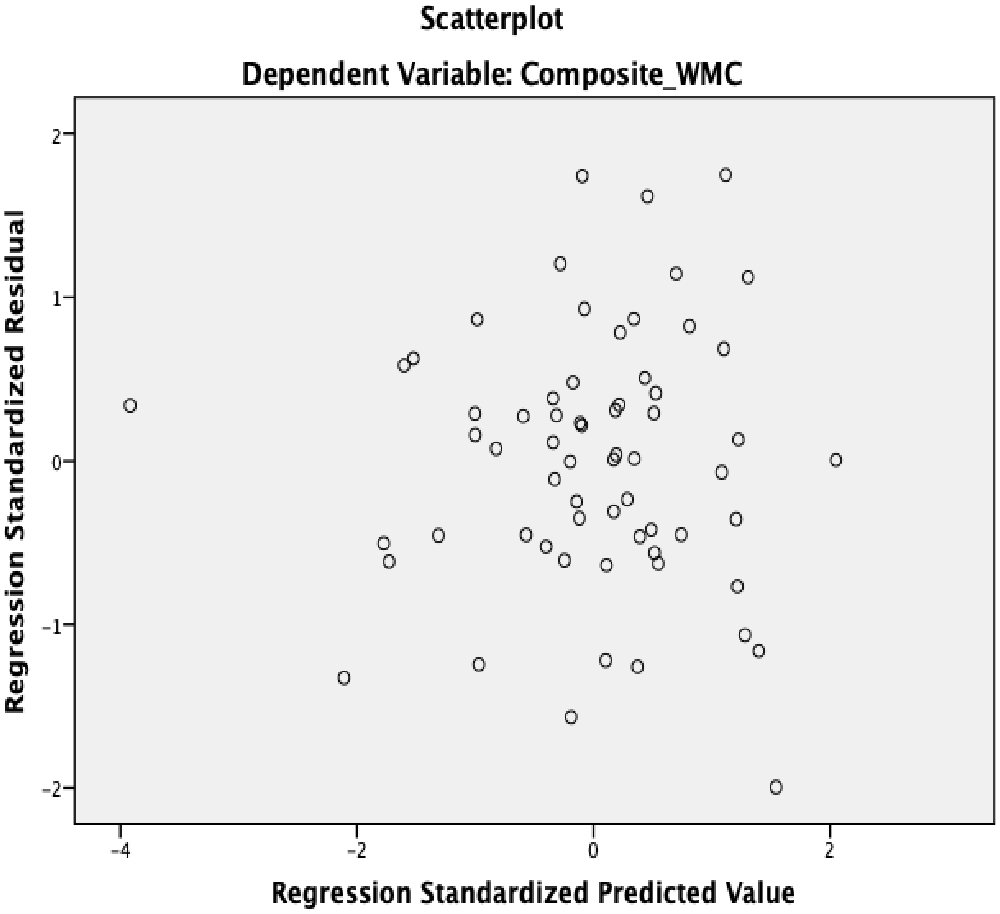

Fig. 1. Shows that the residuals' values fall between ±3

Table 7. Correlations between utterance fluency measures in monologue and dialogue and WMC

Variables	1.	2.	3.	4.	5.	6.	7.	8.
1. Monologue speed	1							
2. Dialogue speed	.64**	1						
3. Monologue breakdown	-.36**	-.21	1					
4. Dialogue breakdown	-.26*	-.23	.31*	1				
5. Monologue repairs	.04	.03	.25*	-.05	1			
6. Dialogue repairs	-.02	.10	.06	.32*	.19	1		
7. Operation span test	-.02	.00	-.03	-.05	.12	.03	1	
8. Backward digit span test	.15	.17	-.21	-.06	-.09	.09	.18	1

***. $p < 0.01$; *. $p < 0.05$*

Table 8. Summary of multiple regression analysis predicting utterance fluency in monologue and dialogue from the WMC

Outcome	Predictor	B	SE	β	t	Sig.	*R*	R^2
Monologue speed		*F* (2.63) = 0.80, *p* = 0.45						
	OST	-1.12	2.77	-0.05	-0.40	0.69	0.16	0.02
	BDST	22.72	18.13	0.16	1.25	0.21		
Monologue breakdown		*F* (2.63) = 1.42, *p* = 0.25						
	OST	0.01	0.50	0.00	0.03	0.98	0.21	0.05
	BDST	-5.46	3.28	-0.21	-1.66	0.10		
Monologue repairs		*F* (2,63) = 0.79, *p* = 0.46						
	OST	0.14	0.13	0.14	1.05	0.30	0.16	0.03
	BDST	-0.74	0.86	-0.11	-0.87	0.39		
Dialogue speed		*F* (2.63) = 0.92, *p* = 0.40						
	OST	-0.84	3.95	-0.03	-0.21	0.83	0.17	0.03
	BDST	35.09	25.87	0.17	1.36	0.18		
Dialogue breakdown		*F* (2.63) = 0.16, *p* = 0.85						
	OST	-0.13	0.41	-0.04	-0.31	0.75	0.07	0.01
	BDST	-1.09	2.70	-0.05	-0.40	0.69		
Dialogue repairs		*F* (2.63) = 0.27, *p* = 0.76						
	OST	0.01	0.12	0.02	0.12	0.91	0.09	0.01
	BDST	0.55	0.78	0.09	0.70	0.49		

The outcomes depicted in the aforementioned table reveal that none of the models achieved statistical significance concerning speed, breakdown, and repair fluency. In terms of the individual contributions of the independent variables (OST and BDST), they did not make significant contributions to any of the models, failing to account for the variation in participants' oral performances in both modes. The p-values for all models exceeded 0.05. For instance, in the case of monologue speech rates, F (2.63) = 0.80, p = 0.45, indicating a p-value greater than 0.05. Moreover, the extent of variance explained in all models was insufficient to attain significance levels in the regression analysis.

5. DISCUSSION

5.1 Research Question 1 (RQ1): Is there a Distinction in Utterance Fluency between Monologue and Dialogue?

The study utilizes three sub-dimensions of L2 fluency—speed, breakdown, and repair (Skehan, 2003)—to investigate different aspects of L2 utterance fluency in both monologue and dialogue. The findings align with previous research by Riggenbach (1998) [25], Michel et al. (2007) [26], Michel (2011) [1], Sato (2014), Witton-Davies (2014) [2], Kirk (2016), Tavakoli (2016) [3], and Peltonen (2017, among others) [4], indicating that L2 participants exhibit significantly higher fluency in discussion dialogues compared to opinion monologues across various fluency measures, except for repair fluency (Huensch and Tracy–Ventura, 2017).

5.1.1 RQ1a: Is there a disparity between monologue and dialogue in terms of speed fluency measures?

Significant distinctions are observed between monologic and dialogic performances concerning speech rates, length of speech samples, number of syllables, and phonation-time ratios. L2 participants demonstrate faster speech rates, longer speech samples, more syllables, and higher phonation-time ratios in dialogue. Conversely, monologues exhibit lower speech rates, shorter speech samples, fewer syllables, and lower phonation-time ratios. No significant differences are found in articulation rates (ARs) and mean length of syllables between monologues and dialogues.

5.1.2 RQ1b: Are there differences in breakdown fluency measures between monologue and dialogue?

Dialogues are associated with fewer silent pauses and end-clause silent pauses per minute, accompanied by a longer mean length of mid-clause silent pauses and more mid-clause filled pauses. In contrast, monologues feature higher numbers of silent pauses and end-clause silent pauses per minute, along with a shorter mean length of mid-clause silent pauses and fewer mid-clause filled pauses. Overall, dialogues exhibit greater fluency than monologues in L2 speech rates, length of samples, number of syllables per minute, mean length of mid-clause silent pauses per minute, and mid-clause filled pauses per minute.

5.1.3 RQ1c: Are there distinctions between monologue and dialogue in terms of repair fluency measures?

Repair fluency involves changes in speakers' language, such as repetitions, false starts, reformations, or replacements. While no significant differences are found in repair measures between monologue and dialogue, previous studies (e.g., Michel, 2011 [1]; Witton-Davies, 2014 [2]) support these non-significant results. More proficient speakers tend to be more concerned about accuracy, producing fewer repairs. Despite non-significant differences, participants in dialogue may repeat themselves more than in monologue, as indicated in Witton-Davies's (2014) [2] study.

5.2 Predicting L2 oral Performance Fluency in Monologue and Dialogue Through Working Memory Capacity Tests

Building on the work of Mota (2003) [27] and Gilabert and Muñoz (2010) [10], the present study posited that individuals with higher working memory capacity (WMC) would exhibit greater fluency, specifically in terms of speed, breakdown, and repair, compared to those with lower WMC. The relationship between both Backward Digit Span Task (BDST) and Operation Span Task (OST) with fluency measures in monologue and dialogue, including speed, breakdown, and repair, was assessed using Pearson's correlation coefficient (r). Additionally, multiple regression analysis was employed to investigate the predictive capabilities of WMC.

The results indicated that neither OST nor BDST showed statistically significant correlations with the composite fluency measures (speed, breakdown, and repairs) in monologue and dialogue. Moreover, the multiple regression analysis yielded non-significant findings across all models ($F(2,63) = 0.80$, $p = 0.45$). This aligns with the conclusions drawn from Awwad's (2017) [28] study, which explored the predictive influence of language proficiency and WM on the oral performance of L2 participants, encompassing lexical complexity, syntactic complexity, fluency, and accuracy. Awwad's findings suggested that variations in participants' WM, as measured by BDST, and language proficiency did not statistically account for differences in syntactic complexity, accuracy, speed, and pausing fluency.

Comparing the findings of the present study with those of other researchers (e.g., Fortkamp, 2000 [29]; Mizera, 2006 [30]; Kormos and Trebits, 2011 [31]; Awaad, 2017 [28]; Georgiadou and Roehr-Brackin, 2017) supports the conclusion that there are no discernible associations between working memory capacity and L2 utterance fluency measures [32-67].

6. CONCLUSION

This study aims to present a theoretical and a methodological approach to fluency in an interactional context. The analysis of monologic and dialogic fluency measures seeks to make original contributions to the field of Second Language Acquisition and testing. Additionally, this study serves as an exemplar for future research, emphasizing the importance of considering participants' native language (L1) data to enhance the study's robustness. Thus, the present study follows the psychometric correlational approach and focuses on the relationship between the individual differences in WMC (as measured by two complex WM tests, BDST and OST) and L2 fluency performance in monologic and dialogic tasks.

Little is known about how fluency alone is operationalized in both dialogue and monologue. The production of L2 speech, a generally used communication tool, is not always smooth (Felker et al., 2019). Difficulties in formulating or articulating words lead to disruptions and disfluency markers like fillers, repairs, or repetitions (Felker et al., 2019). Limited WMC may be associated with these disruptions, responsible for allocating attentional resources in L2 processing stages (Skehan, 2014b). Consequently, investigating IDs in L2 learners' WMC and differences in monologic and dialogic performance is expected to provide predictive data for L2 oral tasks and ensure their validity in classrooms.

The results additionally verified that there were no notable distinctions in the utilization of repairs between dialogue and monologue, as both modes exhibited similar values. However, speech rates were observed to be higher in the context of dialogue. Moreover, the participants' working memory capacity, assessed through OST and BDST, did not serve as a robust predictor for elucidating the differences in L2 oral performances during both monologue and dialogue tasks.

It is important to discuss the fact that, even if a measure of L2 fluency does not show any significant difference between monologue and dialogue tasks, it does not mean that this measure is not accurate or informative (Pallotti, 2009). The possible reason for this lack of difference could be that both groups are similar in this particular measure. Additionally, Pallotti (2009) demonstrates that researchers should pay attention to not only differences and variations among groups in terms of measures, but also to similarities and contrasts. For example, if two groups of participants do not show any significant differences, this is considered an interesting finding, even if this measure does not show any difference after a period of time. It seems possible that this result is due to a personal trait that does not change or vary. Thus, it does not mean that this measure is poor or invalid, but it must show its basic construct adequately (Pallotti, 2009).

7. LIMITATION AND FUTURE SUGGESTIONS

A potential limitation in this study that might impact the assessment of L2 utterance fluency is the relatively small sample size, which could potentially obscure distinctions between dialogic and monologic performances. To enhance the statistical reliability and focus of the findings, it is recommended that future iterations of this study employ a larger sample size. However, recruiting more participants for the current study was challenging, as it would have been time-consuming and exceeded the scope of this thesis. Subsequent research on L2 fluency should explore various factors influencing the oral fluency of L2 learners, such as online planning, social context, task types, and topics.

Furthermore, adopting a mixed-method design could yield comprehensive insights into L2 fluency in both dialogic and monologic performances, as well as working memory capacity (WMC). For instance, qualitative research, including simulated recall questionnaires, could be incorporated to supplement the quantitative findings and provide a more nuanced understanding of the intricacies involved.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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