Language Related Research
E-ISSN: 2383-0816
https://lrr.modares.ac.ir
https://doi.org/10.48311/lrr.2025.7159
https://lrr.modares.ac.ir/article_7159.html

Tarbiat Modares University

Vol. 17, No. 3
pp. 119-143
Fall 2026

Received: 22 June 2023
Received in revised form: 9 August 2023
Accepted: 20 August 2023

Working Memory, Gender, and EFL Listening Comprehension: Metacognitive Intervention through L1

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Abstract

The aim of the present study was to examine whether Metacognitive Intervention (MI) had any significant effect on English as a Foreign Language (EFL) learners' Working Memory (WM) and if gender had any effect on it. The findings indicated that there was a significant effect on EFL learners' working memory in listening comprehension after they received MI in L1. It was also found that gender had a significant effect on the EFL learners' working memory and listening comprehension when they receive MI in L1. The findings might contribute to assist language instructors to adopt strategy-based approaches to teaching listening. Furthermore, curriculum designers and ELT policymakers might consider metacognitive intervention as an effective teaching approach and add it to EFL learners' curriculum.

Keywords: gender differences, listening comprehension, L1, metacognitive intervention, working memory

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1. Introduction

Listening is one of the most brain-teasing skills for foreign language learners due to the complexity of its puzzling process and the different types of knowledge required for successful comprehension (Goh & Vandergrift, 2022; Siegle, 2023). One of the newest and most effective approaches to cope with this difficulty is metacognitive intervention (MI), which is based on using some specific metacognitive strategies, such as planning, monitoring, problem solving, and evaluation (Tanewong, 2019; Than et al., 2025). It also employs metacognitive knowledge that is constructed into three related kinds of knowledge: person knowledge (learners' knowledge about themselves), task knowledge (learners' knowledge about the nature and demands of listening tasks), and strategy knowledge (the knowledge of strategies that are used for fulfilling listening tasks) (Flavell, 1976). Many newly published studies have reported the effectiveness of MI in EFL learners (Bozorgian & Fakhri Alamdari, 2018; Bozorgian & Shamsi, 2022; Liu, 2020; Zeng & Goh, 2018). They reported that it promotes a sense of agency, autonomy, and self-regulation among learners and can aid them to plan, monitor, control, and evaluate their own learning listening process (Ahmadi Safa & Motaghi, 2021; Maftoon & Fakhri Alamdari, 2020; Sajjadi, 2022).

One of the crucial factors involved in successful listening comprehension is working memory capacity (Wallace, 2020). Working Memory (WM) can be defined as "mental processes responsible for the temporary storage and manipulation of information in the course of ongoing processing" (Juffs & Harrington, 2011, p. 138) when an individual is performing higher-order tasks such as comprehension, learning, and reasoning. WM is relatively a new concept in language learning and teaching and plays an important role in language comprehension (Michel et al., 2019; Rost, 2014). There is a consensus among researchers that working memory is involved in the performance of a number of cognitive tasks (e.g., Baddley et al., 2009; Conway, 2008; Engel de Abreu & Gathercole, 2012). In general, learners with higher working memory capacity perform better on their language learning tasks than those with lower capacity (Fortkamp, 1995; Tomitch, 2004).

The importance of working memory capacity, how to measure it, and its limitations were examined through some studies (Chien & Morrison, 2010; Lesser, 2007; Walters, 2004). As a noticeable case, Daneman and Carpenter (1980) proposed a measure of working memory span that predicts reading comprehension

performance. In this span test, reading sentences assessed the processing component of working memory; the storage component of working memory, in turn, was assessed by asking participants to memorize and later retrieve the final word of each sentence that they read. In addition, Just and Carpenter (1992) stated that the nature of a person's language comprehension depends on learners' working memory capacity. Individuals vary in the amount of processing and storage capacity they have available for meeting the computational demands of language processing. This conceptualization predicts quantitative differences among individuals in the speed and accuracy with which they comprehend language.

WM is a vital component of listening comprehension processes and thus a possible source of individual differences in comprehension ability (Daneman & Carpenter, 1980). However, Andringa et al. (2012) and Kormos and Sáfár (2008) suggest that working memory is a weak predictor of listening comprehension when other factors such as linguistic and nonlinguistic cognitive factors (e.g., vocabulary size, grammatical processing ability, semantic processing ability, segmentation ability, word monitoring, sentence processing efficiency, and intelligence) emerge in listening comprehension.

Recent research, primarily utilizing correlational designs and overlooked the role of MI on WMC. Moreover, even though gender plays an indispensable role in second language acquisition, gender differences with their focus on the combined effect of metacognition and working memory have been inadequately investigated. Specifically, the relationship between gender and WMC is still understudied. To fill this gap, this research aims to investigate the effect of metacognitive intervention and gender differences on EFL listeners' working memory when they receive training in their L1. The following questions are addressed in this research:

1. Does metacognitive intervention in L1 have any significant effect on EFL learners' working memory in listening comprehension?

2. Does gender have any effect on EFL learners' working memory and listening comprehension when they receive metacognitive intervention in L1?

Also, based on the findings of the related literature, the following two hypotheses were formulated:

$H0_1$: Metacognitive intervention in L1 has no effect on EFL learners' working memory in listening comprehension.

$H0_2$: Gender has no effect on EFL learners' working memory and listening comprehension when they receive metacognitive intervention in L1.

2. Review of Literature

2.1. Working Memory and MI Through L1 In Listening Comprehension

According to De la Campa and Nassaji (2009), using L1 moderately in a classroom, where a teacher assumes that L1 supports learning and teaching a target language, is reasonable. They also asserted that L1 provides a secure context for the learners, which helps them to take risks in the classroom. Thus, it must be used as a precious cognitive tool for special purposes such as facilitating communication, providing instructions, negotiating meaning, and helping students to have less anxiety, better comprehension, and faster learning (Kraemer, 2006).

More recently, the effectiveness of MI through L1 in EFL learners' listening comprehension has been adequately investigated (Bozorgian et al., 2022; Fakhri Alamdari & Hosnabakhshan, 2021; Goh, 2018). For example, to examine the effectiveness of MI on listening comprehension, Maftoon and Fakhri Alamdari (2020) performed an experiment to explore the impact of metacognitive intervention on metacognitive awareness and listening performance of 60 intermediate EFL learners through a process-based approach. Their findings showed that there was a considerable and meaningful variance in the overall metacognitive awareness and listening performance of the participants. Furthermore, Goh (2018) diagnosed some frequent problems that learners faced during the second language listening process. The most frequently mentioned problem was quickly forgetting what was heard. She attributed this problem to learners' limited working memory capacity, which can be improved by utilizing some metacognitive strategies.

Some research has also been conducted on the effect of working memory capacity and language learning performance. For instance, Shahnazari-Dorcheh and Adams (2014) examined the role of working memory capacity in the development of second-language reading ability. The results of this study indicated a significant relationship between working memory capacity and reading ability at lower levels of proficiency. In another study, Christiansen (2016) investigated the relationship between language aptitude, working memory, and attentional control. Findings revealed a significant relationship between one of the phonological short-term

memory measures and L2 proficiency, as well as between attentional control and L2 proficiency. These findings confirmed the findings of previous research on WM and added weight to the relationships among WM, attentional control, and language learning hypotheses.

In a review article on the relationship between working memory and language, Baddeley (2003) probed the contributions of working memory to language reading skills. Findings showed that readers with higher capacity of WM were amazingly accurate at localizing previously read words, and this could be seen when they made regressions upon encountering a comprehension problem in text reading. Baddeley (2003) further hypothesized that visuospatial working memory may also be involved in the understanding of spatial information (e.g., grammatical structures involving spatial terms such as above, below, and under). Wen (2012) introduced a principled approach to incorporating the construct of WM into Second Language Acquisition (SLA) research. As a result, she argued for an integrated framework of WM for SLA that draws on insights from established WM research in cognitive psychology as well as initial findings from SLA studies looking into the effects of WM. Within this framework, she proposed a set of general principles that serve as a basis for further studies probing the WM-SLA nexus. Applying some tenets from this framework, she reported on an empirical study investigating the differential effects of WM constructs on L2 task-based speech planning and performance, culminating in forged links bridging WM components and their corresponding L2 speech performance measures.

Similarly, Santacruz and Ortega (2018) examined how working memory training could contribute to retaining vocabulary studied in English lessons through the implementation of a set of strategies. Two intact groups of beginners, one experimental group with 28 students and one control group with 22 students, belonging to an undergraduate English as a foreign language course at a Colombian university, were involved in their study. After being exposed to a series of memory strategies for a period of 10 weeks, it was evident that most learners in the experimental group benefited from the intervention. They showed gradual progress in the retention and retrieval of the words studied in the lessons, and their overall competence in the foreign language improved.

There are contradictory ideas about the relationship between WM and L2 listening comprehension. Wallace (2020) examined the relationship between

memory and listening comprehension and claimed that there is no relationship between memory and listening comprehension, and in this regard, individual differences in memory capacity are not effective. He explained that since the listening test used in his research was in multiple-choice format, the participants did not need to generate new representations of the input. Instead, they linked to representations that were activated from language processing by reading. Moreover, he used medium to long texts (more than one minute) that did not inhibit the influence of memory capacity on learners' listening comprehension.

Vandergrift and Baker (2015, 2018) found a relationship between WM and listening performance. They also reported that the metacognitive intervention affected learners' working memory and indirectly influenced listening comprehension by manipulating their conceptual knowledge and top-down processes. They concluded that integrating MI in teaching listening could enhance the learners' awareness of their own performance, working memory, and consequently listening skills. McNamara and Scott (2001) and Chein and Morrison (2010) also stated that utilizing some strategies may help language learners compensate for limitations in their working memory capacity.

In line with these findings, Bozorgian et al. (2022) probed the impact of MI on EFL learners with low working memory. Findings showed that learners with low WMC who received MI outperformed their counterparts in the control group who were trained without MI. Learners in the experimental group used directed attention, mental translation, and person knowledge strategies more than control group members. Therefore, the improvement in their listening comprehension was attributed to the positive effects of MI on organizing one's thoughts, focusing on the listening process, and avoiding distraction.

2.2. Gender Differences and Language Learning

Regarding gender differences in using strategies in language learning, Cantrell and Carter (2009) found that male students use problem-solving strategies more than female students. They found that both male and female students used global reading strategies the least. Female students apply global reading strategies more than males. In another study, Fenfang (2010) found that males are more adventurous and bolder compared to females, who are more careful and considerate in their reading. For that reason, males are more ready to explore the text as shown in global reading

strategies. This explanation was supported by the report of Logan and Johnston (2009) that males' and females' performance on reading comprehension depends on a few factors, including whether they are more suitable in different types of reading instruction and learning environments. They stated that there is enormous variation in both male and female cognitive abilities and reported that females have a more positive attitude toward strategy-based language learning. However, Berkant's (2009) study showed that causal thinking as a component of metacognition and gender was not a crucial factor in learning. Generally, not all the subscales showed gender differences as reported by Fenfang (2010) and Ozkan and Hatice (2013). Additionally, Saemah et al. (2013) stated that males and females had positive attitudes toward using metacognitive strategies, and they were considered very important in classroom learning by both genders.

However, there is an extensive line of inquiry for gender, WMC, and MI separately; the influence of these factors as a combination is understudied. As a close case in point, Fakhri Alamdari and Bozorgian (2022) investigated the combined effect of gender, metacognitive intervention, and dialogic interaction on Iranian EFL learners' multimedia listening comprehension. They conducted their study on 1080 advanced EFL learners in Iran. The learners received metacognitive instruction (MI) as well as metacognitive intervention through dialogic interaction (MIDI), and their performance was determined by considering their gender. Findings demonstrated that: 1) members of the MIDI group outperformed their counterparts in the MI group, and 2) female learners had a better performance compared to their male peers. The researchers claimed that female learners' linguistic maturity helped them to realize the nature, purpose, quality, and demands of utilizing MI in the listening learning process.

In line with the stated problems in L2/EFL listening posed so far, the current study is an endeavor to examine whether metacognitive intervention in L1 has any effect on EFL learners' WM in listening comprehension. In addition, it investigates whether gender has any effect on EFL learners' working memory and listening comprehension when they receive metacognitive intervention in their L1.

3. Methodology

3.1. Research Design and Sampling Method

This study was quasi-experimental, along with a single-subject design to measure the relationship between gender, working memory, and listening comprehension when the participants received MI in L1 during an eight-week treatment. This research fairly meets the conditions of quasi-experimental studies since the participants were not randomly assigned to each group and intact classes were used instead (Creswell & Creswell, 2018). Participants were chosen by a convenience sampling method. This method was selected since the participants were chosen for the purpose of the study and were available and willing to volunteer. Before training sessions, QPT was conducted to screen 112 volunteers (50 male and 62 female students separately) to determine their proficiency level, and 60 students with beginning level (30 females and 30 males) were purposefully selected and placed into two classes. They took EFL courses at a private language institute. The participants were 13-15 years old, and all of them were students of a middle school in the urban area of the city. They were native Persian speakers who were learning English as a foreign language.

3.2 Instruments

3.2.1. Quick placement test (QPT)

In order to choose the beginning-level EFL learners and find a homogeneous sample, a Quick Placement Test (QPT) (Syndicate, 2001) was utilized. The QPT consisted of three parts: Listening comprehension, reading comprehension, and grammatical structures. The test had 100 items for which the highest score was 100. Based on the standard of the test itself, 100 minutes were allotted to conducting it. The listening section of the test consisted of 20 questions followed by the reading comprehension section, which consisted of four passages with 40 questions. The third section of the QPT aimed at testing the grammatical knowledge of participants by giving 40 questions. All of the questions in the three sections were in a multiple-choice form. The reliability of QPT has been calculated as 0.945.

3.2.2. Pretest and posttest listening

Regarding the research questions, to investigate the relationship between working

memory and listening comprehension when Metacognitive Intervention was delivered through L1, the researchers employed a standardized listening comprehension test as both the pretest and the posttest, selected from the book *Tactics for Listening* by Richards (2010). The listening comprehension test included 20 items, each of which had one score and consisted of multiple-choice and True/False items. Two expert researchers in the field, to ensure its validity, reviewed the items of the test aligned with the contents of the materials covered in the MI. To calculate the reliability of the test, KR21 was conducted, and a reliability of .82 was reported.

3.2.3. Forward and backward digit span test

In order to measure WM capacity, three types of tasks, including reading span, operation span, and counting span, are mainly used. According to Engel de Abreu and Gathercole (2012), these tasks indicate some main aspects of cognition. Subsequently, scores obtained from such tasks may represent various cognitive functions. In fact, working memory span tests provide a measure of working memory capacity that reliably predicts performance in higher-level cognitive tasks. Particularly in this study, the researchers used the forward and backward digit span test developed by Richardson (2007) as a pretest and posttest to measure participants' working memory capacity. To reduce participants' anxiety while taking the test, the researchers applied the test in the learners' first language. Digit forward and digit backward were administered as separate tests but the number of digits correctly reproduced on each was added to give a total score. The rationale for combining the results in this way was twofold: first, the reliability of the separate scores was relatively low because only a few sequences differentiated among normal individuals; second, using separate scores for forward and backward digit span would give undue weight to digit span in the whole instrument (Wechsler, 1997). This test was reliable enough and had high internal consistency reliability (α = .74) (Gignac et al., 2017).

3.3. Data Collection Procedure

Beginning EFL learners chosen by applying the Quick Placement Test were assigned into two male and female experimental groups. Two pretests preceded the

intervention process in order to elicit the participants' working memory capacity and listening comprehension level. The results were considered as the control measurement and kept in the logbook for further comparison. Then, the working memory and the listening comprehension pretests were given to all participants in two separate sessions to mitigate the fatigue effect for better competencies measurement.

Experimental groups received an eight-week intervention program, designed by the pedagogical cycle proposed by Goh and Vandergrift (2022). The pedagogical cycle included a few stages focusing on metacognitive intervention and involved the learners in using these strategies: planning/predicting stage, first verification stage, second verification stage, final verification stage, and reflection stage. In fact, Goh and Vandergrift's (2022) pedagogical cycle comprises stages that are sub-strategies of the three main metacognitive strategies: *planning*, *monitoring*, and *evaluation*. Learners followed all five stages each week. The stages, as well as their descriptions, were presented in Table 1. The researchers explained the metacognitive intervention in the first language to help learners properly understand the stages of the metacognitive intervention. Teaching metacognitive intervention in the first language leads to more significant improvement in the overall listening performance of the learners (Fakhri Alamdari & Hosnabakhshan, 2021).

Table 1

Stages of Listening Instruction and Underlying Metacognitive Processes (Adapted from Goh & Vandergrift, 2022)

Pedagogical cycles	**Metacognitive strategies**
Pre-listening: Planning/predicting stage 11. After learners have been informed of the topic and text type, they predict the types of information and possible words they may hear.	1. Planning and directed attention
First listening: First verification stage 2. Learners verify their initial hypotheses, correct them as required, and note additional information understood	2. Selective attention, monitoring, and evaluation
3.3. Learners compare what they have understood/written with peers, modify as required, establish what still needs resolution, and decide on the important details that still require special attention.	3. Monitoring, evaluation, planning, and selective attention
Second listening: Second verification stage attention 4. Learners verify points of earlier disagreement, make	4. Selective monitoring, evaluation, and problem-solving

Pedagogical cycles	Metacognitive strategies
corrections, and write down additional details understood	
5. Class discussion in which all class members contribute to the reconstruction of the texts' main points and most pertinent details, interspersed with reflections on how learners arrived at the meaning of certain words or parts of the text.	5. Monitoring, evaluation, and problem solving
Third listening: Final verification stage 6. Learners listen specifically for the information revealed in the class discussion that they were not able to decipher earlier	6. Selective attention, monitoring, and problem-solving
Reflection stage 7. Based on the earlier discussion of strategies used to compensate for what was not understood, learners write goals for the next listening activity	7. Evaluation, planning Planning and directed attention

In this approach, stage one is the planning/predicting stage. The researchers described the metacognitive strategy and introduced the keywords in L1. They helped the students to brainstorm the listening topic with relevant explanations and examples so that they could predict the types of information and possible words they may hear. This stage helped the listeners to better understand the planning process in their regular classroom activities.

Stage two was the first verification stage in which the students listened to the CD recording for the first time to assess their prediction about the topics and words used. The first verification stage assisted the listeners in monitoring their prediction of the listening context and their firsthand understanding, as well as considering their peer listening performance. This sequential action of the listening task facilitated attention to the listening details and purposeful listening. Therefore, the notion of selective attention in listening was highlighted in this stage.

Stage three, the second verification stage, emphasized the importance of a particular metacognitive strategy, which was the monitoring strategy. After listening to the audio for the second time, the listeners realized that they misunderstood some points in the first verification stage. Activity in this stage helped the listeners to assess their listening problems through a monitoring strategy. After that, they shared their listening performance with their peers which allows them to monitor each other's performance.

Stage four, the final verification stage, provided listeners with the opportunity to

engage in purposeful listening, focusing on the specific points they did not decode correctly or fully in the second verification stage.

Stage five was the reflection stage. In this phase, listeners reflect on the metacognitive strategies used during the listening task and how they were used.

After the treatment, two posttests, including the working memory capacity test and the listening comprehension test, were administered on two separate days as the posttests of the study. The results of participants' posttests for each group were recorded in a logbook for further comparison with the pretest results.

3.4. Data Analysis

Regarding the first research question, focusing on the effect of MI in L1 on EFL listeners' working memory, the researchers conducted pretests and posttests. Responding to the second research question, in which gender was also considered to see how the MI in L1 affected the male and female EFL learners' working memory and listening comprehension, the researchers applied an independent sample t-test to answer the research question, comparing the scores of female and male participants' working memory and listening comprehension when they received metacognitive intervention through L1. An independent sample t-test indicated whether there was a statistically significant difference in the mean score of the two groups or not (Gerald, 2018).

4. Results

Prior to comparing the performance of the male and female groups, it seemed essential to check the assumptions of independent sample tests. According to Field (2013), assumptions of using parametric statistical tests include normality of distribution, homogeneity of variances, having at least interval variables, and independence of measurements. The values of Kurtosis and Skewness and their corresponding z-scores for both groups were calculated to test the first assumption (see Table 2).

Table 2
Skewness and Kurtosis Values

	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
Female	-.112	.328	-.624	.749
Male	.165	.314	-.759	.616

Regarding the female group, the z-score of Skewness was 0.328, and the Kurtosis z-score was .624. The male group's z-score of Skewness was 0.314, and their Kurtosis z-score was .759. Comparing the z-scores against the known values for the normal distribution indicates that a value greater than 1.86 is significant at $p < .05$. As it is evident, none of the z-scores is higher than 1.86, which indicates a normal distribution of the scores. Furthermore, to examine the second assumption, namely, the homogeneity of variances, Levene's test was run, and Table 3 presents the results.

Table 3
Levene's Test Results

	Levene Statistic	df1	df2	Sig.
Based on Mean	.084	1	58	.722
Based on Median	.078	1	58	.719
Based on the Median and with adjusted df	.078	1	34.02	.719
Based on trimmed mean	.082	1	58	.720

According to Table 3, Levene's test is non-significant at $p > .05$. Thus, it is concluded that the difference between the groups' variances is not significant and roughly equal. Therefore, the assumption of homogeneity of variances is met. Since the main assumptions of the parametric test were met, the researchers followed parametric statistics (i.e. independent samples t-test) to address the research questions.

To answer the research questions of the study, we first analyzed descriptive statistics of the QPT test. The descriptive statistics of the QPT results were illustrated in Table 4.

Table 4

The Descriptive Statistics of the QPT

	N	Min	Max	M	SD
QPT	112	120	149	134.5	6.71
Valid N 112					

According to Table 4, the mean and standard deviation of QPT scores were 134.5 and 6.708, respectively. As mentioned before, based on the QPT results, 60 learners were divided into two equal intact groups: male and female learners. The descriptive analysis of the pretest and posttest of the Female Group (FG) and Male Group (MG) for their listening test and Digit Span Test was presented in Table 5.

Table 5

Descriptive Analysis of the Pretest and Posttest of FG and MG for their Listening Test and Digit Span Test

	N	Min.	Max.	M	SD
Listening pretest for FG	30	12	16	14	1.23
Listening posttest for FG	30	13	19	16	2.71
Listening pretest for MG	30	12	17	14.5	1.21
Listening posttest for MG	30	13	18	15.5	2.30
Digit Span Test pretest for FG	30	8	11	9.5	1.45
Digit Span Test posttest for FG	30	9	13	11	2.00
Digit Span Test pretest for MG	30	7	10	8.5	1.43
Digit Span Test posttest for MG	30	8	12	10	1.30
Valid N	30				

As shown in Table 5, the listening pretest score of FG for the listening test is *M* = 14 and *SD* = 1.23; and the posttest score of FG is *M* = 16 and *SD* = 2.71. The performance of MG in the listening pretest is *M* = 14.5 and *SD* = 1.21, while the posttest of this group indicates a score of *M* = 15.5 and *SD* = 2.30. In the FG for their Digit Span Pretest, *M* = 9.5 and *SD* = 1.45, while the posttest of this group indicates *M* = 11 and *SD* = 2.00. In addition, the descriptive analysis of the male group for their Digit Span pretest and posttest was calculated. In MG, for their pretest, *M* = 8.5 and *SD* =1.43, while the posttest of this group shows *M* = 10 and *SD* = 1.30.

Table 6
One Sample Independent T-test

	Test Value = 0			
	t	df	Sig. (2tailed)	Mean Difference
Working Memory	99.663	58	0.00	66.804
Listening Comprehension	66.601	58	0.00	23.821

The results of the one-sample t-test in Table 6 indicate that metacognitive intervention in L1 had a significant effect on both working memory and EFL learners' listening comprehension scores (α = 0.00, ρ < 0.05). Thus, working memory had a positively significant relationship with EFL learners' listening comprehension when they received metacognitive intervention in L1, and the first null hypothesis is rejected. The second null hypothesis indicated that gender did not have any effect on the relationship between EFL learners' working memory and listening comprehension when they received metacognitive intervention in L1. To examine this hypothesis, an independent sample t-test was conducted, and the results were summarized in Table 7.

Table 7
Independent Samples T-test Results of Male and Female Groups

Groups	N	Mean	SD	Levene's Test for Equality of Variances		t-test for Equality of Means			
				F	Sig.	t	df.	Sig.	(2-tailed)
FG	30	11.0	1.72	11.00	0.001	2.49	58	0.014	
MG	30	10.5							

According to Table 7, the mean score of the female group is 11, and the male group is 10.5, with a level of significance of .001. As the level is less than 0.05 set for the study, F (2, 58) = 11.00, (ρ < .05), the finding revealed that there was a meaningful difference between the male and female groups' performance in the posttest, verifying that gender had an effect on the EFL learners' working memory and listening comprehension when they receive MI in L1. In fact, there was a difference between male and female working memory and listening comprehension scores when

they received metacognitive intervention in L1. Accordingly, the second null hypothesis is also rejected.

5. Discussion

The present research examined whether metacognitive intervention provided in L1 has any effect on EFL learners' working memory in listening comprehension. In addition, it investigated whether gender had any effect on the EFL learners' working memory and listening comprehension when they received MI in their L1. The findings revealed that metacognitive intervention in L1 had an effect on EFL learners' working memory in listening comprehension. In addition, it was found that gender had a significant effect on the EFL learners' working memory and listening comprehension when they received MI in L1.

Regarding the first research question, one of the main justifications for the results can be attributed to metacognitive intervention. For instance, planning before listening and evaluating after listening are two strategies commonly used in listening activities and may be taught in listening instruction or improved by learners themselves as they use metacognitive strategies. Moreover, according to Goh and Vandergrift (2022), anxiety may hinder working memory and subsequently affect information processing. Therefore, providing a peaceful atmosphere where there is no fear of being evaluated aids learners in using the full capacity of their working memory. On the other hand, repeating input may make learners familiar with the content and structure of the text. As a result, their cognitive load will decrease, their attention will increase, and their working memory will be freed for a better focus on text features.

The positive effect was evident when the participants were able to retrieve, recognize, use, and transfer the metacognitive strategies. Throughout the intervention period, students learned from some classroom tasks such as comprehension, oral discussions and participation, role-plays, small debates, and written composition exercises, which took place during the course. In the first place, this finding may be accounted for by the hypothesis proposed by McNamara and Scott (2001), who state that an individual's WM problems may be due to the lack of strategies to process information. It is possible that the participants in the groups were able to incorporate and transfer the training they received; thus, enhancing their WM and ultimately their overall listening performance. On the other hand, the

strategies implemented by the groups are consistent with those described by Chein and Morrison (2010). It could be explained in this way that the nature of metacognitive strategies helps learners to improve their performance in tasks by requiring retention of information over time as their purpose is to reduce memory overload by encoding, repeating, and chunking received information.

The findings are consistent with the findings of previous studies conducted by Baker and Vandergrift (2015, 2018) in which they concluded that paying attention to metacognitive intervention helps learners to understand listening process easily and enhance their working memory capacity. However, there was an incongruity between the results of the present study and Wallace's study (2020) in which no significant relationship was found between WM and listening comprehension. This discrepancy can be allotted to the test formats used in studies and the age and level of learners.

With respect to the relationships between WMC and language learning proficiency, the finding of the present study is somehow concordant with reported findings by Shahnazari-Dorcheh and Adams (2014) as well as Christiansen (2016) in which the positive effect of WMC on some other language skills was approved. However, in those studies, some different aspects of language learning and individual differences through some cognitive approaches were taken into account. All in all, the above-mentioned studies confirmed that learners with a high capacity of working memory outperformed their counterparts with low working memory.

Regarding the gender differences addressed in the second research question of the current study, the answer is affirmative. The present study indicated that there are some gender differences in the level of metacognitive awareness. The most differences seem to firstly emerge on knowledge of cognition rather than on regulating cognition. However, some elements of both knowledge and regulation of cognition are differently related to learning according to learners' gender. It seems that males and females differently use their metacognitive knowledge and skills in learning listening process. This study also revealed that both genders used their metacognitive knowledge and skills in learning listening. Hence, metacognition skills in a specific domain could be used as an indirect assessment of performance. Even if learning goals could be easily established at a cognitive level, it is difficult to do the same thing at a metacognitive level.

The findings in this study mainly support existing literature (Cantrell & Carter,

2009; Fenfang, 2010; Logan & Johnston, 2009). Indeed, the findings of the present study are mainly consistent with previous studies that measure gender differences in using metacognitive strategies and listening performance. The role of gender in listening comprehension was investigated in the previous study (Fakhri Alamdari & Bozorgian, 2022). The results showed that female EFL learners outperformed their male counterparts in listening comprehension and metacognitive awareness. The reason was attributed to the gender differences in second language acquisition and in using metacognitive strategies differently. However, the results of the present study contradict some other research. For instance, Sperling et al. (2002) investigated the gender differences in metacognitive skills (knowledge of cognition and regulation of cognition) and revealed insignificant gender differences in these areas. These results contradict the findings of the present study. The reason may be attributed to the learners' age and level of proficiency.

6. Conclusion and Implications

This study delved into the concept of working memory and metacognitive intervention to find out their effect on EFL learners' listening comprehension across gender. Based on the obtained results, it is concluded that metacognitive intervention in L1 can improve EFL learners' listening performance and working memory. In addition, the Forward and Backward Digit Span Test can be used to measure the working memory capacity of the participants. In addition, it is argued that the gender variable had a significant effect on the EFL learners' working memory and listening comprehension. Therefore, learners with high working memory have been more cognizant of the process of listening and employed self-control and self-regulation toward orchestrating their strategy use while performing a listening task. Therefore, having used MI with high working memory helped them practice listening on their own and become autonomous listeners.

The findings may contribute to assisting language instructors to adopt strategy-based approaches in teaching listening and other language skills in order to solve some listening problems related to working memory in learning L2. Teachers should also be trained to employ pedagogical cycles of listening instruction to improve learners' listening performance. EFL learners should learn to understand the nature and purpose of working memory and metacognitive intervention. Thus, language instructors should make an attempt to enhance their awareness of enhancing working memory through metacognitive intervention. Moreover, by

applying metacognitive intervention in L1, students will be more willing to communicate and motivated to assist their peers. Furthermore, it may be important for curriculum designers and ELT policymakers to consider metacognitive intervention as an effective teaching approach and take it into account for planning curricula and designing syllabi.

Like any other research, the present study is constrained by a number of factors. There were some sorts of limitations to this study. The first one was due to the inability to control all the factors influencing learners' WM in processing language as well as their personality traits, during conducting the research. The second limitation addressed the limited number of samples due to COVID-19 restrictions. Finally, the study also encountered time constraints and was conducted through a semester of instruction; a more extended training period might increase the reliability and credibility of the results. Future lines of research may also seek to find out which aspects of listening in detail are improved through metacognitive intervention and enhancing WMC. It may also focus on the dynamic assessment of the learners' performance in listening. It would also be of benefit to the body of literature in this domain to include a qualitative feature in the research by including think-aloud protocols, self-reports, and interviews. Consideration of other proficiency levels and L1 learners' prior knowledge, and metacognitive intervention through dialogic interaction could also be of significance to future studies.

Acknowledgment

We thank the editor and two anonymous reviewers for their helpful comments on the earlier drafts of this study.

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