The Role of Working Memory in L2 Listening Comprehension

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Abstract

The role of working memory in L2 listening comprehension and its component processing was investigated. The study also investigated the extent to which this role varies across L2 proficiency levels. 150 Japanese EFL learners completed L1 and L2 digit span tasks, listening span tasks, L2 listening comprehension tasks, and a battery of L2 proficiency tasks. The correlation analysis showed that working memory capacity was related to both bottom-up and top-down processing in L2 listening, and the association between working memory capacity and L2 listening comprehension was found to be stronger in the lower-level group than the higher-level group. The results indicate that WM plays a greater role in controlled processing than in automatic processing of L2 listening.

Keywords

Listening comprehension, working memory

1. Introduction

WM is assumed to play a critical role in listening processing by storing the result of the listeners' comprehension as they deal with the information in a spoken discourse at the same time. However, despite the importance of WM capacity, there has so far been limited understanding of the information processing and storage function of WM, especially in the listening process. Moreover, most of the previous research on the role of WM in L2 performance has overlooked the overlap between WM capacity and L2 linguistic and processing sub-skill variables. It would be meaningful to examine the extent to which WM capacity accounts for unique variance in L2 listening comprehension after removing its variance common to STM or L2 sub-skill variables. Therefore, the study attempted to examine whether WM capacity has influence on L2 listening comprehension independently of L2 linguistic knowledge and processing skills across different L2 proficiency levels. The research questions addressed in the present study were:

RQ1: Does individual difference in WM capacity and STM capacity influence L2 listening comprehension and L2 linguistic knowledge and processing sub-skills?

RQ2: How does the role of WM differ across L2 proficiency levels?

2. Methodology

2.1 Participants

Participants in this study were 150 Japanese 1st and 2nd year students from a technical college in Japan. Their major was English language.

2.2 Instruments

The present study focuses on both storage and processing components of working memory capacity. L1 WM capacity was measured through the Japanese version of Listening Span Test (henceforth, LST) (Endo & Osaka, 2011). L2 WM capacity was measured through the ESL version of LST developed by Ushiro and Sakuma (2000). Short–term memory (henceforth, STM) capacity was measured through L1 and L2 random Digit Span Tests (henceforth, DST) carefully pilot tested and recorded by Joyce (2008). The listening section of TOEIC IP test was used as an indicator of L2 listening comprehension. From the viewpoint of Joyce's (2008) research about linguistic knowledge and psycholinguistic skills as components of L2 listening, five explanatory variables identified as important in his study were operationalized: L2 vocabulary breadth, L2 phonological modification knowledge, L2 syntactic knowledge, and L2 sentence stress awareness, and metacognitive knowledge.

2.3 Procedure

The study was conducted in July 2011. The TOEIC IP test was administered to all the participants on the same day. Within a week after the TOEIC was conducted, the participants took all the other tests in their TOEIC classes, which were divided into two lessons to reduce their burden.

3. Results and Discussion

RQ 1 concerned whether individual differences in WM and STM capacity influence L2 listening processing. The results of the correlational analysis showed that WM capacity was related to both L2 listening comprehension and processing sub-skills, as shown in Table 1. On the other hand, it was found that STM capacity was associated with only L2 sentence stress awareness. It is assumed that the process of building a mental model in L2 listening may involve the attentional resource allocation aspect of the central executive in WM to a much larger extent than STM capacity.

Table 1: Correlations among the Variables (*n*=150)

	(1)	(2)	(3)	(4)	(5)
(1)TOEIC	---				
(2) L1 LST	.221**	---			
(3) L2 LST	.456**	.451**	---		
(4) L1 DST	.028	.181*	.106	---	
(5) L2 DST	.094	.249**	.198*	.434**	---
Vocabulary	.766**	.217**	.400**	.118	.054
Stress	.391**	.335**	.403**	.165*	.175*
Syntactic	.718**	.216**	.430**	.110	.110
Phonological	.811**	.155	.486**	.133	.110
Metacognitive	.332**	.156	.331**	.085	.156

Note. *p<.05, **p <.01

RQ 2 concerned how the role of WM differs across L2 proficiency levels. To examine the influence of L2 proficiency on the role of WM, the participants were divided into two groups according to their performance on the TOEIC listening test scores. The top 50 participants were regarded as the higher-level group, and the bottom 50 participants were regarded as the lower-level group.

The correlations for each proficiency group are shown in Table 2 and Table 3. There were found to be some marked differences between the two sets of correlations. Most notably, the correlations between WM capacity and L2 listening comprehension were greater than the corresponding correlations in the higher-level group.

Table 2: Correlations among the Variables for the Higher-level Group (*n*=50)

	(1)	(2)	(3)	(4)	(5)
(1)TOEIC	---				
(2) L1 LST	.039	---			
(3) L2 LST	.148	.278	---		
(4) L1 DST	.010	.084	.028	---	
(5) L2 DST	.025	.307*	.136	.438**	---
Vocabulary	.594**	.053	.055	.223	-.014
Stress	.166	.135	.243	.112	.018
Syntactic	.618**	.067	.206	.148	.066
Phonological	.531**	-.159	.264	.214	-.119
Metacognitive	.360*	.164	.316*	.098	.294*

Note. *p<.05, **p <.01

Table 3: Correlations among the Variables for the Lower-level Group (*n*=50)

	(1)	(2)	(3)	(4)	(5)
(1)TOEIC	---				
(2) L1 LST	.477**	---			
(3) L2 LST	.370**	.361*	---		
(4) L1 DST	.267	.253	.263	---	
(5) L2 DST	.258	.460**	.320*	.717**	---
Vocabulary	.174	.086	.224	.160	.154
Stress	.410**	.335*	.285*	.334*	.357*
Syntactic	.380**	.288*	.342*	.233	.201
Phonological	.210	.252	.489**	.450**	.538**
Metacognitive	.043	-.023	-.036	.324*	.139

Note. *p<.05, **p <.01

Next, the hierarchical regression analysis was performed. In the case of the lower-level group, WM capacity still accounts for significant variance in L2 listening comprehension even after adjusting for L2 linguistic sub-skill and STM variables, as shown in Table 4.

Table 4: Summary of Hierarchical Regression for the Lower-level group (*n*=50)

	Predictors	β	R^2	R^2change	*F* change
1	Syntactic	.276*	.159	.159	9.056**
2	L1 LST	.291*	.302	.073	4.832*

Note. *p<.05, **p <.01

These findings suggest that limited capacity of WM may affect L2 listening comprehension when L2 linguistic knowledge and processing skills are not efficient enough. Beginner-level listeners need to devote more cognitive resources to process what they hear in each phase of listening. Therefore, WM capacity related to attention control and processing efficiency possibly affects the L2 performance of the lower-level listeners. Another reason would be that the WM capacity of lower-level listeners got predominated by controlled processes involved in L2 listening. The difference across proficiency levels can be understood to reflect different levels of automatization of L2 listening processing.

References

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