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Recent studies into working memory capacity and L2 reading comprehension

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ABSTRACT. *Working memory capacity, commonly believed to be much related to reading ability, has been looked into by previous studies in its positive relationship with L1 reading ability. Whereas, more recent studies explored its relationship with L2 reading ability. Through the a review of the recent studies into the relationship between working memory capacity and L2 reading ability from the perspectives of measurement instruments, test performance scoring, interaction and manipulation of other factors, this paper tries to reveal the findings, complexities, and direction for future research.*

KEYWORDS: *working memory, L2 reading ability, measurement*

1. Introduction

The process of reading comprehension occurs in working memory [1], "a limited capacity system allowing the temporary storage and manipulation of information necessary for such complex tasks as comprehension, learning and reasoning" [2]. Previous studies found positive correlation between working memory capacity and L1 reading comprehension [3] [4] [5]. Recent ones began to look into that between working memory and L2 reading. Through a breif review of several recent studies, this paper intends to reveal the findings, complexities, and direction for future research in this field.

2. Working memory and L2 reading

2.1 Conceptualization of working memory

There is a consensus on the conceptualization of working memory capacity that adopts Baddeley's four-component construct: the phonological loop, the visuospatial sketchpad, the central executive, and the episodic buffer, which views central

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executive as the most important component [6]. It is also agreed that working memory is a limited attention resources for information processing and storage independent of languages [7].

2.2 Measurement instruments

The measurement of working memory capacity shows slight variation though a trend of unifying is found.

Agreeing central executive as a core in the functioning of working memory, Daneman & Carpenter's reading span task (RST) [12] was adopted in most studies as measurement instrument. Early studies as [10] and [13] adopted it directly. However, [4] and [6] later criticized it for using only read-aloud and recall tasks, which measures only storage aspect of working memory but neglect the processing aspect. Then an improved composite RST model [5] was adopted where comprehension tasks were introduced to tap processing capacity, though there were adaptations such as the inclusion of grammaticality judgement and recall tasks in [7] [8] [9], logical judgemente of animate/inanimate subject-verb collocation and recall tasks in [14], content true or false judgement and recall tasks in [15], tense identification and words recall in [16], and sentence judgement and words recognition in [17].

However, some scholars expressed doubts about validity of reading span test, questioning whether the correlation was found because the reading span task taps cognitive process of temporary storage [4] [6] [7] [8] [9] [10] [11]. This opens future research direction into the cognitive resources drawn on by reading tasks and memory.

2.3 Test performance scoring

In most studies working memory capacity is calculated based on the scoring of both accuracy (the indicator of processing capacity) and words recalled (the indicator of storage capacity) [6] [7] [9] [18] [19]. However, in some other studies, response time was introduced as another dimension of scoring to minimizesthe trade-off strategy [10] [14] [15] [16] [17].

For similar reasons, [18] suggested the introducing of cognitive load by means of stress imposed by the presence of a video camera. However, [18] also doubted the positive effect of stress on measuring low L2 working memory capacity group, in that the longer time used may damage their short-term information storage so that they are compelled to use this trade-off strategy.

2.4 Positive relationship established between working memory and L2 reading

Though the research design may vary, positive correlation between working memory capacity and L2 reading was found in most studies. From the perspective of

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knowledge presentation, [14] established positive relationship between L2 verbal working memory and L2 structure building. Operationalizing the construct of reading comprehension into literal comprehension and inferential comprehension, [8] found consistent meaningful relationship between reading span and inferential comprehension, but not literal comprehension. Distinguishing between the role of explicit and implicit knowledge, [9] found significant positive relationship between L2 reading comprehension and explicit knowledge but not between implicit knowledge. Surveying into thematic inferential processing and L2 reading comprehension, [15] established positive relationship between working memory and reading ability.

3. Interaction and manipulation of other factors

3.1 Interaction of other factors

However, some other studies explored contribution to L2 reading by other factors. [10] indicated receptive vocabulary, rather than working memory, as most related to inference capacity, which functions a determining predicator of L2 reading comprehension. [16] found topic familiarity as the most significant predicator for L2 reading comprehension, arguing that working memory capacity compensates for topic unfamiliarity and that the effect of working memory was not significant when topics are familiar. [8] revealed significant relationship between working memory capacity and L2 reading comprehension and content familiarity between and L2 reading comprehension. [17] revealed no significant relationship between working and L2 reading comprehension. However, considering that the participants were allowed to preview a video and listen to audio narration before reading and to look up vocabulary during reading, this study contributed more in pointing to future research into the interaction of compensation tactics between working memory capacity. A few other studies also probed into the strategies used to compensate low working memory capacity such as longer response time [15] and testing strategies [19].

3.2 Manipulating other factors in working memory test

There has not been agreement on if and when to include readers' schema (topic/content knowledge) [20] in the experiment design. However, it is suggested that we include schema factors when interaction relationship with working memory is surveyed but remoev them when individual contribution of working memory is surveyed.

Text genre selected for reading comprehension tests were not consistent. Most studies chose narrative genre, but some of them such as [19] and [21] chose expository genre to minimize the influence of participants' prior knowledge.

Another factor that is not consistent is text availability during reading comprehension test. [6] [8] [19] provided chances for the participants to refer back

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to the text, while others did do so. To eliminate this effect, [19] suggested the use of offline reading test to minimize the chances of strategy use by the participants.

One more complexity lies in the response format of reading comprehension tasks. The most often used format is multiple-choice questions such as Nelson–Denny reading comprehension test. However, multiple-choice questions are not without problems. Some studies attempted to adopt limited produce questions [22] such as summary completion task [14], reading comprehension followed by a written recall protocol in participants' L1 [16].

This, however, raises another question, i.e., whether tasks should be designed in readers' L1 or L2. Most studies reviewed designed tasks in readers' L2. However, tasks taken in both L1 and L2 is also suggested [6].

Another complexity lies in subjects' different language backgrounds. [23] found the scores for German working memory to be higher than that of French for German-French bilinguals. [24] found Korean-English bilinguals score lower in phonological memory test on Korea. Subjects of more bi-lingual backgrounds, especially that outside Indo-European family, or not phonological orthography need to be included in future research.

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4. Conclusion

A review of recent studies suggests a consensus on the conceptulization of working memory and a positive relationship between working memory and L2 reading comprehension. Improved versions of RST is generally taken as the measurement instrument; however, intervention of cognitive process on reading span tasks needs to be taken into consideration by future studies. Accuracy and words recalled are generally scored during the test, while response time and cognitive load are suggesed to be included with caution. Studies suggested the interaction of other factors such as topic familarity, text genre, text availability, response format, and subejects' language backgrounds that contribute to L2 reading comprehension, which need to be considered in future reseach design.

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