The Effects of LWR (Listening While Reading) and Intrinsic Cognitive Load on L2 Reading Comprehension

Peter Kim
Teachers College, Columbia University

Abstract

This study investigated the effect of LWR and the level of passage difficulty on L2 reading comprehension. Five upper intermediate ESL students were exposed to four different treatment combinations of silent reading and LWR with low and high intrinsic load reading passages. Reading comprehension was measured by immediate recall protocol. Under the LWR condition, the total number of idea units decreased when readers were engaged with low intrinsic load passage. There was a marginal improvement in the reading scores under the LWR condition when the readers were engaged with a high intrinsic load passage. In addition, the participants' response to Likert-scale questionnaire revealed that on average, the L2 learners felt that the effect of reading along while listening to an audio had been detrimental to their comprehension.

Keywords: Listening While Reading, Cognitive Load, Reading Comprehension, Redundancy effect

Introduction

There has been relative inattention given to the role of reading in second language acquisition (SLA) as models and theories have traditionally inclined to focus on the linguistic systems of oral language (Carrell, 1988). In the past few decades, shift in focus towards reading has addressed the issues of L2 reading research and pedagogy and their implications in L2 acquisition (for example Grabe, 2009; Han & Anderson, 2009). What the research has shown is that in learning to read the L2, there are two major challenges for the L2 learner: 1) the reading problem and 2) the language problem (Nassaji, 2011). The language problem is rather self-evident. That is, the L2 learner lacks the language competence (e.g., lexical, morphosyntactic, pragmatics, etc.) to fully process and comprehend the text. Furthermore, the lack of L2 knowledge compounds its debilitating effect when the learner must simultaneously also navigate the reading problem: the sub-skills of reading comprehension. Reading is often divided into two underlying cognitive processes that are identified as lower and higher levels. The lower level skills are lexical access, orthographic processing, and morphological analysis, among others. The higher-level processes operate at the discourse level, and they include background knowledge, text model of comprehension, and inferencing (Grabe, 2009). However, the limited capacity of working memory and human cognition in general (for example, Cognitive Load Theory), presents the reading problem for L2 learners as a tradeoff between attending to form – both grammatical and phonological –versus meaning (e.g., Sweller, 1988; VanPatten, 1996).

Listening to the text being read out loud while reading along is one type of reading instruction that can ease the cognitive burden of the reader by providing the internal voicing needed to scaffold the lower-level processes of reading. This means that more cognitive resources may be directed towards higher-level reading processes and comprehension in general. Although the

literature on the benefits of listening-while-reading (LWR hereafter) practice has been extensive in the case of the emerging L1 learner (see for example, Blonder et al., 2018; Schmitt et al., 2011; Valentini et al., 2018), examination of LWR as a theoretical and empirically sound practice has been scant in the field of instructed SLA. Specifically, there is little research on the role of proficiency as an interaction variable with respect to LWR and reading comprehension. The reason why proficiency is important is that for advanced learners, lower-level processing may have already been automatized relative to beginners who are struggling with both levels of reading. This has implication on whether LWR is equally effective across all proficiency levels or its effect is selective. The purpose of this study is to fill this gap in the LWR literature by measuring reading comprehension of advanced level ESL learners after they have been exposed to LWR conditions of varying cognitive loads. Participants in the study listened while reading along low and high intrinsic load passages under the experimental condition of LWR and the control condition of silent reading. Immediate recall protocol was used to quantify the number of idea units as a measure of comprehension. Finally, a brief 5-question survey was conducted to gauge the participants' reaction and experience with LWR instruction.

Background

Definition of Terms

Listening while reading (LWR) has been also known as read-along strategy, simultaneous reading and listening, concurrent written and spoken presentation, or reading while listening (RWL), depending on the various educational and language research contexts. The term LWR specifically refers to the practice used for improving reading fluency and literacy, whereas RWL is focused on auditory discrimination, rate, rhythm and the natural flow of spoken language. In short, LWR (listening *while reading)* is focused on reading, but RWL (reading *while listening*) is focused on listening comprehension assisted by reading (Chang, 2011). Traditionally, LWR has been most commonly implemented in language classrooms as a technique of playing audiobook tapes while learners read along with the sound. In recent years, LWR has been fitted as part of a CALL (Computer Assisted Language Learning) package for L1 students of low reading proficiency or reading dysfunction (Gibson, 2009). Previous studies on LWR primarily focused on its positive effect on reading fluency while its role on reading comprehension was considered as an epiphenomenal side effect of LWR. In the following review, the role of LWR on reading fluency and its subsequent effect in comprehension are discussed.

The role of LWR in reading fluency and comprehension

Several researchers including Carol Chomsky (1976) found read-along techniques to be effective in improving reading proficiencies of below average readers (see for example, Belton, 1985; Blum & Koskinen, 1991, 1995; Carbo, 1978). Years of extensive research in the development of reading comprehension in emerging L1 students have led to better understanding on the relationship between listening and reading. The instructional strategy of LWR appears to combine the benefits of reading and listening by complementing the traditional silent reading method with an audio input that enhances the cognitive and/or linguistic processes of reading itself. Theoretically, the "Simple View of Reading Model" views phonological awareness and verbal comprehension as main contributors of reading fluency (Gough & Tunmer, 1986). And reading fluency in general is defined as the ability to read a text accurately, quickly, and with appropriate expression. The development of reading fluency includes automatization of lower-level

component skills: 1) accuracy in decoding of words in text with minimal use of attentional resources 2) and prosody, or the appropriate use of phrasing and expression to convey meaning. Regarding the first component, automaticity in orthographic recognition, rapid word naming, and phonological process as defined by Katzir et al. (2006) appear to contribute to accurate decoding at the word level. Clearly, fluency as word reading efficiency and phonological awareness, contribute to reading comprehension, and instructional practices that improve fluency are expected to improve overall reading skills and comprehension.

The second major component of fluency stresses the importance of prosody competence during reading comprehension. For example, a study by Belton (1985) examined the effects of intonation strategies and read-along techniques on reading comprehension. The author argued that an important aspect of the reading process requires the reader to supply the appropriate intonation patterns of the spoken language to the written language. Intonation was viewed as an important signaling system that aids in syntactic processing and reading comprehension. Belton concluded that training in read-along techniques improved reading comprehension. In a more recent study, Taguchi et al. (2016) looked at the role of prosody and the effect of listening to the text while reading. Taguchi and his team of researchers approached LWR as a form of scaffolding to aid reading comprehension. Their technique of interest was repeated-reading (RR) and not LWR per se. However, LWR was recognized as an element of RR, an audio model of repeated reading. Based on his twenty years of experience in the use of RR and LWR as a subcomponent to RR, he concluded that greater emphasis should be placed on the role of prosody in fluency and comprehension because prosody provided "parsing points" during syntactic parsing, and it also helped L2 learners break continuous stream of input into meaningful phrases that facilitated retrieval of their meanings (Taguchi et al., 2016). Woodall's (2010) was one of the few empirical studies that provided direct support of LWR's role on reading comprehension. An experimental group of 69 students read *Charlotte's Web* using the LWR technique while 68 students in the control group read the same book without any audiobook support. Reading comprehension was measured via 8 quizzes, and the results showed that the control group outperformed on all quizzes. Participant questionnaire also revealed that many felt the LWR technique helped them understand the book better, remember the text better, and helped them increase their reading speed (Woodall, 2010).

Woodall (2011) discussed three possible explanations on why LWR would support reading comprehension. First, from a cognitive point of view, lighter processing load and more processing capacity afforded by the automatic decoding provided by the audiotape may have contributed to increase in comprehension. He argued that the burden of decoding is large for beginning L2 readers while it is relatively small for advanced readers. Hence, simultaneous reading and listening may have helped low level L2 readers' comprehension by lessening their cognitive load. Increase in reading fluency (provided artificially by the audiotape) could have facilitated the learners' reading comprehension, assuming that the decoding process is distinct from comprehension processing. Second, even if one assumes that comprehension and decoding are not distinct but interconnected tasks, the Dual Route Theory of reading (Coltheart, 1978) proposes that reading comprehension is facilitated by sight word recognition *or* phonological recoding, which would be facilitated by the use of an audiotape. However, citing Ehri (1992), Woodall argues that word recognition *contains* phonological trace, and thus word recognition and phonological trace are not mutually exclusive but complementary. In other words, the sound of the word is inseparable from its meaning. Therefore, when a beginning level reader struggles on the phonological trace, the meaning of the word can become elusive. According to Woodall's interpretation of Ehri's concepts, "fluency itself

is part of comprehension" (Woodall, 2010, p.197). Third, the author referred to Vygotsky's zone of proximal development (ZPD) as a possible explanation for the effects of LWR. The audio recording's role is likened to the role of a more experienced and knowledgeable assistant in a sociocultural learning perspective. The fluent reading by the audio helped the reader to decode and reach a higher level of fluency than he or she is capable of doing alone. In this sense, the audio is seen as an intervention by a more experienced mentor similar to a way a human teacher would model a passage by modeling for the class. A mechanical device may have fulfilled this social role and as a result, helped to push the learner into his or her ZPD.

Differential effects of LWR

As alluded to by Woodall's (2010) discussion on LWR, not all researchers agree that LWR is beneficial for all L2 learners and that the effect of LWR may have differential effects based on the characteristics of the learner. For example, a study by Cloer and Denton (1995) examined the effect of LWR on L1 reading comprehension with three experimental groups based on reading proficiency: below average, average and above average. All three groups were subjected to silent reading and reading & listening treatment. Reading comprehension test was given following the treatment. For all three groups, the mean scores for two different treatments resulted in near identical scores. Although statistically insignificant, there was a slight increase in the scores for below average readers. Surprisingly, for the above average group, the mean score was significantly lower for the LWR treatment. Based on the findings the authors questioned the appropriateness of using the LWR strategy for all levels of reading proficiency, and suggested that only the less competent readers would benefit from LWR. One possible explanation as to why the competent reading group's scores declined while the below average group increased, was that LWR may have helped the struggling readers with fluency, but it may have interfered with competent reader's cognitive processes due to the simultaneous presentation of input from two different modalities.

Redundancy effect of LWR

In Diao and Sweller's (2007) study, they investigated the "redundancy effect" in reading comprehension of participants subjected to concurrent written and spoken presentations. Diao and Sweller hypothesized that based on the Cognitive Load Theory, concurrent written and spoken input imposes an extraneous cognitive load that interferes with reading comprehension. If either the visual or the auditory input complement each other, then learning is hypothesized to be enhanced by the dual-mode presentation of reading and listening. However, if both channels provide identical information, then elimination of redundancy leads to enhanced learning. The authors acknowledged that their stance contradicts the popular literature on the benefits of LWR. The authors attributed this discrepancy to the claim that past research had primarily focused on the benefits of RWL that measured listening assisted by written text and not LWR that measured reading comprehension. Thus, while Diao and Sweller (2007) acknowledged the benefits of RWL, they raised doubts on LWR due to the "redundancy effect" that accompanies its practice. In their study one group of participants received written and spoken forms currently, while the second group received only reading materials. The results of the study supported their hypothesis that concurrent form of written and spoken text interfered with comprehension. At the lexical level, LWR group gained less vocabulary than the reading-only group, and at the comprehension level, participants reported a higher cognitive load with lower understanding and recall. The adverse effect of LWR was greater when the passage conveyed high intrinsic load content. Specifically, passages that contained more complex syntax and complex discourse structure that required higher

cognitive processing resulted in more severe interference from the redundancy effect (Diao & Sweller, 2007).

Summary of literature

One major finding in literature was that large number of studies have shown positive correlation between reading comprehension and LWR practice. However, a more nuanced approach that distinguish low level reader from an advance level reader have shown both gains and losses on reading comprehension. In fact, a small number of researchers (e.g. Cloer & Denton, 1995; Diao & Sweller, 2007) have shown that LWR may actually be harmful to reading comprehension due to the distracting and cognitively extraneous nature of the redundancy effect. Diao and Sweller (2007) provided a more theoretical rationale in their disapproval of LWR technique by invoking the Cognitive Load Theory that refers to the relationship between working memory and mental effort (Sweller, 1988). According to Diao and Sweller (2007), simultaneous presentation of written and oral English for the purposes of comprehension is detrimental because the redundancy of spoken and written modalities increases the cognitive load of the task. Sweller's (1988) theory is best applied in the area of instructional design of learning materials that are cognitively challenging or complex. According to Sweller, there are three types of cognitive loads that pertain to instructional material. This study will examine one of three types, the intrinsic cognitive load of the reading material. Intrinsic cognitive load is the difficulty of the content conveyed by the instructional material. It is a level of difficulty that cannot be altered by instructional intervention unless the exact text itself is modified. In short, low cognitive load materials are easier to read and understand because it requires less cognitive effort from the reader, whereas high cognitive load materials are more difficult to read because it requires more cognitive effort in order to understand the meaning of the passage. Also, a large number of studies on LWR have focused on emerging L1 readers and L2 readers of lower proficiency levels that measures fluency and comprehension. What is currently lacking in research is the effects of LWR on upper-intermediate to advanced adult ESL learners' reading comprehension.

The purpose of this study is to explore the effects (positive, negative or none) LWR has on reading comprehension of low and high intrinsic load of advanced adult ESL learners, and in so doing broaden our understanding of a method that has resulted in conflicting findings as reported.

Method

The current study was a small scale, quasi-experimental classroom-based study. There were two research questions that were inspired by Diao and Sweller's (2007) study on the negative effects of LWR on reading comprehension due to the redundancy effect.

1) How does LWR affect the reading comprehension?
2) How does the intrinsic cognitive load of the reading passage moderate the effects of LWR on reading comprehension?

In this study, the dependent variable was the LWR treatment and the intrinsic cognitive load of the reading passage was treated as a moderating variable that either enhances or diminishes the effects of LWR on reading comprehension. Silent reading (SR) treatment was used as the control to compare with LWR treatment.

Participants

The participants of the study came from an upper-intermediate ESL class. All participants (N=5) were non-native speakers of English tasked with learning English as a second language. Each participant was placed in his/her ESL level based on CEP's diagnostic test which comprised of a speaking section, computerized reading comprehension section, a grammar section, and a writing section. The combined score of four assessments were used to place each participant in ESL levels that were based on the Common European Framework of Reference for Languages (CEFR). CEFR demarcates three broad levels: basic user (A1, A2); independent user (B1, B2); and proficient user (C1, C2). All participants of the study scored either B2 or C1 and subsequently placed in upper-intermediate 3 class (UI-3) bordering on C1 (University of Cambridge, 2011). A total of six students are enrolled in the UI-3 class. The class is a 10-week course that meets three times a week, Monday, Wednesday and Thursday for two hours each. Accounting for probable inconsistencies in data collection due to absences, five out of six participants (n = 5) were selected for the current study. The five participants comprised of three male students and two female students with diverse professional and ethnic background. All subjects in the study have indicated that they have had over 10 years of instructed ESL in their native countries.

The reading materials and instrument

Reading materials for silent reading and LWR were taken from educational online sources. As upper-intermediate ESL students, their reading level places them in the approximate readability score range of Flesch-Kincaid grade level 5.5, Automated Readability Index of 4.3 and average grade level of 6.5 and a TOEIC reading score of 385-450 (University of Cambridge, 2011). Two reading passages each for LWR and silent reading that fit this range were selected for treatment for a total of four reading passages. Two readings passages were identified as "easy" or low intrinsic load passages and two reading passages were chosen as "difficult" or high intrinsic load passages. Low intrinsic load (LIL) was operationalized as straightforward and factual prose that does not require synthesis or inferencing from the reader beyond the sentence level in order to process the passage. On the other hand, high intrinsic load (HIL) passages require more than replication to reproduce the passage. These passages require reflection while reading and checking for understanding and synthesis at the paragraph level. The first LIL reading passage was titled "Benefits of Reading" (see Appendix A). The second LIL reading passage was titled "History and Culture of Native Americans" (see Appendix B). The other two passages were selected for the difficulty of the content, i.e., high intrinsic load. One was titled "The Turing Test" (see Appendix C). The last reading passage was titled "The Paradox of Unanimity" (see Appendix D).

To gauge the effect of LWR from the reader's perspective, there was a questionnaire with 5 items on a Likert scale of 1-5. Each student was asked to respond to each statement with strongly disagree, disagree, neutral, agree, and strongly agree on a scale of 1-5 respectively. The five items were the following statements: 1) Reading and listening to the reading passage at the same time helped me to read faster in English; 2) the audio reading speed was too fast; 3) Hearing the pronunciation in English helped me to understand the passage better. 4) I can concentrate and understand the reading better when I'm reading silently compared to listening and reading at the same time. 5) Listening to the audio distracted me from trying to understand the passage.

Procedure

The dependent variable of LWR and control of silent reading (SR) were combined with low and high intrinsic load reading passages to create four treatment conditions. All four treatment conditions were conducted on different days of the class. The first treatment condition was a silent reading of a low intrinsic load passage (SR-LIL). The participants were given enough time to read the passage at least twice. The time required to read the passage twice was estimated by the instructor by silently reading the passage twice slowly and timing himself. After the time was up, readers were told to turn the reading passage over and write as much as they can remember and understand about the passage. There was no time constraint for the immediate recall protocol. The second treatment condition was a listening while reading (LWR) condition on a low intrinsic load passage (LWR-LIL). The participants were given a passage about the history and the culture of Native Americans. They were told to read along with the audio recording of the same passage. The audio was played twice, and afterwards the participants were subjected to immediate recall protocol. The third treatment was a silent reading of a high intrinsic load passage (SR-HIL). Same procedure as SR-LIL was carried out but with a different reading material. The final treatment was a listening while reading a high intrinsic load passage (LWR-HIL). The same procedure as LWR-LIL was carried out but with a more difficult reading passage. Table 1 below summaries the four treatment conditions.

Table 1

Summary of four treatment conditions

Silent Reading (low intrinsic load)	**Silent Reading (high intrinsic load)**	**LWR (low intrinsic load)**	**LWR (high intrinsic load)**
Topic*: Benefits of Reading* Word Count:408 Time to Read: 7:06	Topic*: The Turing Test* Word Count: 400 Time to Read: 7:00	Topic: *History and Culture of Native Americans* Word Count: 372 Time for LWR:6:06	Topic: *The Paradox of Unanimity* Word Count:422 Time for LWR 6:20

As the literature on testing reading comprehension recommends, multiple choice questions often do not adequately measure one's reading comprehension due to poor question designs that are passage independent or designed as mere word recognition and matching exercise (Bernhardt, 1983). As a result, reading comprehension was operationalized by the use of immediate recall protocol. The immediate recall protocol similar to the one implemented by Bernhardt was be used to measure each participant's reading comprehension. An "answer key" instrument listing all possible idea units for each passage was used to score each subject's protocol. This was constructed by slashing each passage into meaningful idea segments. Approximately, idea units were realized as clauses. Scoring involved awarding a point for each idea unit expressed by the protocol, allowing for leniency on grammar and spelling as long as the intended meaning was evident. For low intrinsic load with – LWR treatment, this amounted to the total number of benefits of reading listed by the protocol. For low intrinsic load with +LWR, this amounted to the total number of facts about Native Americans listed by the protocol. For high intrinsic load with – LWR, readers' depth of understanding was noted in addition to the numeric total of idea units generated by the

protocol. Also, individual scores for four treatment conditions were graphed in order to observe any positive or negative effects from one treatment condition to another.

Results

Table 2 gives the idea-unit scores, means and standard deviation for each treatment of SR-LIL, LWR-LIL, SR-HIL, and LWR-HIL. Idea-unit scores for each student under each treatment was recorded, and the mean and the standard deviation were calculated in order to estimate the participants' overall performance and variance under the four different conditions. All participants in the study had indicated that the topics on the reading passages were unfamiliar to them after the treatment. However, there was one exception. Participant number 3 was a case of an outlier. He was a professor of computer science who was very familiar with the topic on the Turing Test. As a result, his score was omitted from the data because it was deemed as a measure of his background knowledge which may confound with the measure of his reading comprehension.

Table 2
Idea-Unit Scores; Means and Standard Deviations of Idea-Unit Scores for Each Treatment

Participants	LIL-SR	LIL-LWR	HIL-SR	HIL-LWR
Student 1	28	24	24	16
Student 2	12	10	9	12
Student 3	12	15	*	14
Student 4	18	8	9	12
Student 5	17	14	15	22
Mean	17.40	14.20	14.25	15.20
SD	6.54	6.18	7.08	4.14

*Note. LIL-SR = Low Intrinsic Load – Silent Reading; LIL-LWR = Low Intrinsic Load – Listening While Reading; HIL-SR = High Intrinsic Load – Silent Reading; HIL-LWR = High Intrinsic Load – Listening While Reading. *HIL-SR score for Student 3 was removed from the data due to the student's expert prior knowledge in the topic.*

Under the LIL-SR treatment, the participants displayed the highest number of idea-units compared to the other conditions (mean= 17.40) with a relatively high SD of 6.54. The idea-unit scores decreased when the LIL condition was kept constant but the method of administration was changed from silent reading to listening while reading. The LIL-LWR treatment resulted in a mean of 14.2, a decrease of 3.2 from the silent reading treatment. The average score under the HIL-SR condition was 14.25, which was similar to the mean score of LIL-LWR. Keeping the method of administration constant at silent reading, the change in intrinsic cognitive load resulted in a decrease of 3.15 as the passage went from low intrinsic load to a high intrinsic load. Or in other words, the average score of idea-units decreased by 3.15 when the participants silently read the passage with the higher intrinsic cognitive load. For the two conditions under high intrinsic load, the difference in SR and LWR resulted in an average increase of 0.95 idea units. Participants on average gained about one idea units when the method was changed from SR to LWR under the high intrinsic cognitive load condition. Overall, LIL-SR treatment appeared to be most productive

(mean =17.40), while the LIL-LWR to be least productive (mean= 14.20). Highest instance of deviation in scores was found under the HIL-SR (SD= 7.08), while the lowest deviation from the mean was in HIL-LWR (SD= 4.14).

Next, each student's idea-unit scores were compared under the conditions of SR and LWR for LIL passage and SR and LWR for HIL passage (figure 1 and figure 2). The effect of intrinsic load on silent reading comprehension was measured by comparing idea-unit scores for LIL and HIL under the SR treatment (figure 3). The effects of intrinsic load on listening while reading was measured by comparing idea-unit scores for LIL and HIL under the LWR treatment (figure 4).

Figure 1. *Comparison of SR vs. LWR in Low Intrinsic Load Passage*

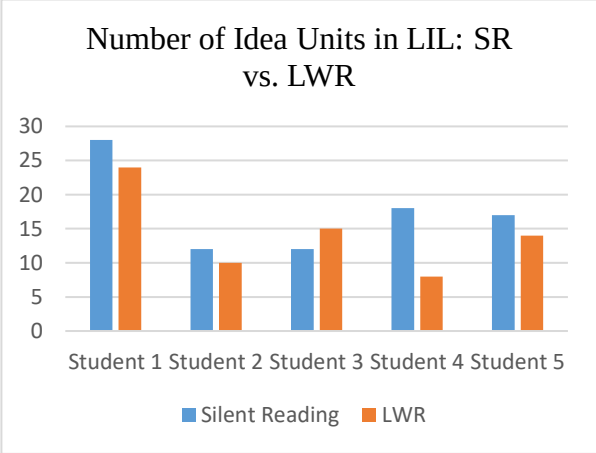

Figure 2. *Comparison of SR vs. LWR in High Intrinsic Load Passage. Note. SR data for Student 3 was removed due to his prior knowledge in the topic.*

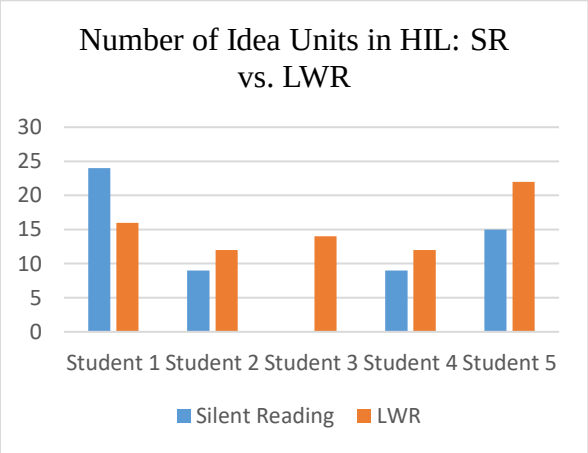

Figure 3. *Comparison of LIL vs. HIL in Silent Reading.*

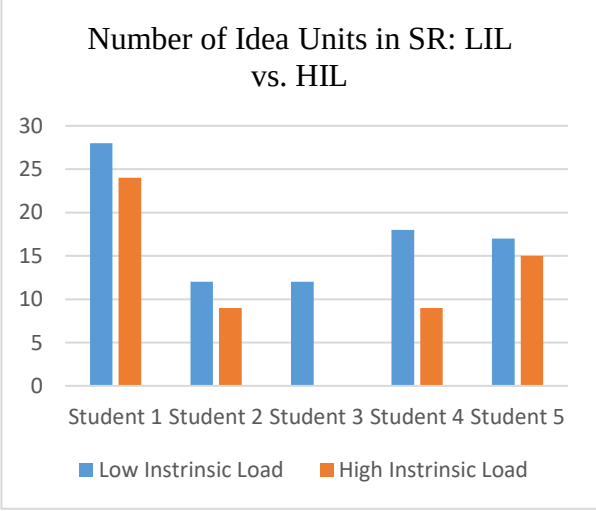

Figure 4. *Comparison of LIL vs. HIL in Listening While Reading.*

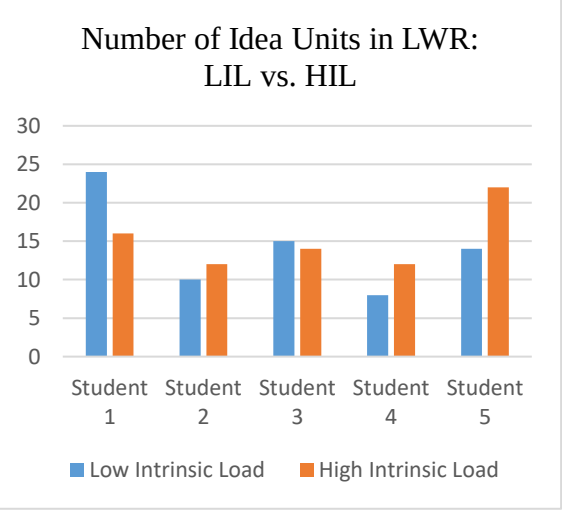

Figure 1 shows that for the low intrinsic load passage, four out of five participants' reading scores decreased as the method of reading changed from SR to LWR. One student showed improvement in reading comprehension by three idea units. Figure 2 shows that when reading the high intrinsic load passage, three out of four participants' reading score increased as the condition changed from SR to LWR (student 3's score omitted). The lone exception was Student 1 who showed drastic decrease of 8 idea units under the same condition. Figure 3 shows the changes in silent reading score when low intrinsic load passage is compared with high intrinsic load passage. All four students showed decrease in idea-unit scores when the passage changed from low to high intrinsic load. In Figure 4, comparing the LWR scores of low intrinsic load passage and high intrinsic load passage revealed a mixed result. Three out of five students' scores increased while the remaining two decreased in their scores. The overall effect of increase (14 idea units) was larger than the overall effect of decrease (9 idea units).

Lastly, in table 3 below, the Likert Scale Questionnaire Scores were tabulated with their mean and stand deviation for each question.

Table 3

Likert Scale Questionnaire Scores, Mean and Standard Deviation

Participants	Q1: Reading and listening to the passage at the same time helped me to read faster.	Q2: the audio was too fast.	Q3: hearing the pronunciation of words helped me understand better.	Q4: I can concentrate and understand better when I'm reading silently.	Q5: LWR distracted me from trying to understand the passage.
Student 1	4	2	3	3	3
Student 2	2	2	3	4	4
Student 3	2	3	3	3	3
Student 4	2	3	5	5	5
Student 5	5	4	3	5	5
Mean	3	2.8	3.2	4	4
SD	1.41	0.83	1.09	1	1

Note. 1= Strongly Disagree; 2= Disagree; 3= Neutral; 4= Agree; 5= Strongly Agree

Questions 1 through 3 generated a neutral response on average. Also, on average, questions 4 and 5 seem to indicate agreement to the statements that viewed LWR negatively. Overall the deviation of scores among the five participants were relatively similar. Only question 1 showed the largest deviation with a range of 3 points on the Likert scale.

Discussion

One of the most important premises of this study was the operationalization of the concept of an intrinsic load as it pertains to a particular reading passage. Intrinsic load was operationalized as the difficulty of the passage based on the level of inferencing required. It was assumed that low intrinsic load passages required retrieve of factual information, but high intrinsic load passages required deeper level of inference at supra-sentential level of paragraphs. There is some evidence found in Figure 3 that the passages were effective in discriminating low intrinsic load versus high intrinsic load. That is, the high intrinsic load passages were more difficult. Figure 3 shows that the overall score of reading comprehension decreased as the passage became more intrinsically difficult. The highest mean score on the LIL-SR supports the assertion that in general, the readers found the LIL-SR passage to be the easiest to read and recall. Therefore, assuming that the HIL required more processing from the reader, the effects of LWR on decreasing the passage's intrinsic burden or increasing it by being a distraction can be inferred.

Regarding the first research question, "how does LWR effect L2 reading comprehension?", when the participants read a low intrinsic load passage, their overall score decreased, except for one student who showed a slight improvement. However, under the high intrinsic load condition, the LWR method resulted in improvements for three out of four students (figure 2). Under the LWR conditions, three out of five students showed improvements in their reading score compared to a LIL passage (figure 4). It appears that for LIL passages, the LWR was a distraction that lowered their overall performance. However, for the HIL passage, the LWR facilitated the reader's comprehension and resulted in a higher reading score. When the passage was intrinsically more difficult, listening to the reading of the passage while reading along may have helped the participants to understand the passage better but not when the passage was relatively easy.

The conflicting finding on the effect of LWR for LIL versus HIL is puzzling but not unprecedented. As previously mentioned in the literature review, a study by Cloer and Denton (1995) similarly resulted in a slight increase in the scores for below average readers but for the above average group, the mean score was significantly lower. The current study's result is analogous to Cloer and Denton's findings in that the effect of LWR treatment was not uniform but discriminatory in task intrinsic load. Just as Cloer and Denton's study showed that the effect of LWR differed among low and high groups, the effect of LWR differed under low and high intrinsic load conditions in this study. If LWR had a redundancy effect for high level readers in Cloer's research, it may have been due to the audio version providing no additional information to the reader, hence the redundancy. However, for the low-level reader, the audio presentation of the passage was not redundant but helpful for comprehension. In the same vein, in the current study, LWR had a discriminating effect that revealed differences under LIL versus HIL. When the reader's skill level was relatively higher than the passage's intrinsic level, LWR can be a source of redundancy, which might explain why the LWR treatment led to a decrease in reading comprehension scores. When the reader's skill level was lower than the passage's intrinsic level, the audio of the LWR is no longer redundant but helpful.

Interestingly, the results of the questionnaire that asked how the participants felt about LWR did not match empirical data. The results of the questionnaire show that for most participants, LWR did not facilitate their reading of the passage. For question 3, four out of five participants felt that listening to the pronunciation of words did not affect their comprehension. On question 4, three out of five students said they were able to concentrate and understand better during silent reading. On question 5, three out of five said that LWR had distracted them from trying to

understand the passage. In fact, between question 4 and 5, no one responded in favor of LWR or in disfavor of silent reading. Those who didn't endorse LWR remained neutral. In short, even though the reading scores improved for most participants under the LWR conditions, the participants felt that listening while reading did not help them with their comprehension. One particular response by student 4 illustrates this apparent contradiction expressed by the group. On question 3, student 4 was the only one who responded that listening to the pronunciation of words helped her with comprehension. However, on questions 4 and 5, she strongly agreed that LWR had distracted her and that she can understand better when she reads silently. One possible explanation for this is that the two seemingly conflicting responses may not be mutually exclusive and there may be a deeper level of overlap between the two constructs. Also, readers may not have been consciously aware of the facilitating effects of LWR on reading comprehension. The data shows that regardless of how ineffective the LWR method may have appeared to the participants, there were at least *some* facilitating effects of LWR on reading comprehension.

Conclusion

The purpose of the study was to examine whether LWR facilitated reading comprehension for advanced ESL students whose proficiency may have obviated its benefits towards lower-level processing. The study showed that when the reading passage is relatively easy, LWR can be accompanied by redundancy effect that distracts the reader from having an optimal reading experience. Nevertheless, when the passage was relatively difficulty due to its high intrinsic load, the redundancy effect accompanied by LWR disappeared and the voicing of the words had a facilitating effect on reading comprehension. This begs the question: if the redundancy effect explains the negative effects of LWR on reading comprehension under some particular conditions, then what explain its facilitative effect in others? In a similar research conducted by Diao and Sweller (2007), the redundancy effect on LWR treatment was greater on passages that required a higher cognitive load and processing. Their findings showed that LWR did not have any positive effects on reading comprehension. Instead, the effect was negative and more severe for passages that contained complex syntax and discourse structures requiring greater processing. Still, Diao and Sweller's specific choice of LWR implementation may provide a simpler explanation for why their LWR did not deliver any assistance to reading comprehension. In an effort to create appropriate materials for LWR, Diao and Sweller had used a computer program called Authorware. Authorware is a software that creates various types of learning application. The audio for LWR was created by using Authorware which utilizes a text-to-speech functionality. Using a text-to-speech software provides flexibility for the content creator, but there is a huge drawback. "Spoken" passages created by text-to-speech programs are produced by stringing together the selected words articulated in isolation. As a result, the audio is a computer-generated speech that is completely devoid of any sentential prosody. The important missing element in Diao and Sweller's LWR was the para-linguistics element of prosody, pitch, volume, intonation and emphasis that is common to all human speeches. In fact, as previously mentioned in literature review, advocates of LWR practice commonly list this element as one of the reasons why LWR is effective and beneficial for developing fluency and reading comprehension skills (Belton, 1985; Taguchi et al., 2016). It is commonly understood that a speech of an articulate orator is filled with emotions, feelings, and other pragmatic elements that add a layer of meaning on top of words. Therefore, an audio of a reading passage devoid of these elements are maximally redundant because the sound provides minimally only pronunciation of words and adds no other information that may be conveyed by

the suprasegmental features. One limitation of the study was the small number of participants that precluded any meaningful statistical analysis on the data that is beyond the sample level. Also, inherent to the small sample size is the lack of generalizability based on the findings.

Future research on LWR should further question how developing a reading fluency for prosody effects reading comprehension and shed more light on the effects of para-linguistic elements of reading and fluency. This is because a good reader has the ability to not only process and comprehend a given passage but also has the ability to imagine the prosodic elements of the writer who "speaks" to the readers through the words on a page.

Lastly, the practice of LWR has implications for pedagogy and reading instruction. First, in the traditional classroom LWR may be more beneficial to beginners and low-intermediate learners than advanced level students. This is because LWR provides the right type of scaffolding needed for those who are struggling with the lower-level processes that mostly operate at the sentential level. In fact, some ESL classes do use audio books to accompany silent reading in the classroom as a teaching tool. Nevertheless, advanced learners may find LWR to be beneficial in developing their prosody and pronunciation of the target language as well as developing listening fluency. If the focus is on comprehension, LWR could prove to be counter-productive since the advanced reader must compete with the audio in vying for attention to meaning.

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Appendix A

Reading about Reading (retrieved from https://www.stmarysdubai.com/wp-content/uploads/2016/12/REVISION-PAPER-Year-5-English-Language.pdf)

Did you know that some people don't do their reading assignments? It's shocking, but it's true. Some students don't even read short texts that they are assigned in class. There are many reasons for this. They may be distracted or bored. They may be unwilling to focus. They may be unconfident readers. Whatever the reason, it has to stop today. Here's why.

Reading stimulates your mind. It is like a workout for your brain. When people get old, their muscles begin to deteriorate. They get weaker and their strength leaves them. Exercise can prevent this loss. The same thing happens to people's brains when they get older. Brain power and speed decline with age. Reading strengthens your brain and prevents these declines.

You can benefit from reading in the near-term too. Reading provides knowledge. Knowledge is power. Therefore, reading can make you a more powerful person. You can learn to do new things by reading. Do you want to make video games? Do you want to design clothing? Reading can teach you all this and more. But you have to get good at reading, and the only way to get good at something is to practice.

Read everything that you can at school, regardless of whether you find it interesting. Reading expands your vocabulary. Even a "boring" text can teach you new words. Having a larger vocabulary will help you better express yourself. You will be able to speak, write, and think more intelligently. What's boring about that?

Do not just discount a text because it is unfamiliar to you. Each time you read, you are exposed to new ideas and perspectives. Reading can change the way that you understand the world. It can give you a broader perspective on things. It can make you worldlier. You can learn how people live in faraway places. You can learn about cultures different from your own.

Reading is good for your state of mind. It has a calming effect. It can lower your stress levels and help you relax. You can escape from your troubles for a moment when you read, and it's a positive escape. The benefits of reading far outweigh those of acting like a doofus So do yourself a favor: the next time you get a reading assignment, take as much as you can from it.
Squeeze it for every drop of knowledge that it contains. Then move on to the next one.

Appendix B

Native American History and Culture (retrieved from https://www.youtube.com/watch?v=XS8DEjd2QBg)

They were the first people ever to live in North America. Exactly when they came, and how they arrived is still a mystery. But many scientists believe that as long as 30,000 years ago, some hunters from Asia walked or sailed along the coast of a land bridge that once connected Russia to Alaska. Their decedents became known as Native Americans or American Indians. As they spread out over the vast continent, Native Americans adapted to living in different regions, and hundreds of unique cultures were born.

The Plains Indians hunted buffalos by stampeding them over cliffs. On the northern pacific coast, tribes like the Haida and Kwakiutl sailed the ocean and fished. They cut down giant red cedar trees for houses, dugout canoes and ceremonial totem poles. When the first white settlers arrived in the 1500s, about a million Native Americans lived north of Mexico. But the outsiders changed everything. Diseases from Europe such as smallpox, tuberculosis wiped out entire tribes. Settlers began to claim Indian lands for themselves. Some tribes resisted and fought back. Others attempted to cooperate. In the end, the result was the same. In the late 1800s, the US government forced the remaining Indians to leave their traditional homeland and live on tracks of land called reservations. Over the next century, Native Americans continued to fight for their rights through political activism.

"We were told that our religion was wrong. We were told right before our faces that we are heathens. But no more, we're going to take this."

Today, there are more than five hundred and fifty federally recognized tribes in the US. Native Americans are working to improve living conditions on the reservations and to preserve their languages, religions, and cultural identities. The pot-lash, a religious ceremony that was once banned by the Canadian government is being held again by the Kwakiutl. On the Navajo reservation, some ancient ways are blended with modern lives. This sand painting depicts the cloud people. It's being created to pray for the safety of a group traveling by airplane. Other Native American artists are reviving their tribe's traditional art forms; a movement which could help these unique cultures survive in to the next century.

Appendix C

The Turing Test (retrieved from https://www.youtube.com/watch?v=_tIIBEA0AW8)

Do computers think? It isn't a new question. In fact, Alan Turing, a British mathematician, suggested an experiment to answer the question in 1950. And the test, known as the Turing Test, is still used today. In the experiment, a group of people are asked to interact with something in another room through a computer. They don't know whether it is another person or a computer that they are interacting with. They can ask any questions that they want. They can type their questions onto a computer screen, or they can ask their questions by speaking into a microphone. In response, they see the answers on a computer screen or they hear them played back by the computer. At the end of the test, the people have to decide whether they have been talking to a person or to a computer. If they judge the computer to be a person, or if they can't determine the difference, then the machine has passed the Turing Test.

However, a machine can be programmed to produce responses that appear to be intelligent without the awareness required for thought. Therefore, a computer could pass the Turing Test if it were programmed to generate behaviors like humans. But in that case, the test wouldn't really answer our original question.

For example, if an English-speaking person receives questions on a computer from a Chinese person in another room, the English-speaking person won't understand the questions. However, if there's a large reference that is available and if the reference is detailed enough, then the English speaker could break the message. If a sequence of Chinese characters are received, the reference could suggest which sequence of Chinese characters would be expected in response.

In other words, the behavior would be correct although the English speaker wouldn't be thinking at a level that included meaning. The person would be manipulating symbols without understanding them. The person would be acting intelligent without being intelligent, which is exactly what a computer could be programmed to do. Therefore, at least in theory, a computer could be designed with complex information that would allow it to provide behaviors without being aware of what it's doing. If so, then it could pass the Turing Test, but the test itself would be meaningless because it doesn't really answer the most basic question about computer intelligence, which is, "can the computer think?"

Appendix D

Paradox of Unanimity (retrieved from https://www.youtube.com/watch?v=heCSbA8w57A)

Imagine a police lineup where ten witnesses are asked to identify a bank robber they glimpsed fleeing the crime scene. If six of them pick out the same person, there's a good chance that's the real culprit, and if all ten make the same choice, you might think the case is rock solid, but you'd be wrong.

For most of us, this sounds pretty strange. After all, much of our society relies on majority vote and consensus, whether it's politics, business, or entertainment. So it's natural to think that more consensus is a good thing. And up until a certain point, it usually is. But sometimes, the closer you start to get to total agreement, the less reliable the result becomes.

This is called the paradox of unanimity. The key to understanding this apparent paradox is in considering the overall level of uncertainty involved in the type of situation you're dealing with. If we asked witnesses to identify the apple in this lineup, for example, we shouldn't be surprised by a unanimous verdict. But in cases where we have reason to expect some natural variance, we should also expect varied distribution. If you toss a coin one hundred times, you would expect to get heads somewhere around 50% of the time.

But if your results started to approach 100% heads, you'd suspect that something was wrong, not with your individual flips, but with the coin itself. Of course, suspect identifications aren't as random as coin tosses, but they're not as clear cut as telling apples from bananas, either. In fact, a 1994 study found that up to 48% of witnesses tend to pick the wrong person out of a lineup, even when many are confident in their choice. Memory based on short glimpses can be unreliable, and we often overestimate our own accuracy. Knowing all this, a unanimous identification starts to seem less like certain guilt, and more like a systemic error, or bias in the lineup.

When you look at it this way, the paradox of unanimity isn't actually all that paradoxical. Unanimous agreement is still theoretically ideal, especially in cases when you'd expect very low odds of variability and uncertainty, but in practice, achieving it in situations where perfect agreement is highly unlikely should tell us that there's probably some hidden factor affecting the system. Although we may strive for harmony and consensus, in many situations, error and disagreement should be naturally expected. And if a perfect result seems too good to be true, it probably is.