Field: Reading

Reading-aloud Activities And Cerebral Activation*

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Background

Reading-aloud (*Ondoku*) is a popular activity among EFL learners and teachers in Japan (e.g., Kadota, 2004). Studies have found that it can be effective in the development of English proficiency (e.g., Suzuki, 1998; Takeuchi, 2003). Several studies also investigated why reading-aloud is so effective for EFL learning using a brain imaging technique (Kawashima, 2000; Takeuchi et al., 2009). Kawashima, for example, indicates that reading-aloud in English activates various areas of the brain especially the prefrontal cortex, thereby, according to him, contributing to language learning. The study of Takeuchi et al. reports that reading-aloud in English causes higher activation in the prefrontal cortex of the brain, which is closely related to linguistic processing (Osaka, 2008). These studies were, however, conducted using a single time reading activity. In the classroom context, reading aloud is not conducted only once but rather repeated many times in a variety of ways (e.g., Saito, 2000; Shizuka, 2009). To our knowledge, however, no research has been implemented to explore what sequence of repetition (i.e., simple repetition of the same activities or that of different types of reading aloud activities) is more effective in terms of brain activation.

In this study, we thus tested the following three hypotheses concerning reading-aloud by applying the near-infrared spectroscopy (NIRS), also known as "optical topography," which is a real-time, non-invasive brain imaging technique with less participant-restraint:

(1) Repeating different types of reading aloud activities (in English) increases the degree of cerebral activation as far as later activities require deeper processing of the passages.
(2) Repeating simply the same type of reading aloud activities decreases the degree of cerebral activation.
(3) Reading aloud an inappropriate difficulty level (e.g., more difficult) of passages causes lower degrees of cerebral activation than reading aloud an appropriate level of passages does.

Participants and Methods

A total of 17 right-handed, healthy volunteers (8 females and 9 males) participated in the study. Their ages ranged from 18 to 48 (mean 25.94 years). They were categorized into two groups according with their English proficiency: the higher and lower proficiency groups. The English proficiency of the two groups was confirmed to be different in TOEFL scores (t = 5.87, p < .001, effect size r = .85). Both groups of the participants did two sequences of four reading aloud activities: Sequence A is 1) normal reading aloud, 2) reading aloud while paying attention to the parsed phrases, 3) reading aloud while paying attention to the meaning of the passage, and 4) "reading and looking up" (reading a phrase silently and then looking up and repeating it aloud); Sequence B is a four-time repetition of reading the same English passage aloud. Sequence A is made based on the usual classroom activities reported in the literature (e.g., Higashitani, 2009; Tsuchiya, 2004)

The ETG-4000 Optical Topography System (Hitach Medical Co., Japan) with a 52-channel array of optodes was used for NIRS measurements. The changes in blood hemoglobin concentrations in their brain were measured by the device while the participants were conducting the two sequences of reading aloud activities described above. The difficulty of the materials was checked with readability indexes, and the order of conditions was counterbalanced across the participants. Comparisons of blood hemoglobin (oxy-HB) concentrations were then made based on these four conditions: (a) Sequence A by the higher proficiency group, (b) Sequence B by the higher proficiency group, (c) Sequence A by the lower proficiency group, and (d) Sequence B by the lower proficiency group. Stimulated recall interviews were also conduced to complement the data obtained through the brain-imaging device.

Results

The results of 2 × 2 (activity sequences and proficiency) repeated measures ANOVA and post-hoc tests reached three findings, which are rather contrary to our expectations. First, repetition of different types of reading aloud activities (Sequence A) does not necessarily increase the degree of cerebral activation. Second, repetition of simply the same type of reading aloud activities (Sequence B) does not decrease the degree of cerebral activation but instead maintain its degree. Further analysis of the interview data clarified why these results had been obtained. Finally, when the material was above their proficiency level, the learners' cerebral activation was low in both sequences of activities. More details of the results and pedagogical implications will be given in the presentation.

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