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Using automatic keyword, concept map, and score to support students' summarization

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Abstract: The purpose of this study was to develop automatic keyword, three-layer concept map, and scoring for supporting and measuring college students' summaries in reading academic texts. The three layers represent: (1) the central idea of a text, (2) the main idea of each paragraph, and (3) the supporting ideas of each paragraph. A sample of 52 college students who study English as a Foreign Language (EFL) was grouped into the experimental and control groups, 28 and 24 students in each. The results of this study indicate that the students of the experimental group made more significant improvement on reading comprehension and summarization after receiving the explicit and strategic feedback of automatic keywords, three-layer concept maps, and scores than students in the control group. The automatic keywords, three-layer concept maps and scores not only become reliable predictors to evaluate the students' summarization but also serve as scaffolds to improve their reading comprehension and summarization as they actively engage in self-regulated learning.

Keywords: Automatic measurement, automatic scaffold, summarization, three-layer concept map

1. Introduction

A recent trend for evaluating students' language proficiency has been to assess their integrated reading and writing skills, rather than discrete skills (Kırmızı, 2009). In acquiring reading and writing skills, students need to identify key words from each paragraph, construct concept maps to decode texts, and integrate the main ideas or key elements into an organized and logical summary (Kırmızı, 2009). Summarization is a particularly difficult task for EFL students to learn as they have to determine what content in a passage is the most important and transform it into succinct statements in their own words (Weigle and Parker, 2012). Summarizing a text requires students to understand the meaning of the vocabulary, analyze text structure, select the essential ideas across paragraphs, and write the ideas into a summary in their own words (Brown, Day, & Jones, 1983). That is, summarization is a reading-based writing as students require preliminary reading before paraphrasing main ideas from the texts.

While previous studies have examined the scaffold of concept maps on reading and writing, this study focuses on the keyword extraction, automatic concept maps and automatic scores as feedback for learning to write summaries. First, many studies have merely proposed general and unclear rules for writing a summary. Without explicit guidance or instruction, novice summarizers are unable to determine what main ideas are missing or what irrelevant details are included in writing summaries (Liu, 2011). Second, many studies have emphasized the benefits of using concept maps to support students' reading and writing; however, few studies have investigated keywords and concept maps as the scaffolds and measurement for writing summaries. Third, most studies only generated concept maps from the frequency of keywords in corpora (e.g. Cimiano, Hotho & Staab, 2005). However, various sizes of corpora may influence the complexities of the concept map.

To fulfill the research purpose of this study, which was to develop automatic keywords, concept maps, and scores to support and measure college students in learning to write summaries, four research questions were addressed: (1) What progress do students make with the scaffold and measurement of automatic keywords, concept maps, and scoring?, (2) What are the relationships among automatic concept maps, summarization, and reading comprehension?, (3) How does automatic keywords, concept maps, and scoring help students write summaries?; and (4) What are students' perceptions toward automatic scaffold and measurement on their summarization and reading comprehension?

2. Method

A total of 52 freshmen from a university in central Taiwan were recruited to learn how to write summaries with the scaffold and measurement provided by automatic keywords, concept maps and scores. According to the results of the university survey, most of them (94%) did not have any experience in writing an English summary or with an online summarization instruction, although they had learned EFL for eight to ten years. Before receiving the instruction on summarization, the students were asked to take the reading section of the standardized test, such as Test of English for International Communication (TOEIC), as the pre-test to identify their English language proficiency. The mean score and standard deviation of the 28 students in the experimental group on the pre-test were 283.39 and 30.16, while the 24 students of control group's mean score and standard deviation on the pre-test were 287.51 and 33.64. The 28 students in the experimental group underwent keyword extraction, automatic concept maps, and automatic scoring in online instruction. The 24 students of the control group received only onsite instruction without any online scaffolding strategies of keyword extraction, automatic concept maps, and automatic scoring.

3. Results

3.1 Students' progress in reading comprehension and summarization

A paired-sample *t*-test compared the means of pre- and post-tests of reading proficiency for both experimental and control groups. The results show that the students of experimental group made great reading improvement as the mean scores increased from 283.39 on the pre-test to 328.38 on the post-test. There is a significant difference between the pre-and post-tests in reading ($t(27) = -4.47$, $p < .00$). In contrast, the mean scores of control group on the post-test (320.59) are represented little reading progress than that of the pre-test (287.51). A slightly difference between the pre-and post-tests is found ($t(23) = -2.83$, $p < .03$). The results indicate that online instructional intervention of keyword extraction, automatic concept maps, and automatic scoring are beneficial scaffoldings for the students of experimental group grasping main ideas and learning to write summaries.

3.2 The relationships among concept map, summarization, and reading comprehension

The correlation between concept maps (scores from the automatic three-layer concept maps), summarization (P-density), and reading comprehension (reading scores on the TOEIC post-test), and a total composite measure of this scale. The significant correlation between the concept map factor and the summarization factor ($r = 0.86$) indicates that concept maps provide scaffolding for the students to write a summary and enhance their reading comprehension. The significance ranges from 0.83 (for concept maps and summarization factor and the total scale) to 0.97 (for reading comprehension factor and the total scale). In other words, the more the students of experimental group employed the automatic concept maps as they wrote their summaries, the better their reading comprehension and writing skills were.

3.3 The scaffold of automatic concept maps on summarization and reading comprehension

The onsite instruction was conducted to help the students accumulate the fundamental knowledge toward drawing their concept maps. After identifying each group of main ideas, the students were encouraged to practice filling in keywords on a paper-based concept map as a "planning" stage before writing their summaries. Based on their concept maps, they were able to complete and later revise their summaries (final draft 1). After receiving the onsite instruction, the keyword extraction, automatic concept maps, and automatic scoring was included in the online instruction. Student A was one of sample cases to receive keywords and automatic concept map (see Fig. 1) to clarify the connection between each group of main ideas and supporting details in the text. Later on, he was asked to write his final draft 2 based on his main idea identification. A score was automatically generated and shown on the screen to inform him how good his summarization was.

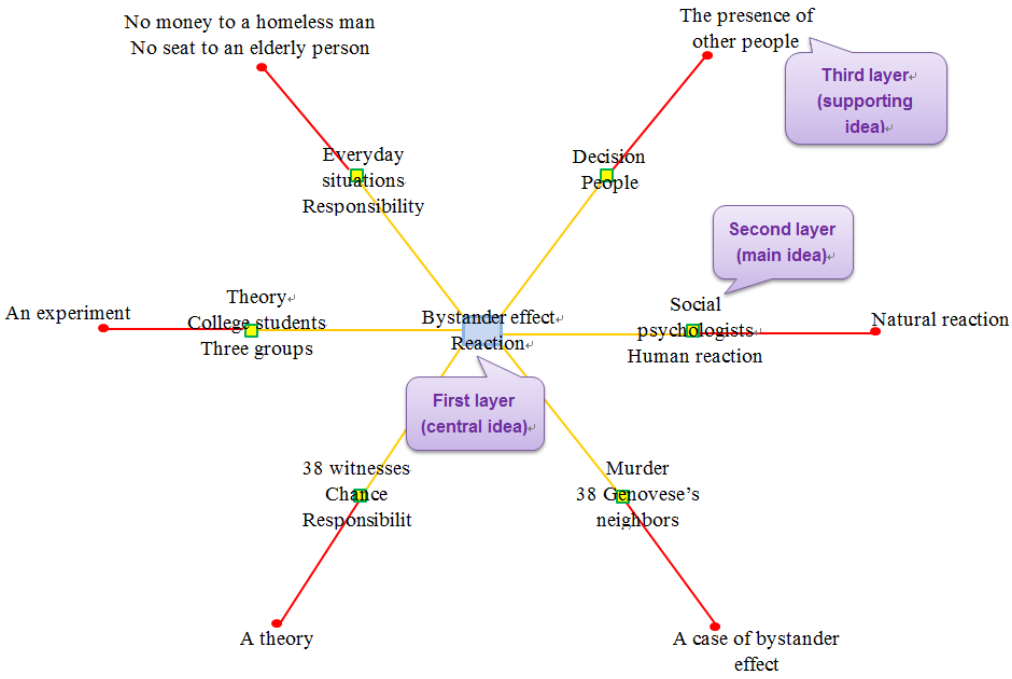

Figure 1. The automatic three-layer concept map provided to students

4. Discussion and conclusion

From the results of this study, it was found that the scaffold and measurement of automatic keywords, three-layer concept maps, and scores had a distinct influence on the students' summarization and reading comprehension. As the students actively and accurately employed the automatic keywords, concept map, and automatic scoring in writing summaries, they were able to have better reading comprehension and summarizing skills. In other words, the automatic measurement and scaffold of keywords, concept maps, and scores facilitated the students to integrate important ideas in a text for enhancing their conceptualization and self-regulated learning as they received immediate and individualized feedback (i.e. the highlights of keywords and scores) without the limitations of time and space.

References

Brown, A. L., Day, J., & Jones, R. S. (1983).The development of plans for summarizing texts. *Child Development, 54*, 968-979.

Cimiano, P., Hotho, A., & Staab, S. (2005). Learning concept hierarchies from text corpora using formal concept anaysis. *Journal of Artifical Intelligence Resarch, 24*, 305-339.

Kırmızı, F. S. (2009). The relationship between writing achievement and the use of reading comprehension strategies in the 4th and 5th grades of primary schools. *Procedia - Social and Behavioral Sciences, 1*(1), 230-234. doi: 10.1016/j.sbspro.2009.01.042

Liu, P. L. (2011). A study on the use of computerized concept mapping to assist ESL learners' writing. *Computers & Education, 54*(4), 2548-2558.

Weigle, S. C. & Parker. K. (2012). Source text borrowing in an integrated reading/writing assessment. *Journal of second language writing, 21*, 118-133.