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COMPUTER-BASED CONCEPT MAPPING FOR SECOND LANGUAGE READING COMPREHENSION: A DESIGN-BASED RESEARCH STUDY

Rivka Rosenberg, Shahrzad Saif, Université Laval
rivka.rosenberg.1@ulaval.ca, shahrzad.saif@lli.ulaval.ca

Abstract. Given the present dominance of the English language in academia, the university students increasingly need to develop the ability to comprehend texts written in English. According to Koda (2005), reading in a second language (L2) demands greater effort than reading in a mother tongue (L1). The aim of this ongoing doctoral dissertation is to examine the role of Concept Mapping (CM) in accessing "background knowledge" and its possible contribution to the enhancement of reading comprehension. Background knowledge is a crucial component for reading comprehension in an L2.

1 Introduction

The goal of this ongoing doctoral dissertation is to establish a strategy whereby students better comprehend their reading in a second language (L2). We seek to better understand how computer-supported concept mapping (CM) can contribute to reading comprehension in an L2. The hypothesis is that this activity will assist the activation of L2 learners' prior domain-knowledge and promote internal structuring of new knowledge and thus aid in reading comprehension.

2 Problem Statement

The English language predominates on the Internet. University students today use the Internet as a main source of information for their academic work. Moreover, since the English language permeates scientific literature, texts written in English are often offered to non-English students as learning resources for course work. Reading requires three main abilities: (1) remembering main ideas, (2) recognizing and building rhetorical frames that organize the information, and (3) linking the text to the reader's knowledge base (Grabe & Stoller, 2002). According to Koda (2005), L2 reading demands greater effort than reading in a mother tongue (L1). The L2 reader tackles a reading task with less knowledge of the target language and of its typical text structures and often does not know which strategies to use when faced with a reading problem (McNamara, 2007). One strategy often recommended for text comprehension and specifically for accessing background knowledge (interchangeably also called "prior knowledge") is the use of graphic organizers, such as concept maps (Novak & Gowin, 1984).

A concept map is a schematic device used to explicitly represent a number of concepts and their interrelationships. CM is a technique that allows students to see the connections between ideas they already have, connect new ideas to knowledge that they already have, and organize ideas in a logical structure. CM in education has been the subject of intensive investigation since the early 1980s (Novak & Gowin, 1984). There is a well-researched body of knowledge showing that CM fosters learning by encouraging students to think both deeply and critically, as well as by enhancing comprehension (Nesbit & Adesope, 2006). However, there is still a lack of data regarding the use of concept maps in L2 in general and in L2 reading comprehension in particular (Jiang & Grabe, 2007). In addition, computer-supported CM has rarely been explored in an L2 reading context. Hence, this research aims to explore the potential of this activity in L2 reading for university students and ultimately to better understand the reading comprehension process in L2.

3 Theoretical Considerations

The answer to comprehension problems often lies within the students' prior knowledge. This study focuses on the "prior knowledge" problem in reading as well as the structure of knowledge. Schema theory describes how prior knowledge is integrated in memory and used in higher-level comprehension processes (Anderson & Peterson, 1984).

Background knowledge is a person's reservoir of information on a variety of topics; information retained in one's long-term memory; information that is essential to understanding a situation or problem. Carrell (1983b) in her meta-analysis concluded that there are three components of background knowledge: (1) familiarity -prior knowledge in the content area of the text (familiar vs. novel). (2) context- prior knowledge that the text is about a particular content area (context vs. no context), and (3) transparency- the degree to which the nouns and verbs in the text reveal the content area (transparent vs. opaque). Transparency means broadness of terms in relation to verbs and nouns, for example: fuel is a liquid and is an ambiguous term. A more precise term would be octane, and a middle point would be the term fuel.

According to schema theory, when individuals develop knowledge, they attempt to fit it into some structure in memory that helps them make sense of that knowledge (Carrell & Eisterhold, 1983). For learning to occur, new information must be integrated with what the learner already knows. A strategy proposed in the present research is CM. According to Novak & Gowin (1984), a concept map is comprised of nodes, representing concepts, and links representing the relationships between concepts. Connecting lines are labeled to explain the relationships between concepts. Two concepts related by a labelled-link form a proposition. The fundamental goals in the use of CM are to foster the importance of assimilating new information with previously learned, meaningful learning. Novak's work is based on the cognitive theories of David Ausubel (1963) (assimilation theory) who stressed the importance of prior knowledge in being able to learn new concepts.

In Ausubel's view, to learn meaningfully, students must relate new knowledge to what they already know. Ausubel describes meaningful learning as "a process in which new information is related to an existing relevant aspect of an individual's knowledge structure" (Novak, 1998, p. 51). It is this relating new information to existing knowledge that accounts for a number of phenomena: the acquisition of new meaning, retention, the psychological organization of knowledge as a hierarchical structure, and the eventual occurrence of forgetting. As new information enters the human mind, it interacts with knowledge subsumed as a conceptual system. Both L2 reading and CM stress the importance of assimilating new information with previously learned information.

The present study hypothesises that the use of concept mapping as a reading strategy facilitates access to background knowledge which in turn will enhance reading comprehension in L2 learners. Specifically, the study tries to answer the following research question: How does CM help L2 learners access their background knowledge while reading academic texts? The aim of the study is (1) to develop and test a reading strategy based on computer-supported CM for university students and (2) to develop a theoretical proposal describing how the reading comprehension process in an L2 is influenced by the use of this strategy.

4 Methodology

A Design-based research (DBR) (Kelly, Lesh & Baek, 2008) is used to gain data that will be interpreted to answer the above question. The study itself is operationalized through a pre-test/post test paradigm. There will be two groups established- an experimental group (that receives the treatment condition) and a control group (which does not received the experimental condition). For purposes of data analysis, four conditions will be established (two within subject conditions and two between subject's conditions). DBR was first introduced in 1992 by Brown and Collins and has become a popular methodology in educational science (Brown, 1992). A DBR research includes an iterative cycle of: (1) designing a learning activity, (2) testing it in an Educational context, and (3) theory-building.

4.1 Participants

Approximately twenty university graduate students (*N=20*) at the intermediate level of English, enrolled in a university course in Educational Technology at a French-Canadian University, will be recruited for the study. For these students English is their L2.

4.2 Research Instruments

Three academic English texts will be tested for their difficulty level (according to readability scales) and two will be

chosen for the study. According to Chall (1958) readability is defined as reading ease. The readability of the texts will be verified with the Flesch-Kincaid (Flesch, 1948) validated scale.

There is no real consensus in the literature regarding techniques for measuring L2 reading comprehension (Koda, 2005). L2 reading assessment, by design, has dual functions; measuring both reading skills and language ability. There are variety of approaches and assessment designs. The basic premise underlying most reading assessment is that comprehension is a product of the reader's interaction with the text. Such assumptions are clearly evidenced in common assessment measures such as multiple-choice questions and others. In our research, participants will be asked to summarize their comprehension of the text.

The participants in this study will use the CmapTools software, a free software developed at the Institute for Human and Machine Cognition (IHMC) (http://cmap.ihmc.us/conceptmap.html), in order to create the CM.

A debriefing session will also be used to collect data with respect to the students' comprehension and background knowledge of the chosen texts. The debriefing sessions will include questions on the three components of background knowledge mentioned above (familiarity, context and transparency). It will also include questions on the process of CM and their reading comprehension; some questions will be predetermined while others will emerge during the experimentation. Several questions on reading comprehension are adapted from Swaffar, Arens & Byrnes (1991) and several questions on CM are adapted from De Simone, Schmid and McEwen (2001).

4.3 Data Collection Procedure

The design of the activity includes six steps (depicted in Figure 1) which will last approximately three hours with a fifteen minute break in the middle. In step one, students will be asked to read an English text and they will be tested for their reading comprehension of it and of their prior knowledge of the topic. The test will include questions on the three components of background knowledge mentioned above. It will also include questions on participants' background knowledge. Some questions will be predetermined while others will emerge during the experimentation. In step two participants will undergo a training session on how to create concept maps with the CMapTools software (http://cmap.ihmc.us/conceptmap.html). In order to take advantage of CM, an individual needs to be reasonably comfortable with it. In step three, participants will read a second text (different from the first one, however on the same topic) and represent their comprehension of it in the form of a concept map created with the software. They will be asked to represent the concepts and logic of the text. In step four, each student will be asked to add their pre-existing knowledge of these concepts and asked to incorporate this knowledge on the concept map in a different color. Participants will be asked to attempt to link this pre-existing knowledge to the already identified concepts and links identified in phase three. During this phase participants will be able to consult the text when needed. Each participant will be asked to save their concept map on the computer. In step five, another reading comprehension test will be administered. Some questions will be predetermined while others will emerge during the experimentation. The results will be presented to students so that they can provide relevant rationale. In this manner students will have the opportunity to familiarize themselves with the CM strategy and self reflect on its impact on their comprehension. In step six participants will be asked to explain orally how and why they constructed their maps the way they did. These final debriefing interviews (see example questions above) will reveal more details on their reading comprehension. The steps described are one iteration. After each iteration theoretical propositions will be derived on how the computer-supported CM has influenced participants' reading comprehension.

In the present research, hypotheses are generated in relations to three variables; two independent variables and one dependent variable. In taking the steps depicted in the Figure below (Figure 1), hypotheses will be tested. In the figure, IV1 represents background knowledge and includes two levels: present/ Yes or absence/ No (between subjects). IV2 represents CM and includes two levels: before the condition and after (within subject). DV represents reading comprehension. The first two steps are the control and the next three steps are the treatment. The design is a "within-subject design."

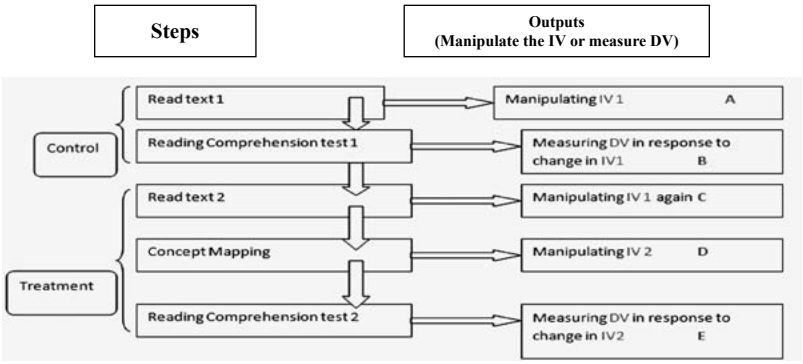

Figure 1. Steps and Outputs of the Data Collection

Hypothesis from output B: more background knowledge will result in more reading comprehension. Hypothesis from output E: effective use of CM will result in better reading comprehension. The third hypothesis is that combining background knowledge and CM will produce better reading comprehension.

4.4 Data Analysis of the Mixed Method Research (Quantitative and Qualitative)

Our research question is: How does CM help L2 learners access their background knowledge while reading academic texts? Imbedded in this question are two questions: (a) does CM facilitate one's access to background knowledge? (This is an empirical question). If the answer to this question is positive, then: (b) how does it do so? (This is a theoretical question). In order to answer the first question (a), quantitative analysis is necessary. This will be best resolved with inferential statistics, an Anova or T-test will be administrated. In order to answer the theoretical question (b), qualitative analysis will be necessary to generate theories and the debriefing sessions will serve for that purpose. The qualitative and quantitative analysis methods have yet to be worked upon.

5 Conclusion

Limited attention has been given to CM for reading comprehension in an L2 in general and in a computer-supported L2 reading context in particular. The present study is an attempt to advance the theoretical knowledge in the fields of educational technology and L2 acquisition and offer new insights on learning strategies that could be used to enhance learning and teaching in an L2. DBR can be one way to build theoretical propositions on learning with technology.

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