The Impact of Employing Computer-based Concept Mapping on Enhancing Reading Comprehension in EFL College Learners

Assoc. Professor Abdullah M. Almelhi
King Khalid University, Saudi Arabia

Abstract:
The aim of this research was to identify the impact of employing computer-based concept mapping on improving reading comprehension in EFL college students in a reading course for EFL college learners. The sample was comprised of two EFL college students groups, each including 30 male students in a Southern Saudi Arabian university. The experimental group studied the reading course using computer-based concept mapping strategies through IMindMap for presenting the reading passages and themes while the control group studied the same passages and topics in the conventional method. A reading comprehension assessment was applied to both groups after the interventions. Statistical analysis revealed statistically significant differences in the mean scores of both groups (a=0.05) on posttesting to the good of the experimental group. Results also indicated a considerable effect size of using electronic concept mapping strategies in improving reading comprehension in EFL college readers. Recommendations for pedagogy included organizing training workshops for EFL language instructors to use CMC strategies and programs to teach reading skills through CMC strategies and advanced organizers. Further research recommendations were forwarded.

Keywords: Computer-based concept mapping, reading comprehension, college advanced reading, EFL learners

أثر توظيف استراتيجية الخرائط المعرفية الحاسوبية في تحشين فهم القراءة لدى متعلمي اللغة الإنجليزية بمستوى الجامعي

المستخلص:
من الهدف من هذا البحث هو تحديد أثر استخدام خرائط المفاهيم المعتمدة على الكمبيوتر في تحسين فهم القراءة لدى طلاب اللغة الإنجليزية طلاب اللغة الإنجليزية مقرر القراءة لمتعلم اللغة الإنجليزية مقرر القراءة. تألفت العينة من مجموعتين من طلاب اللغة الإنجليزية تتضمن طلاباً وطالبة 60 طالباً وطالبة، اجتمعت ضمن جامعتين جنوب المملكة العربية السعودية. درست المجموعة التجريبية دورة القراءة باستخدام استراتيجيات خرائط المفاهيم المتاحة IMindMap المستندة إلى الكمبيوتر، من خلال برمجية التدقيق مقاطع موضوع القراءة؛ بينما قامت المجموعة الضابطة بدراسة المقاطع الموضوعات نفسها بالطريقة التقليدية، تم تطبيق اختبار الفهم القرائي على كلما المجموعتين بعد التدخل التجريبي. حُددت النتائج التحليل الإحصائي عن وجود فروق ذات درجة إحصائية في مستوى الدرجات لكلا المجموعتين (النفلكفا = 50%)، لاحظت النتيجة استخدام استراتيجيات خرائط المفاهيم الإلكترونية في تحسين الفهم القرائي لدى طلاب اللغة الإنجليزية مقرر القراءة. تضمنت التوصيات التربوية تنظيم ورش
Introduction

Reading comprehension is a significant language skill integral to overall language development; language comprehension is dispensable for all language and thinking skills and it is the ultimate goal of literacy (Ortlieb, 2013). The development of reading comprehension skills is essential for success in academic achievement.

EFL instructors in Saudi universities need to improve students’ reading comprehension skills in English through employing effective reading comprehension cognitive and metacognitive strategies which not only activate schemata needed to decipher written texts, but also relate current learning to prior learning in structured and semi-structured classroom settings (Chamot, 2005; Oxford, 1990; Sadeghi & Langhroudy, 2012; Vandergrift, 2003; Wenden, 2002; Whittington, 2012).

Therefore, researchers, educational psychologists and pedagogues have studied effective strategies to improve reading comprehension. EFL pedagogy has always been after improving and developing language learning skills through following self-directed and permanent learning approaches acquired in the course of reading comprehension. Extant research (e.g., Brown, 2005; Culver, 2008; Murray, 2008; Noronha-Nimmo, 2008; Pan, 2006; Thampradit, 2006; Tapinta, 2006) revealed that effective EFL strategy-based learning can satisfy the needs of language learners and repair their language deficiencies, leading to facilitate learning in EFL settings. Reading comprehension is a complex process that takes place in the human brain. Reading comprehension is possible when learning materials is linked to the learners' life experiences and their prior knowledge, which requires some sort of schematization of graphemes and series of words (Moore & Lo, 2008; Lipson & Wixon, 2009; Zeki, 1993).

Available research mostly addressed the difficulties involved in internal mental representations or how schemata activation could be exploited to improve reading comprehension characteristically in EFL conditions, but not noticeably in EFL contexts. Prior research also addressed cognition and meta-cognition processes in other disciplines such as educational psychology or cognitive psychology, but rarely in EFL theory.
For instance, Zeki (1993) suggested that visual imaging in the brain takes place because of retinal processing and outputting since "Ganglion cells are the sole source of visual input to the rest of the brain. They have center-surround receptive fields." According to Zeki’s theory, the brain creates a visual world where visualization and comprehension take place simultaneously. Therefore, concept mapping is a new method that is used for ameliorating and expediting learning and comprehension. Concept mapping can help learners to develop learning autonomy and organize, expedite, retain and retrieve information in effective ways (Buzan & Buzan, 1996).

The use of concept mapping is some sort of advance organizers that assist in mental visualization that helps in reading comprehension, retaining and retrieving information (Buzan & Buzan, 1996; Tucker, Armstrong & Massad, 2010). Concept maps can efficiently be used as scaffolds for higher-order thinking skills (Holzman, 2004). Concept mapping not only helps in improving and organizing learning, but it can also help in enhancing long-term memory retrieval as well as cognitive processing of oral material (Farrand, Hussain & Hennessey, 2002). Previously, concept maps were done manually, but developmentally in a computer age, special software started to be used for computerizing concept mapping. Computerized concept mapping is more professional and attractive (Dara, 2010). Prior research on the effects of concept mapping in the traditional form and the computerized concept mapping indicated that computerized concept mapping has advantages over manually drawn concept maps (Dara, 2010; Nong, Pham & Tran, 2009). Computerized concept maps are more attractive, faster to produce and more professional, and therefore, prior research indicated that computerized concept mapping strategies could be effective in inducing reading comprehension (Stankovic, Besic, Papic & Aleksic, 2011). For instance, Peng (2011) showed that computerized concept maps improve reading comprehension by linking the functions of both brain hemispheres since computerized concept mapping includes word processing, logical processing of language and mathematical analysis. This eventually leads to improving creativity, mental visualization, comprehension, analysis, synthesis and mental imaging (Benavides, Rivera & Rubio, 2010; Siriphanich & Laohawiriyanon, 2010; Liu, Chen & Chang, 2010; Kim & Kim, 2012; Hofland, 2007).

• **Problem of the Study**

  The researcher noticed that EFL adult learners are deficient in reading comprehension skills at the college level as is shown in reading courses grades. Guthrie & Klauda (2014) indicated that EFL college students need to develop cognitive processing strategies and techniques
such as computerized concept mapping strategies in order to enhance reading comprehension. Concept mapping using computer software helps relate prior knowledge to current knowledge in a way that helps improve analysis, elaboration, synthesis and evaluation by activating schemata (Siriphanich & Laohawiriyanon, 2010). Most EFL readers cannot link prior knowledge to current information and therefore fail to process new knowledge in effective ways. This study aimed to determine the following research question:

Are there statistically significant differences between the experimental and control group participants on posttesting to the advantage of the experimental group due to using IMindMap for learning reading through CMC?

- **Methodology**

- **Design**
  The study is a semi-experimental investigation in which the researcher employed a pretest, post-test control group design.

- **Participants**
  This study was implemented in two classes per week over a period of one semester. Sixty majors at a southern university located in Southwestern Saudi Arabia were selected to participate in this study by convenience. To investigate the efficacy of different computerized concept maps on their reading comprehension, all participants were divided into two homogeneous groups.

- **Procedure**
  They were all pretested on a reading comprehension test to obtain baseline scores for later comparison with posttesting mean scores.

  The first experimental group received instruction into Reading IV, an advanced course in reading comprehension, through IMindMap, a software for generating concept maps. The participants were trained on the basics of IMindMap and they integrated it in their reading assignments in class and in home assignments. There were seven key points made in the teaching procedure:

  - Decide the general topic or title of the map.
  - Consider ideas related to the reading passages/assignments
  - Select the words and phrases that fit in best with the general topic, and that will support the main ideas in the reading passage.
- Draw and connect these words or phrases to the main topic with a line referring to the relationship.

- Repeat the process of brainstorming and branching for each of the subtopics students highlighted or circled until they form adequate ideas on the reading text to help them fully comprehend the text.

- Use the concept map to organize students' reading comprehension.

- Use the concept maps to refer to the text topics and subtopics as a visualization of global and local information in the reading text as they read and reread it.

- The control group received no-mapping reading instruction in the traditional way.

The instructional model can be shown as follows:

![Figure 1: The instructional model](image)

After the treatments were completed 10 weeks later, they were posttested on Version B of the Reading Comprehension Test.
IMindMap software for computerized concept mapping learning was first developed by Tony Buzan, a brain researcher, in the 1970s (Buzan, 1977; 2005) as a specialized technique to make notes as brief as possible while being as interesting as possible. Therefore, it was used as a reading comprehension and writing assistant to extract briefings of reading material or brainstorm ideas for writing assignments. As of that time, mind-mapping has proven to be a simple way to make notes in a variety of ways (Brinkmann, 2003), and now millions of people use mind maps for brainstorming, project planning, decision making, and document drafting.

Thus, mind-mapping started to be employed as an effective way to get information into the human brain. It is a creative and logical means of recording and noting that literally "trains" our ideas (Buzan, 2005). The Mind Map also clearly shows how the points are linked together (Khoo, 2006).

Since the process of building a mind map engages the learner with the content, it is an active learning strategy that can be used during the lesson instead of traditional lectures (Willis and Miertschin, 2006). Using IMindMap software for mind mapping, students can be more actively involved in their learning process (Edwards and Cooper, 2010), improving students' critical thinking (Mueller et al., 2002). It is also important to pay attention to the use of symbols and symbols in mind maps.

To clarify the reasons that students become competent to hold self-confident presentations without notes can be traced back to mental mind mapping (Mento et al., 1999), since mind mapping combines not only words but also symbols and icons with specific key points.

Remarkably, mind mapping is also a technique for group-work brainstorming, as in reading or writing instruction, especially for adult learners, as ideas can be made as good as possible without interfering with the hierarchy of search engines (Murley, 2007). In addition, IMindMap software can be employed as a teaching tool and for the preparation and review of lectures. The technique allows quick writing and reviewing of notes. (Edwards and Cooper, 2010). An original and useful Mind Map will be created and given to students as a summary for the upcoming semester, tutorial or lecture. (Edwards and Cooper, 2010). Alternatively, reading instructors can train their students to receive, retain and retrieve relevant information from reading texts as they use ImindMap software for computerized concept mapping in reading classes. Mind mapping can display reading comprehension.
global and local information in the form of PowerPoint presentations (Murley, 2007).

- **Results**
  
The research question was to investigate the effectiveness of the computerized concept mapping versus traditional reading instruction treatments on the reading comprehension of the learners of different writing proficiencies.
  
The following table shows the participants' mean scores and standard deviations on pretesting and posttesting of reading comprehension.
  
  **Table 1: Mean scores and standard deviations on reading comprehension pretesting.**

<table>
<thead>
<tr>
<th>Group</th>
<th>No</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
<th>Adjusted Mean</th>
<th>STD Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>30</td>
<td>14.833</td>
<td>2.94</td>
<td>17.233</td>
<td>3.18</td>
<td>17.3</td>
<td>0.54</td>
</tr>
<tr>
<td>Experimental</td>
<td>30</td>
<td>15.167</td>
<td>3.21</td>
<td>19.667</td>
<td>3.31</td>
<td>19.588</td>
<td>0.54</td>
</tr>
</tbody>
</table>

The mean scores on posttesting for the experimental group were greater than those for the control group. To discover the statistical significance of these differences, ANCOVA was used the results of which are below summarized:

  **Table 2: ANCOVA results.**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Type II Sum of Squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest (Covariate)</td>
<td>121.237</td>
<td>1</td>
<td>121.237</td>
<td>14.080</td>
<td>0.000</td>
<td>0.198</td>
</tr>
<tr>
<td>Group</td>
<td>77.508</td>
<td>1</td>
<td>77.508</td>
<td>9.002</td>
<td>0.004</td>
<td>0.136</td>
</tr>
<tr>
<td>Error</td>
<td>490.797</td>
<td>57</td>
<td>8.610</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>700.850</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ANCOVA results showed in Table 2 above indicate that there are statistically significant differences (α=0.05) between the experimental and control groups. By comparing the mean scores for both groups, the results show that the improvement occurred in the experimental group due to using computerized concept mapping.

For the effect size, Eta Squared value (η²) reached 0.1267, a value that indicates an average effect size, given total variance of the covariate (i.e., using IMindMap for computerized concept mapping in reading instruction). The value of Δ(d) was found out to be 0.751, which indicates a considerably big effect size.

- **Conclusion**
  
Recently, EFL college students expect to use more digital media applications in everyday lives for their learning and these smart...
applications should be seamlessly integrated into their classroom experience. With this software, IMindMap for computerized concept mapping, EFL students can learn that reading is an exciting experience, and they would be able to visualize the entire reading text content remarkably. As a result, the learning process could be more interesting and entertaining, where it attracts students who are visual, auditory or kinesthetic learners. Indisputable, with iMindMap in the class, reading instruction can really impact the teaching and learning process through its ability to adapt to the learning styles of different students. Therefore, this study strongly recommends the use of iMindMap in class to improve the learning process of the new generation.

Since this study is only a semi-experimental investigation, it was limited to only one small population of EFL students, some selected topics of the reading curriculum and a specific computer mind-mapping tool. That's why, prospective research can be extended by applying the experimental research method.

In addition, future research can also analyze the impact of using iMindMap on student performance, both in the exam and in the exam the understanding of the reading topics, global understanding, local understanding and application of specific reading comprehension skills.

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