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Comparing effectiveness of methods of presentation and providing concept maps on reading comprehension

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ABSTRACT

The purpose of this study was comparing effectiveness of methods of presentation of concept maps and methods of concept mapping on reading comprehension. The subjects of this study consisted of 66 third-year high school students (33 female, 33 male), that were selected randomly by multistage sampling method. Participants were randomly assigned to three treatment groups and one control group. The research instruments were: 1) experimental texts, 2) comprehension test, and 3) Camp Tools software, and 4) Teacher-generated concept maps. Treatment groups included computer-based concept mapping, paper-pencils concept mapping, and reading text with prepared concept maps. The control group for the study did not receive any concept map. The results of this study indicated that presentation of per-prepared concept maps significantly improved comprehension, compared to the map generation and control group. But paper-pencil and computer-based concept mapping compared to the control groups were not statistically significant. The best way for use of concept maps is teacher-generated concept maps with texts.

Keywords: Concept map, Read comprehension, Paper-pencil concept mapping, Computer-based concept mapping

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INTRODUCTION

Concept maps are graphical tools for organizing and representing knowledge. Concept maps were originally created at Cornell University as a research tool by Dr. Joseph Novak. His work was based on Ausubel's assimilation theory. In Ausubel's view, to learn meaningfully, students must relate new information 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). In Ausubel's view also, Cognitive structure is organized hierarchically, with new concepts or concept meanings being subsumed under broader, more inclusive concepts [1]. According to Novak (1998), three prerequisites needs for meaningful learning: (1) learner's prior knowledge; (2) teacher's meaningful material; (3) learner's choice. In other words, teachers should prepare meaningful material according to the individual's prior knowledge. This enables the students to make sense of their learning by building on old knowledge and their own cognitive structures. Concept mapping is based on Dual coding theory too. Dual coding theory places equal importance on both verbal and non-verbal processing. It assumes there are two cognitive sub-systems; one specialized for the representation and processing of non-verbal objects and the other specialized for dealing with language. It is built on the use of imagery in associative learning. Verbal learning is most effective when accompanied by visual learning. Since there are two cognitive processes, they support each other [25]. The concept map appears as a graph-like structure, with nodes represented by polygons and

lines joining them together. The nodes represent a central concept or idea, while the lines connecting the nodes represent a link or relationship between two concepts. Nodes are labeled by the concept they represent and the links are labeled according to the relationship between the two concepts they connect. Figure1. Show a Concept Map about CmapTools that prepare whit Cmap Tools software. When constructing a concept map, the concept mapper first selects key concepts from a topic. Then he or she prioritizes the concepts such that the most inclusive concept is listed first and the least inclusive listed last. The concept map is arranged according the hierarchical list and the concepts are linked with appropriate words to describe the relationship between the concepts. Finally, the concept mapper inserts crosslinks, connecting different vertical threads of the concept map. The crosslinking step is important for showing an integrated understanding of the various aspects of the topic [15].

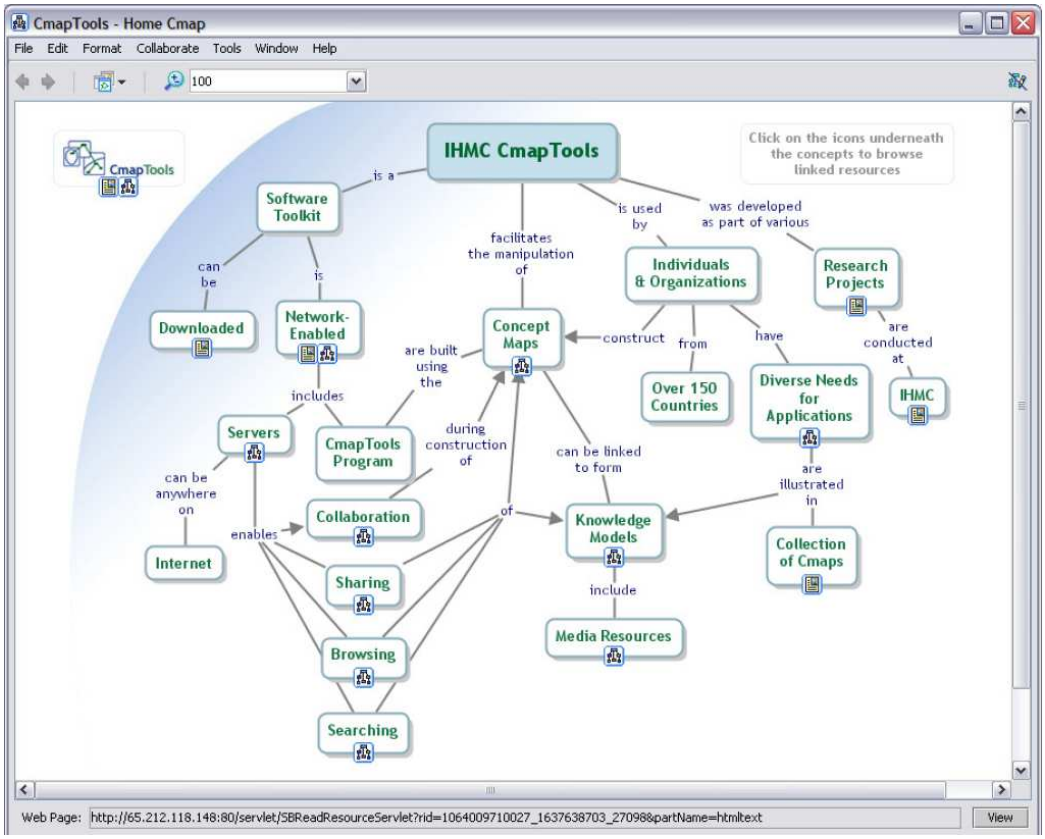

Figure 1. Concept Map about CmapTools (from http://cmap.ihmc.us)

Concept maps in teaching positions and in the teaching - learning process can be used in various ways. According to who will prepare a concept map or concept map of what the teacher and student in the manufacturing process, they are divided into two categories: Teacher-generated concept map and Student-generated concept map. However, the proportion of teachers in teacher-made maps, and maps can also be varied to provide full or partial hallmarks to be provided to students and they are asked to complete the map. The traditional way of constructing concept maps uses paper and pencil. But with the rapid development of Information and Communication Technologies, a number of computer-assisted concept mapping systems have been proposed [6]. Basis on the instrument used in making maps, concept mapping process can be categorized in two ways: Paper-pencil concept mapping (construction of concept maps on paper by hand) and computer-based concept mapping (concept mapping by special software). Basis on numbers of people involved in the concept mapping process, there are two ways for building a concept map: Individual concept mapping and Collaborative concept mapping.In the individual concept mapping one person builds or completes a concept map. A Concept map that made by a student, indicates the student's understanding of that issue [2]. The Student who is involved in the self-discussion of concept mapping, has the additional benefit. In contrast, concept mapping provides multiple individual views and experiences and the representation of knowledge is extensive. Collaborative concept mapping occurs when two or more people actively involved in the process of

creating a concept map. In this way students think about the ideas presented by the group members and their perceptions of their defense. Their understanding of the subject by analyzing the acceptance or rejection of the views of others extend.

In figure 2. is shown varios ways of making and provide a concept map.

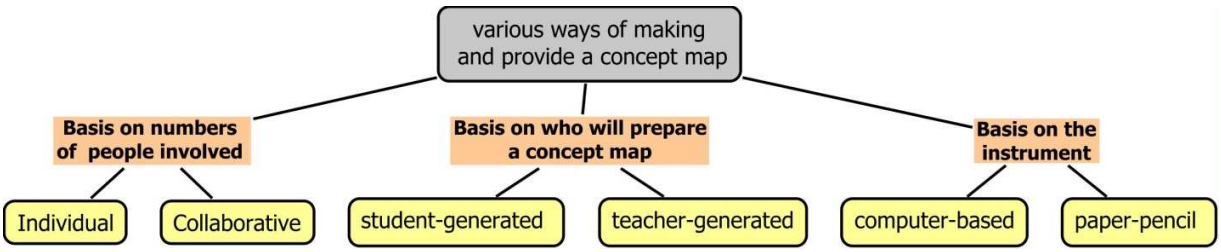

Figure 2. varios ways of making and provide a concept map

Of the methods of prepare of concept maps, in this study three methods included, individual Reading texts whit prepared concept map, paper- pencils concept mapping and computer-based concept mapping have been compared. Here some of the research done in this field are discussed. Research evidence suggests that there are many advantages of using concept maps than conventional methods of teaching and learning. For example Horton and colleagues [12] in a meta-analysis concluded that concept mapping had the positive effects of on achievement and attitude. McCagg & Dansereau [19] found knowledge map had a positive impact on the students' understanding and recall of memory. Chiou study [3] showed that strategy of concept mapping in comparison with traditional teaching can significantly improve student learning. Studies by Mesrabadi and Ostovar [21], Hatami and Abdullah Mirzaei [11] and the Sarhangi and colleagues [26] have showed a positive effect of concept mapping on Iranian students. However, there are studies that have not reported positive effects of concept maps. For example, Huber [15] in a study to evaluate the effectiveness of concept mapping on learning anatomy on health students discipline. The results show no differences between the experimental group and the control group (those using concept maps and traditional learners) found. Willerman and MacHarg [29] examined the use of concept maps as an “advance organizer” for eighth-grade students in a science unit. They reported significant differences in performance of a concept map group at the end of the unit over a control group that did not use concept maps. Research studies on the effectiveness of concept mapping and achievement in middle grade science are scarce, and those that are available give mixed results concerning its efficacy [29]. Fraser and Edwards [7] too, found no significant differences in scores on traditional classroom tests for 9th-grade science students who constructed concept maps and those who did not. Studies about comparing different methods of constructing concept maps had more inconsistent results as far Msrabady and colleagues [20] state that does not seem to be any way to carefully and firmly reply to this question that which ways of make a concept map is more effective than another. To compare the effectiveness of the presentation and construction concept maps several studies have been done. In these studies have been researched two main ways of using the concept maps includes construction concept maps by learners and providing prepared maps by the teacher. Fraser and Edwards [7] in their study showed that students with different ability levels, when receive the greatest benefit of concept maps that themselves have been made the maps. Wandersee [28] also believes that the main educational benefits of concept map is for person who construct, not the person who receives it. Markow & Lonning findings [18] and Msrabadi and colleagues [20] confirm this view, but Willerman & MacHarg in this area have concluded that the effectiveness of concept map will be when map made by the teacher, not the students, because the maps made by a teacher more complete and accurate than maps made by a students. Concept maps can also build by paper and pencil or by special computer soft wares. Computer-based concept mapping is a graphical, visual and spatial creative tool that helps guide designers to their own problem-solving paths [13]. Many studies have shown that the attitude of students to Computer-based concept mapping than to paper and pencil concept mapping has been more positive [14]. Fisher and colleagues [6], showed that SemNet (a concept mapping system) had a positive effect upon student’s map construction. Erdogan [4] indicate that paper-based and computer-based concept mapping strategies produce better results than the conventional method. However, the effects of paper-based and computer-based concept mapping strategies were not significantly different. Despite numerous studies on different methods of constructing and provide concept maps is done but still much inconsistency in this area. In addition, most of the researches are on learning and achievement and less in

effectiveness of reading comprehension have. Therefore, This study has attempted to evaluate effectiveness of different ways of making concept maps than traditional method of studying and learning.

MATERIALS AND METHODS

The subjects of this study consisted of 66 third-year high school students (33 female, 33 male), from one town of Iran that were selected randomly by multistage sampling method. Participants were randomly assigned to three treatment groups and one control group. Treatment groups included computer-based concept mapping, paper-pencils concept mapping, and reading text with prepared concept maps. The control group for the study did not receive any concept map.

Instruments

1) Experimental texts: Two texts with the titles "concentrate on sport" and "conflict" was created. The texts were presented to several high school teachers to consider the appropriateness of content and difficulty of unfamiliar words and phrases and texts for secondary school students are evaluated. According to the comments of the teachers were a few changes in the text. The criteria of selection the texts are: firstly unfamiliar texts for responders, and secondly appropriate to understanding level of high school students. Being unfamiliar texts criterion is chosen because previous data subjects may have affected the results.

2) Comprehension test: Based on content experimental texts, a test was developed to assess participants' comprehension. This test initially consists of 30 multiple-choice items. According to Willerman and MacHarg [29], a test must be at the comprehension level and above in order to measure meaningful learning. Consequently, many items on the achievement tests used in this study were at the comprehension level or above. Initial test conducted on a small group of society research. Then was commutated discriminative and difficulty index of test questions and remove inappropriate questions. Final test consists of 20 multiple-choice items (10 questions from each text).

3) Camp Tools software: The one group of 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 concept maps. This free software is a program that allows the users create concept maps. The software has provided many possibilities for concept mapping and a map can be linked with other concept maps. This software is very easy to work so that users with each discipline and department and little knowledge of computer software can familiar with software in one meeting. The software is available in many languages, and has enabled tens of thousands of users throughout the world to share and collaborate through a network of Public Places where any user, whether a student, a teacher, or a scientist, can create their own space and publish their knowledge models.

4) Expert-generated concept maps: Researchers whit Cmap Tools software construct one concept map for any text. Any of them whit related text after the initial reforms by researcher, were given to four high school teachers that were evaluated according Just place the following hierarchy of concepts. After reviewing the comments teachers, final revisions were made in the maps and two concept maps for texts' focus on sports "and" conflict "was prepared.

Research design in this study was an experimental design with pre-test and post-test. This study were included, three experimental group and a control group. First of all groups were experimental pretest comprehension of texts. In group "A" with the experimental texts, were given related concept maps that previously were prepared by the researcher. The participants were studied the texts and the concept maps. Group "B" after learning method of paper-pencils concept mapping, along with study of the texts, was construct the maps. Group "C" after learning computer-based concept mapping whit Camp Tools software, was construct the concept maps of two experimental texts. The control group was given the experimental texts without using concept map and they read the text conventionality. After the studying and learning the material, four groups (three experimental groups and one control group) were performed a post-test and groups were compared with each other. Training participants was that all of the experimental and control groups prior to the implementation for introduce whit the objectives of the study, were exposed to a 30-minute session. Then the subjects of experimental group "B" (paper and pencil concept mapping), in 4 sessions, 60 minutes introduce whit concept maps, and principles of map preparation and learned these into practice. Also, the subjects of experimental group "C" (computer-based concept mapping), in 5 sessions of 60 minutes, introduce whit concept maps, and principles of computer-based concept mapping and learned these into practice. Educational plan was that the two groups in the second session, introduce whit defining a concept map,

components and features of concept mapping (with instruction booklet). At the after meeting, they completed a preliminary incomplete concept map prepared by the researcher. In subsequent sessions, according to experimental group, spicial training by paper and pencil or computer were presented. The design of this reaserch are showed in Table 1.

Table 1. Research design

experimental group "A"	Pre-test	Reading texts whit prepared concept map	Post- test
experimental group "B"	Pre-test	paper- pencils concept mapping	Post- test
experimental group "C"	Pre-test	computer-based concept mapping	Post- test
control group	Pre-test	Reading texts without using concept map	Post- test

RESULTS

Table 2. presents the means differences of the pretest and posttest results for the control and experimental groups. To determine differences between groups (according to the unequal number of subjects in each group) Scheffe post hoc test was used. Results of this test shows that the comprehension mean scores of the experimental group “Reading texts whit prepared concept map” were consistently higher than those of the control group, while the mean of the other two experimental groups (computer-based concept mapping and paper- pencil concept mapping) did not differ significantly whit control group.

Table 2. Analysis of variance for comparisons means pre-test and post-test in reading comprehension

Group	N	Pre-test		Post-test		F	-p value	Scheffe Post hoc test
		Mean	Std. Deviation	Mean	Std. Deviation			
computer-based concept mapping	11	0/06	2/05	4/78	4/49	17/22	<0/001	computer-based, paper- pencil, prepared concept map & control
paper- pencil concept mapping	17	2/15	2/96	7/35	4/69			
Reading texts whit prepared concept map	16	1/85	2/65	12/82	3/10			
Reading texts without using concept map	22	1/61	1/78	7/49	2/25			

DISCUSSION

The purpose of this study was comparing effectiveness of methods of presentation of concept maps and methods of concept mapping on reading comprehension. The results of this study indicated that presentation of per-prepared concept maps significantly improved comprehension, compared to the map generation and control group. But paper-pencil and computer-based concept mapping compared to the control groups were not statistically significant. The findings of the study is similar to Willerman & MacHarg wives [29], that indicated effectiveness of concept map will be when map made by the teacher, not the students, and Chiou findings. But, the findings with regard whit Fraser and Edwards views that in their study showed that students with different ability levels, when receive the greatest benefit of concept maps that themselves have been made the maps. Also, the findings with regard whit Wandersee believe that the main educational benefits of concept map is for person who construct, not the person who receives it, and do not similar with Markow & Lonning findings and Msrabadi and colleagues. Several factors may have contributed to the lack of treatment effects in paper and pencil and computer concept mapping, in particular. One reason, discussed briefly in the introduction section, is that maps made by a teacher is more complete and accurate than maps made by students. Willerman & MacHarg Have noted that the effectiveness of concept mapping on achievement learners may be due to the teacher's concept map lead students to learn the same objectives and will guide students to test questions. Another possible reason for this result is that the concept mapping is not a simple process [23] but is "a mentally challenging task" [6], that require higher order thinking skills such as evaluation and classification of information, identify relationships, and logical thinking [16]. As a result, concept mapping is “effort-demanding” activity and requires a lot of attention and effort Chang, Sung, and Chen, 2002 especially for students with lower educational levels is challenging and difficult task [6]. Among the many difficulties that students may have to deal with it in concept mapping the researchers found that the most difficult part of it is adding linking words or phrases between concepts and Creation Relationship Between them [23, 6, 16]. Another reason may be participants’ lack of concept mapping experience. It was discovered that over 50

percent of the students who achieved a high level of concept mapping mastery showed significant gains in achievement, while those who did not show concept-mapping mastery showed no significant gains in achievement [27]. Low familiarity with concept mapping may have required the participants to devote part of their cognitive processes to the interpreting instruction and constructing concept maps rather than organizing the content, which is at the core of concept mapping [9]. Low motivation of students to speculation in lessons are other possible reasons for these results. Most of students are accustomed that teachers think rather than them and specified important parts of the course. Extraction the questions and them answers, summarizing lessons, and so on by the teacher or the profit institutions for facilate university entrance exam has led to this approach. However, the research results indicate that is still much research to be done in the field of concept mapping. The findings of this study have several important implications for educational systems and educators. First, Using concept mapping, which focuses on prepared concept maps, can be improving students learning. Second, The result points out the importance and difficulty of preparing and training students for concept mapping tasks, therefore, an efficient map-training need for full familiarity whit concept mapping.

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