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Use of C-Map as a Cognitive Tool in Collaborative and Individual Concept Mapping for Enhancing ELL Students' Reading Comprehension

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USE OF C-MAP AS A COGNITIVE TOOL IN COLLABORATIVE AND INDIVIDUAL CONCEPT MAPPING FOR ENHANCING ELL STUDENTS' READING COMPREHENSION

by

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Enaz Yousef Rasheed Mahmoud
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ABSTRACT

Among those who teach English to English Language Learners (ELL), reading comprehension is considereda an essential language skill critical for knowledge acquisition and information exchange. However, in various parts of the world, including Jordan, reading comprehension has been reported as a difficult area for ELL students to master.

The purpose of this study was to investigate in-depth the impact of the use of the reading software C-map as a cognitive tool in collaborative and individual concept mapping to promote reading comprehension among ELL readers. The independent variable of this study was concept mapping, which functioned on three levels: collaborative, individual, and control groups. There were four dependent variables: reviewing, listing, enforcing, and overall reading comprehension. 106 ELL high school students from Jordan, aged 17-18 years, participated in the study as subjects, divided into three groups: a collaborative group of 32, an individual group of 36, and a control group of 38. All groups were instructed by the same high school ELL English teacher for 10 weeks. Both the ELL English teacher and the rater received training appropriate to their responsibilities.

At the outset of the study, all ELL students took the same pretest individually. They then underwent orientation training appropriate to their groups. Over the course of the study, the students' work was rated using the same rubric 10 times, one time per a week. At the conclusion of the study, all subjects took the same posttest individually. All instructional materials were accredited by the Jordanian Ministry of Education and the reliability and the validity of study instruments were ensured. The collected data was analyzed quantitatively using the independent samples *t*-test and one-way ANOVA. Results, limitations, and recommendations were discussed and interpreted in light of study's purpose, questions, and hypotheses.

CHAPTER I

INTRODUCTION

Statement and Causes of the Problem

On global scale, the English language is considered the most widely used among all languages (Al-Shourafa, 2012). For English Language Learners (ELL), reading comprehension, an outcome that results from a mix of skills and abilities, is perceived as critical for knowledge acquisition and information exchange (Liu, Chen, & Chang, 2010; Chiu, Huang, & Chang, 2000). High-level reading comprehension enables students to be successful in all other areas of learning.

However, reading comprehension skills have been reported as difficult for high school ELL students to master (Bahr & Dansereau, 2005; Chang, Sung, & Chen, 2002; Chularut & DeBacker, 2004; Fadhilah, 2009; Rosenberg, 2010). Rosenberg (2010) has reported that high school ELL students in Russia have problems understanding the sentences they are reading. He notes that high school ELL students from advanced, medium, and low academic achievement levels all have difficulties connecting vocabulary to ideas in the reading context. Similarly, Chang, Sung, and Chen (2002) have found that Taiwanese ELL students cannot extract the general concept or idea contained in a written passage. They have found that students could not grasp the general idea and were slow in extracting secondary ideas from the text regardless of their academic level in other subjects.

Many Arab countries have a problems helping high school students develop their ELL reading comprehension (Fadhilah, 2009; Al-Shboul, Ahmad, Nordin, & Rahman, 2013; Tweissi, 1998). Fadhilah (2009) has reported that Egyptian high school ELL students struggle to grasp content the first time they read a paragraph written in English. However, her study

did show that high school ELL students, who have advanced academic achievement in other subjects, demonstrated higher levels of comprehension than students at medium and low academic levels. She concluded that the proficiency level of ELL reading comprehension is still not enough and needs to be improved. Al-Shboul, Ahmad, Nordin, & Rahman, (2013) conducted a study in Lebanon to investigate differences between public and private educational systems in teaching ELL reading comprehension to high school students. While they found that students in private schools perform better at ELL reading comprehension skills than those in public schools due to the higher amount of practical learning activities in private schools, they maintain that ELL students in both educational systems need more training in practicing ELL reading comprehension skills in schools and daily life. They mention as well that both educational systems suffer from a lack of practical ELL reading comprehension activities. Tweissi (1999) completed a study in Oman that compared ELL reading comprehension skills of Omani ELL high school students to those of other Arab students living in Oman. He reported that non-Omani Arab ELL high school students performed better than Omani ELL high school students. He attributed this finding to the use and study of the English language at home. He maintained as well that most of the ELL high school students in his sample better develop their ELL reading comprehension skills by having more practice in their daily lives.

In Jordan, as in many other Arab countries, the problem is obvious and multifaceted. High school ELL teachers, administrators, and parents acknowledge that reading comprehension levels are inadequate (Al-Zoubi, 2005; Moshira, 2006; Al-Khajaya & Al-Khresheh, 2012; Hussein, 2012). As Jordanian high school graduates learn English, they struggle to grasp and understand the contents of reading texts (Al-Zoubi, 2005; Moshira, 2006; Al-Khajaya & Al-Khresheh, 2012; Hussein, 2012). They have difficulty eliciting the general idea of the text, connecting one sentence with another, describing the meaning of

words in their context, and cannot retain most of the information that they are able to grasp. They are unable to recall, retrieve, explain, or describe most of the information and the concepts they have read about. Their reading in English is slower than their reading in Arabic, requiring more than four times as much time to get through sentences and paragraphs as their reading in Arabic, and they are still unable analyze and break the text down to its main concepts (Al-Shourafa, 2012; Al-Qatawneh & Alodwan, 2012; Al Odwan, 2012a; Al-Khajaya & Al-Khresheh, 2012).

Many reasons and causes exist for the low level of ELL reading comprehension among Jordanian high school students. Many ELL teachers in Jordan, for example, continue to focus on increasing students' vocabulary or their grammar progress rather than on overcoming students' problems and difficulties in English reading comprehension (Al-Shourafa, 2012). As native speakers of Arabic, Jordanian students face a totally different language structure when they start learning English (Alshirah, 2012). Furthermore, rather than focusing on developing ELL reading comprehension skills, the educational culture focuses on rote learning, with the grammar-translation method being the prevalent method in ELL instruction.

According to Al-Adwan and Smedley (2012) and Al-Zoubi (2005), although Jordanian ELL students meet the required threshold of vocabulary, they struggle to achieve a sufficient level of reading comprehension. The main reason this study focuses on Jordanian ELL high school students and not other Arab populations is that the Jordanian educational system has the strongest and most advanced ELL curriculum and highest ELL criteria among Arab countries (Global Innovation Index, 2013). Jordanian ELL students study English more than twelve years, plus pre-school and college years, whereas other Arab countries average only 8 years of ELL instruction (www.nature. com; kinghussein.gov.jo). Still, however, Jordanian ELL high school students' reading comprehension is weak and insufficient in

comparison with other Arab ELL high school students (Smadi, 2013; Samak, 2006). For these reasons, this study focuses on Jordanian ELL high school students and is of particular interest.

Part of the reason Jordanian ELL students have poor ELL reading comprehension is the way ELL is taught in Jordan. Jordanian high school ELL teachers employ various strategies, such as traditional lecturing, discussion-based learning, and vocabulary memorization (Al-Zoubi, 2005; Hussein, 2012; Al-Qatawneh & Alodwan, 2012). Traditional lecturing, however, with its focus on rote learning and its view of learners as passive knowledge receivers, does not allow ELL students enough practice in reading comprehension skills to lead them to a high level of academic achievement in reading comprehension (Al-Jamal, 2007).

The effects of traditional lecturing methods, in particular, on Arab ELL students' reading comprehension have been studied. The research shows a very low level of interaction, coupled with weak performance in ELL reading comprehension. In the Jordanian setting, traditional lecturing requires students to receive the information embedded in the text via teachers' translations. As a result, Jordanian ELL students remain unable to comprehend the reading text itself and grasp the embedded concepts and ideas it holds (Al-Zoubi, 2005).

In contrast, the discussion-based method, an ELL teaching and learning strategy, encourages students to engage in learning in a social environment. This strategy enables ELL students to search, discuss, and present the knowledge they find. Although these advantages are important, ELL students who use this strategy in their learning nevertheless demonstrated a low level of ELL reading comprehension (Al-Khajaya & Al-Khresheh, 2012).

Similarly, Arab ELL students who have been taught by this strategy showed insufficient level of ELL reading comprehension. The discussion-based strategy does not focus so much on the cognitive development of ELL students as on developing their social

skills. In the Jordanian setting, students who engaged in discussions during discussion-based style learning still have serious difficulty grasping and comprehending the information in the content (Hussein, 2012).

Another strategy widely used to enhance ELL students' reading comprehension skills is vocabulary memorization (Al-Qatawneh & Alodwan, 2012). Vocabulary memorization is a strategy of receiving, coding, storing, and retrieving vocabularies and meanings in the human memory. This strategy, however, has not been found to be a good choice for teaching ELL reading comprehension because it does not allow ELL students to practice the skills of ELL reading comprehension (Al Odwan, 2012a).

Correspondingly, Arab ELL students have been shown to achieve a low level of ELL reading comprehension using vocabulary memorizing; this strategy has been reported to develop ELL students' memories more than their cognitive skills, which is essential for improving ELL reading comprehension. In Jordan, ELL students and teachers use this strategy as they attempt to reach a sufficient level of ELL reading comprehension skills. It has been found, however, that after using vocabulary memorizing Jordanian ELL students are able to retrieve individual vocabulary elements, but are still unable to comprehend the overall reading material (Al-Shboul, Ahmad, Nordin, & Rahman, 2013). As a result, Jordanian students rarely achieve the targeted level of effective reading comprehension.

Many ELL teachers in Jordan feel they are under-equipped and lacking in proficiency when they attempt to assist students in developing their ELL reading comprehension skills (Al-Qatawneh & Alodwan, 2012; Tweissi, 1998). This deficit is confirmed Al-Khajaya and Al-Khresheh (2012), who found that the low reading comprehension abilities of Jordanian university students was due to a lack of relevant ELL teaching techniques, including discussion, active learning, organizing, coding, and connecting between concepts, being employed in ELL teaching. Furthermore, Al-Zoubi, (2005) found that ELL Jordanian high

school students performed at a low level of reading comprehension in Jordanian ELL classrooms. He judges their reading comprehension to be low because they only comprehend 65% of the ideas and information included in the material. He indicated that the use of lecture as the most common method of ELL instruction in Jordanian colleges and universities has led learners to find that their learning preferences are seldom respected, which results in a lack of engagement. Hussein (2012) found that the low reading comprehension of Jordanian ELL students was due to the ineffectiveness of study materials and activities, such as teacher-centered learning, including lecturing, the use of long passages, and a lack of communication and interaction between students.

Cognitive Tools

The concept of cognitive tools gained popularity in scholarly literature back in the 1990s (Hutchins, 1995; Norman, 1993). Cognitive tools are defined as tools that enable students to engage and involve themselves in necessary cognitive processes and, as a result, achieve desired learning outcomes (Chiu, 2008). Cognitive tools are tools that support, extend, and enhance cognitive thinking processes in order to organize and acquire the desirable knowledge (Jonassen, 2000; Torres, Forte, & Bortolozzi, 2009).

Cognitive tools provide students with plenty of opportunity for engaging in meaningful learning. They facilitate necessary cognitive processing during learning by enabling students to engage in cognitive thinking processes. They are necessary for the scaffolding of cognitive processes of reflection and articulation. Cognitive tools have many features that maximize students' knowledge construction skills (Chiu, 2008; Conceição, Desnoyers, & Baldor, 2008a).

These cognitive tools help learners achieve a high level of ownership of their own learning and knowledge (Leonardi, 2012; Rosenberg, 2010). They enable students to participate actively in complex learning activities. Cognitive tools are used to enhance

students' critical thinking skills, which are under students' control, and which help them to build their knowledge by themselves. Cognitive tools also allow students to generate ideas that explain relationships between concepts as well as connections between prior and new knowledge (Haugwitz, M., Nesbit & Sandman, 2010; Al-Khajaya & Al-Khresheh, 2012). It has been widely accepted in academia that a cognitive tool serves not just as an add-on to an activity, but also plays an active role by structuring, guiding, and transforming information into an on-going activity (Jonassen, 2000; Hutchins, 1995). Consequently, the major advantage of cognitive tool application is that the user can concentrate and engage in higher order cognitive processing while accomplishing the given task and activity. This result is due to the fact that a part of the cognitive work gets done by the cognitive tool (Novak, 2012; Karasavvidis, 2004).

Concept Map as a Cognitive Tool

One cognitive tool that requires the learner to engage in active cognitive processing is the concept map (Jonassen, 1999; Novak, 2012). Concept mapping is defined as an instructional strategy aimed at helping learners arrange information via different visual graphic aids, with a concept map taking the form of a diagram that shows the relationships among different concepts (Doran, 2002; Novak, 2012; Sung, Chang, & Huang, 2008).

Basically, a concept map is a schematic representation of a learner's understanding of knowledge. Concept maps can result in a visual frame of how their developers mentally structure, arrange, and represent basic concepts in a specific knowledge domain (Baharom, 2012). Concept mapping can have many structures and forms, including: hierarchical, focal, divergent, circular, and connective structures (Doran, 2002). Concept maps allow new information to be organized and connected with more general concepts (Novak & Gowin, 1984). They consist of nodes that describe major ideas and links that show relationships

between concepts (Cho & Lee, 2007). The main purpose of concept maps is to represent the knowledge structure that has resulted from the meaningful learning process (Novak, 2012).

One strength of the concept map is that it sets a precise goal for the learner's activity. Because concept mapping affords representations of key concepts and relations among concepts, it provides specific explanations how the set goal is to be materialized (i.e. through representation of events in the text by visual diagrams). It also shows the relations that are embedded between concepts. Concept mapping includes nodes for the given events and links that mark their relations (Novak, 2012; Hibbing & Rankin-Erickson, 2003).

Concept Map as a Cognitive Tool in ELL

The ability to connect propositional and semantic relationships among the ideas presented in the text is a key to effectively comprehending a passage or an essay (Baharom, 2012). The formation of these connections requires a mindful cognitive process within the student, which is rarely present in current teaching and learning practices in Jordanian educational settings (Al-Khajaya & Al-Khresheh, 2012; Al-Qatawneh & Alodwan, 2012). Very few ELL students engage in such mindful cognitive processes in order to comprehend propositional and sematic relationships when they read texts. To help students engage in such cognitive processes, explicit assistance and tools are needed. Based on past research, concept mapping is a fitting cognitive strategy for improving ELL skills (Chmielewski & Dansereau, 1998; Hyerle, 2000; Baharom, 2012; Liu, Chen, Shih, Huang, & Liu, 2011). Indeed, because concept mapping requires many capabilities, such as reading, writing, synthesizing, vocabulary, conversation, spelling, etc., it has been widely applied as an ELL learning strategy in both school and college outside of Jordan (Al-Qatawneh, 2012; Al-Qatawneh, 2009; Fadhilah, 2009; Conlon, 2009; Sung, Chang, & Huang, 2008; Talebinezhad & Negari, 2007). Depending on past research, concept mapping is perceived as a cognitive strategy for

improving ELL skills (Chmielewski & Dansereau, 1998; Hyerle, 2000; Baharom, 2012; Liu, Chen, Shih, Huang, & Liu, 2011).

According to Chmielewski and Dansereau (1998), concept mapping provides a clarification of the important concepts in a text in a structured and well-organized manner. This strategy refers to thinking process maps or mind maps, yet it is different from certain task-specific organizers due to its special structure (i.e. consistent, connected, and descriptive). Chmielewski and Dansereau break concept mapping down into three types: consistent, connected and descriptive. The consistent type maintains the flow of the source material in presenting the concepts it contains. It shows how one concept leads to another. The connected type of concept mapping presents the causal interaction between concepts. This structure features the strong internal relationships between concepts. In the descriptive type of concept mapping, the concepts play a descriptive role by describing and clarifying other concepts in the structure (Hyerle, 2000; Conlon, 2009). All three types of concept mapping structures play important and different roles in improving ELL reading comprehension because each has unique characteristics that could be suitable to a particular types of content (Hyerle, 2000).

The concept map is considered to be one of the important cognitive tools because it enables students to cognitively engage in learning activities. With reference to this fact, English learning could be perceived as mediated by a concept map (Enright, 2008). Discussing the advantages of concept mapping in English learning, Novak (2012) observed that as a pictorial language of thinking, the concept map has certain advantages since it makes it possible for students to simplify rather complex idea patterns and reduce the cognitive load. The concept map integrates a multi-sensory approach that helps students recall and comprehend texts (Novak, 2012).

These findings are supported by Karasavvidis (2004), who conducted a study to find the impact of concept mapping on the complexity level of ideas that are included in the reading materials. He asked a group of ELL students to use concept mapping to reduce a reading text to its simple ideas. The other group used a normal reading of the text to analyze it. He found that students using concept mapping took more time to analyze the text, but that concept mapping helped them to analyze the ideas and simplify the concepts in the text. Regarding the role concept mapping plays in reducing cognitive load, Ojima (2004) did a study to measure the cognitive load of ELL students while they utilized concept mapping in reading texts. He compared three groups using concept mapping at three different levels: rarely, medium, and intensively. He found that intensive use of concept mapping increased necessary cognitive processes and reduced unnecessary ones. On the other hand, he found that the students who used concept mapping rarely had higher unnecessary cognitive load that interrupted their high level of reading comprehension because they spent less time on unnecessary moving between concepts.

Concept Map as a Cognitive Tool in ELL Reading Comprehension

Applied specifically to the process of teaching and learning ELL reading comprehension, the concept map naturally functions as a cognitive tool through which learners can approach an ELL text with the purpose of understanding it. The concept map provides the student with both specific moves for processing the text and an overarching method for combining those moves to achieve the ultimate goal of understanding the text (Karasavvidis, 2004; Novak, 2012). Therefore, concept mapping could be an appropriate tool for supporting learners in engaging in the necessary cognitive processes for an effective ELL reading comprehension performance (Bahr & Danserau, 2005; Ojima, 2004; Leonardi, 2012).

ELL reading comprehension consists of three skills that are inevitable for achieving a high level of reading comprehension. These three skills are essential for achieving a high

level of ELL reading comprehension. They are: reviewing, listing, and enforcing (Chularut & DeBacker, 2004; Al-Qatawneh & Alodwan, 2012). Reviewing requires students to read the text, indicating the meanings and eliciting the information embedded in the text. Listing requires students to organize and classify concepts in the text based on their properties. Enforcing requires students to connect the ideas, concepts, and meanings together in order to construct a cohesive knowledge structure (Rosenberg, 2010; Coutinho, 2009; Liu, 2011).

In terms of the reviewing skill as a sub-skill of ELL reading comprehension, concept mapping can help students read the text to elicit and extract the key points. It enables students to identify the features of each concept in order to organize them. Concept mapping enhances students' ability to discover and conclude relationships among concepts (Chang, Sung, & Chen, 2002; Hwang, Shi, & Chu, 2011). Furthermore, concept maps are used to facilitate vocabulary learning that is important for mastering reviewing as a skill of ELL reading comprehension (Leonardi, 2012; Bahr & Danserau, 2005; Hibbing & Rankin-Erickson, 2003).

Concept mapping can also significantly improve listing as a sub-skill of ELL reading comprehension because it successfully represents the ELL learning material (Bahr & Danserau, 2005). Concept maps as visual cognitive tools improve data-organizing based on characteristics concepts have in common. This skill enables the students to increase their ability to recall text later and retain knowledge (Khajavi & Ketabi, 2012; Cassata-Widera, 2008; Bahr & Danserau, 2005).

In terms of enforcing as a sub-skill of ELL reading comprehension, concept maps are used to discover the relationships among concept, matching those concepts that have interactions between them. Concept maps improve students' ability to construct ideas by connecting concepts in a meaningful manner, thereby enhance comprehension of essays, paragraphs, and text summaries (Cho & Lee, 2007; Talebinejad & Negari, 2007; Ojima,

2004; Lin, 2003; Gobert & Clement, 1999; Novak, 1998; Hunter, 2008; Ruddel & Boyle, 1989).

Khajavi and Ketabi (2012) found that reading comprehension skills of ELL students were greatly improved by the use of concept mapping. In particular, it was revealed that concept-mapping facilitated text-comprehension skills, summary skills, and skills of learning new vocabulary through reading. Furthermore, Conlon (2009) in a study of native speakers found that secondary school students improved their text comprehension and summary skills in English classes.

Plenty of research exists that compares the traditional way of teaching and concept mapping in their effectiveness in promoting reading comprehension in ELL classrooms (Shih, 1992; Carrell, Pharis, & Liberto, 1989; Mastropieri & Scruggs, 1997; Pressley & Johnson, et al., 1989; Padron, 1985; Padron & Waxman, 1988; Al-Qatawneh, 2012; Al-Qatawneh, 2009; Fadhilah, 2009; Conlon, 2009; Sung, Chang, & Huang, 2008; Talebinezhad & Negari, 2007; Baharom, 2012). These studies indicate the effectiveness of concept mapping as a strategy for enhancing ELL students' reading comprehension.

Collaborative vs. Individual Learning

Though concept mapping promises potential for enhancing students' reading comprehension by facilitating the necessary cognitive processes, it is not an easy and intuitive process to implement without practice (Cho & Lee, 2007; Conceição, Desnoyers, & Baldor, 2008a). Since ELL students in Jordan have been traditionally taught with teacher-centered instructional methods, having students use concept mapping as a cognitive tool might be a considerable leap. Without proper scaffolding and a transitioning process, frustration and, consequently, detrimental effects may occur before the benefits of concept mapping take place (Al Odwan, 2012a).

Individual learning has been used widely in learning and teaching due to its easy management. Individual learning means taking into consideration the student's individual strengths and weaknesses. Since each individual student has a unique experience and background, individual learning enables students to learn based on their individual abilities and paces (Al-Shboul, Ahmad, Nordin, & Rahman, 2013).

In individual learning, the student generates and acquires the knowledge after interaction with the instructor or the knowledge source. Individual learning enables the student to manage the learning process and control learning speed in order to achieve specific goals and objectives. Individual learning requires the teacher to treat every student as a unique person and meet each individual's needs. Individual learning does not engage students in a social learning environment, so the students cannot develop skills and knowledge that require social practice and interaction, such as reading comprehension skills (Cho & Lee, 2007).

One way to alleviate this concern may be collaborative concept mapping, which has demonstrated considerable instructional effects that help to scaffold other skills in students (Enright, 2008; Engelmann & Hesse, 2010; Kwon & Cifuentes, 2009). Collaboration is defined as a "coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem" (Roschelle & Teasley, 1995, p.70 in Stahl, Koschmann, & Suthers, 2008, p. 411). It emphasizes learning through joint action and promotes the exchange of information between learners during the process of socialization as well as cultural education within the group they belong to (Torres, Forte, & Bortolozzi, 2009).

On a simple level, collaborative learning is about two or more students attempting to learn some material together. Wilczenski, Bontrager, Ventrone, and Correia (2001, p.270) provide the following practical definition of collaborative learning: "Students working

together without immediate teacher supervision in groups small enough that all students can participate collectively on a task" (2001, p.270). Collaborative learning is solidly based in the theory that knowledge is constructed through active engagement and interaction among individuals. Furthermore, the concept of collaborative learning emphasizes sharing individuals' experiences and exchanging knowledge, using methodologies that involve learners in completing common tasks (Engelmann & Hesse, 2010).

While focusing on common goals, individuals are accountable to one another and depend on other group members. Indeed, contrary to individual learning, collaborative learning requires learners to capitalize on other group members' skills and expertise by asking questions, assessing teammates' ideas, and checking on the progress of other group members.

In its knowledge-construction approach to learning, collaborative learning reflects the current theoretical shift in education from individual to social perspectives on learning. Indeed, Erkens, Prangsma, and Jaspers (2013) observe that "recent educational research reemphasizes collaborative or cooperative learning" (Erkens, Prangsma, & Jaspers, 2013, p.235). Sfard (1998) discusses two aspects of learning: participation in community tasks and knowledge acquisition. Paavola and colleagues (2004) elaborate on a third view of learning, which they called "knowledge creation." The latter integrates the previously distinguished two approaches; its primary focus is on inquiry within a community as a means of knowledge creation.

Collaborative vs. Individual Concept Mapping in ELL

Concept mapping strategies may be applied individually or collaboratively (Doran, 2002; Cho & Lee, 2007). A review of the literature shows that some research focuses on the comparison of effects of concept mapping on learner reading comprehension in both settings (Khajavi & Ketabi, 2012; Vakilifard, 2008; Kevin, 2009; Luke, Woods, & Weir, 2012; Al-

Shboul, Ahmad, Nordin, & Rahman, 2013; Clariana, Engelmann, & Yu 2013; Freeman & Jessup, 2004). These studies emphasize the idea that concept maps as collaboration tools are used for stimulating communication among ELL learners.

Some studies investigate the differences between the traditional way of teaching and collaborative concept mapping in terms of ELL reading comprehension (Al Odwan, 2012a; Liu, Chen, Shih, Huang, & Liu, 2011; De Simone et al, 2001; Haugwitz, Nesbit, & Sandman, 2010; Coutinho, 2009; Liu, 2011; Khajavi & Ketabi, 2012; Cassata-Widera, 2008; Bahr & Danserau, 2005; Freeman & Jessup, 2004). Most of these studies show the benefits of using collaborative concept mapping.

On the other hand, the effects of collaborative concept mapping versus individual concept mapping as a strategy for reading comprehension among high school ELL students has not received sufficient attention from scholars (De Simone et al, 2001; Luke, Woods, & Weir, 2012). While a few studies compare both collaborative and individual concept mapping in terms of reading comprehension in ELL (Chung et al., 1999; Herl, 1999; Khajavi & Ketabi, 2012; Vakilifard, 2008; Kevin, 2009; Luke, Woods, & Weir, 2012; Al-Shboul, Ahmad, Nordin, & Rahman, 2013; Clariana, Engelmann, & Yu, 2013; De Simone et al., 2001), these studies show contradictory results and lack consensus whether collaborative or individual concept mapping is more effective in promoting ELL reading comprehension.

Some studies indicate that individual concept mapping is more beneficial than collaborative concept mapping in teaching ELL reading comprehension (Khajavi & Ketabi, 2012; Luke, Woods, & Weir, 2012; Herl, 1999). These studies emphasize that the benefit of individual concept mapping is that ELL students create the concept maps based on their own individual cognitive pace and not the group pace (Khajavi & Ketabi, 2012). It is more beneficial, they claim, to expose ELL students to the more complex cognitive activities that are required to construct, connect, and accomplish knowledge (Luke, Woods, & Weir, 2012),

and that it is necessary for the learner to go individually through all the steps of concept mapping and master all particular cognitive steps (Herl, 1999). They emphasize that individual concept mapping is ideal for ELL reading comprehension because it enables students to learn based on their individual learning styles and capabilities (Khajavi & Ketabi, 2012; Luke, Woods, & Weir, 2012; Herl, 1999).

On the other hand, there are many studies that disagree (e.g. De Simone et al., 2001; Chung et al., 1999; Vakilifard, 2008; Kevin, 2009; Al-Shboul, Ahmad, Nordin, & Rahman, 2013; Clariana, Engelmann, & Yu, 2013). These studies emphasize that collaborative concept mapping increases the student's engagement, self-efficacy, and preserves their desire for learning (Chung et al., 1999; Kevin, 2009; Soleimani & Nabizadeh, 2012).

Adopters of collaborative concept mapping claim that it enables ELL students to benefit from other students' cognitive abilities in constructing concept maps (Clariana, Engelmann, & Yu, 2013). They argue that collaborative concept mapping enables ELL students to divide group responsibilities among themselves and focus their cognitive attention on new knowledge construction (De Simone et al., 2001; Al-Shboul, Ahmad, Nordin, & Rahman, 2013). Furthermore, they argue that collaborative concept mapping is ideal for ELL reading comprehension because it increases individual-group engagement in cognitive activities that lead ELL students to achieve a higher level of reading comprehension in less time (Chung et al., 1999; Vakilifard, 2008; Kevin, 2009; Al-Shboul, Ahmad, Nordin, & Rahman, 2013; Clariana, Engelmann, & Yu, 2013; De Simone et al., 2001).

Cognitive activity enhances reading comprehension because it helps learners to build ideas and express them to other people. Collaborative learning plays a similar role in enhancing learners' engagement in constructing and transferring knowledge between learners (Conlon, 2009; Sung, Chang, & Huang, 2008; Talebinezhad & Negari, 2007).

Moreover, collaborative learning is a group-centred strategy because it develops the students' skills only through their collaboration with other members of the student's community and capitalizing on their experience and knowledge. Therefore, exploration and application of the concept mapping in its collaborative mode complements the goals of the curriculum and contradicts set beliefs about the nature of the learning process. Collaborative learning is a relevant subject to reading comprehension because both of them lead to a better understanding of cognitive structures of ideas and knowledge (Kevin, 2009; Liu, 2011; Luke, Woods, & Weir, 2012; Roth & Roychoudhury, 1993b; Chung et al., 1999). Hence, there is a causal relationship between reading comprehension and collaborative learning in terms of facilitating, building, and constructing new knowledge and ideas (Al-Shboul, Ahmad, Nordin, & Rahman, 2013; Clariana, Engelmann, & Yu, 2013).

Based on the previous studies and research analysis, there is a contradiction in terms of determining whether teaching reading comprehension of ELL, collaborative or individual concept mapping is more effective. Some studies have found that individual concept mapping has the advantage in terms of teaching ELL reading comprehension. On the other hand, some studies stated that collaborative concept mapping is more efficient for teaching ELL reading comprehension. Because no conclusive result can be drawn from these conflicting claims regarding whether individual or collaborative concept mapping is the most effective strategy for teaching ELL reading comprehension, a significant need exists for more studies to be conducted in order to shed better light on this issue. Hence, this study compares the effectiveness of collaborative and individual concept mapping in promoting ELL reading comprehension.

Purpose of Study

This study aims to contribute to existing research by focusing on the impact of collaborative and individual concept mapping on ELL reading comprehension. This study is

expected to highlight a variety of aspects of computer-assisted concept mapping as a cognitive tool for enhancing ELL students' reading comprehension in individual and collaborative learning environments. The literature presented has shown conflicting results on the effectiveness of individual and collaborative concept mapping in facilitating ELL students' reading comprehension, which suggests that both approaches have their own strengths and weaknesses.

However, for educators, the question remains of which approach should be used. From an instructional design perspective, while appropriate cognitive tools and its implementations are the main concerns when making the selection decision, the point of time and stage of learning may also be an important variable in determining the effectiveness of the cognitive tool. Therefore, this study focuses on using collaborative and individual concept mapping in facilitating ELL students' reading comprehension skills.

This study is expected to help ELL instructors advance their skills in teaching reading comprehension through the use of collaborative and individual concept mapping as cognitive tools and, furthermore, enable them to make an informed choice between the collaborative and individual approaches. The data will also serve as a reliable basis for the integration of collaborative and individual concept mapping into training on other ELL skills. This study focuses on the cognitive processes involved in concept mapping and, generally, expands the theoretical base of concept mapping use in ELL reading comprehension instruction.

Questions of the Study

In the light of the stated and discussed problem, the following study questions have been developed:

- RQ 1: What is the impact of using concept mapping in facilitating ELL students' development of reading comprehension skills?

- RQ2: What is the difference between using collaborative concept mapping and individual concept mapping in facilitating ELL students' reading comprehension skills?

Hypothesis of the Study

The current research proceeds from the research hypothesis, which has been formulated in the following way: integration of computer-assisted concept mapping into ELL learning may enhance English text comprehension in both collaborative and individual learning environments.

Accordingly, the null hypotheses of the research are divided into two categories, based on the two relative study questions:

Hypotheses pertaining to question one are:

- 1: H_0 – There will be no difference in the ELL students' reviewing skill in reading comprehension between the ELL students who use a concept map as a cognitive tool and the ELL students who do not use concept maps;
- 2: H_0 – There will be no difference in the ELL students' listing skill in reading comprehension between the ELL students who use a concept map as a cognitive tool and the ELL students who do not use concept maps;
- 3: H_0 – There will be no difference in the ELL students' enforcing skill in reading comprehension between the ELL students who use a concept map as a cognitive tool and the ELL students who do not use concept maps;
- 4: H_0 – There will be no difference in the ELL students' overall reading comprehension performance on the posttest between the ELL students who use a concept map as a cognitive tool and the ELL students who do not use concept maps.

Hypotheses pertaining to question two are:

- 5: H_0 – There will be no difference in the ELL students' reviewing skill in reading comprehension between the ELL students who use a collaborative concept map as a cognitive tool and the ELL students who use individual concept maps;
- 6: H_0 – There will be no difference in the ELL students' listing skill in reading comprehension between the ELL students who use a collaborative concept map as a cognitive tool and the ELL students who use individual concept maps;
- 7: H_0 – There will be no difference in the ELL students' enforcing skill in reading comprehension between the ELL students who use a collaborative concept map as a cognitive tool and the ELL students who use individual concept maps;
- 8: H_0 – There will be no difference in the ELL students' overall reading comprehension performance on the posttest between the ELL students who use a collaborative concept map as a cognitive tool and the ELL students who use individual concept maps.

CHAPTER II

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

A World Wide Review of ELL Reading Comprehension

ELL Around the World

English, as the language of global communication and mediation, is the world's most-used language (Shiotsu, 2003). Hence, English language is considered as a dominant and first language that has been used in the world. As a result, many countries in the world use English as an official and first language. In addition, many countries use English as a second language and encourage their people to learn and master it (Chiu, Huang, & Chang, 2000). In the realm of ELL instruction and learning, reading comprehension is considered an essential skill critical for knowledge acquisition and global information exchange throughout the world (Liu, Chen, & Chang, 2010; Mokhtari & Reichard, 2002).

In Asian countries, English has become the high-demand language in all areas of life: education, economy, policy, society, etc. Hence, in Asian countries a strong approach has been used to increase the effectiveness of English instruction for ELL students (Chiu, Huang, & Chang, 2000; Talebinejad & Negari, 2007; Shiotsu, 2010). Likewise, ELL students in Europe need to learn and use a huge amount of information contained in English texts and reading materials. A mastery of English is essential to their academic life and future. South American students as well must have solid, high-level English reading comprehension skills (Gelderen, Schoonen, Stoel, de Glopper, & Hulstijn (2007).

Students in African countries, in order to achieve high ELL reading comprehension proficiency, need to become active learners and engage in high levels of learning activities. (Mokhtari & Reichard, 2002).

Learning ELL Reading Comprehension Around the Globe

Globally, specialists and researchers indicate that actively engaging in reading comprehension instruction enables ELL students to be successful in all other areas of learning. However, although teachers strive to enable students to improve ELL reading comprehension, the results are not sufficient, and students are still struggling to attain ELL reading comprehension proficiency (Khajavi & Khetabi, 2012; Talebinejad & Negari, 2007; Gelderen et al, 2007; Shiotsu, 2003).

The problem of teaching ELL reading comprehension has been explored by a growing number of scholars. Attempts are being made by scholars around the globe to design and implement effective strategies and utilize various tools to facilitate learning. While research on reading comprehension in ELL learning began to grow in the 1960s, it was only at the beginning of the 1970s that ELL reading comprehension instruction became the focus of scholars' attention. At that time, ELL reading began to be viewed as a constructive process (Gao, 2007; Doran, 2002; Al-Sourafa, 2012; Al-Shboul, Ahmad, Nordin, & Rahman, 2013).

Rosenberg (2010) conducted a study to investigate the difficulties ELL students encounter when they use English texts. He identified obstacles ELL students are confronted with as they read textbooks and other reading materials in English, noting that students consumed a huge amount of time translating the words in the text and looking for meanings. He pointed out that the translation process takes a considerable amount of time, physical eye effort, and amounts to a considerable cognitive load. He reported that ELL students in Russia had problems understanding the sentences they were reading because they were more occupied in the translating process than in grasping the meanings of sentences. While they

are reading, the translation process interrupts the sequence of their reading and corrupts their understanding of the ideas. He found that the reason students immersed themselves in the translating process was a lack of vocabulary and the difficulty of retrieving the words' meaning in a short time. He noted that ELL students struggled to elicit ideas from the learning content. He proposed that these challenges are responsible for students' low level of ELL reading comprehension. His study suggested putting more effort and attention toward students using English vocabulary in their daily life rather than restricting the use of English to the classroom. He emphasized the positive impact of quickly recalling the meanings of words on improving ELL reading comprehension skills.

Additionally, Chang, Sung, and Chen (2002) studied the reading comprehension abilities of Taiwanese ELL students and the improvement of their communication skills. Their study revealed that students are generally not able to find the important information in a text. They attributed this inability to a lack of understanding of the general notion and idea of individual paragraphs. They found that Taiwanese ELL students could not recognize the concepts in their reading materials while they are reading, and that inability affected their comprehensive understanding of the meaning of the text. Students paid huge attention to recalling the meanings of individual words and finding the correct vocabulary. Their study emphasized helping students improve their reading comprehension, in particular by helping them to understand the words and connect them in a way that make sense to them. To achieve this, they suggested to ELL students that they reorganize the words and their meanings in their minds. They emphasized the importance of the concepts' organization in the general understanding of learning content.

Egyptian ELL students encounter the same challenge as the Taiwanese ELL students. Fadhilah (2009) has examined Egyptian ELL students' proficiency in understanding learning content the first time they read it. She points out that ELL students are struggling to

understand the learning context on the first reading because they do are not able to read fast enough due to slowness in recognizing the letters and words of the English. She reports that slowness of reading and lack of recognition are crucial obstacles to understanding the texts. Her study shows that these two issues are responsible for misinterpretation and misunderstanding of the meanings of sentences, which led to incorrect comprehension. Her study proposed that ELL students need more practice reading English content, in order to become more familiar with English text. Maximizing familiarity with English text will enhance the students' ability to recognize words and connect meanings effectively.

Chularut and DeBacker (2004) investigated the influence of reading English texts on the academic achievement of ELL Turkish students. They measured the entry reading comprehension skills, prior knowledge, and new knowledge acquisition of students reading texts in English and Turkish. They found that ELL students found it easy to recall the definition of each individual word, and that there was a positive relationship between the sentence's length and the difficulty of reading comprehension. ELL students at the beginning of the experiment preferred short and direct sentences for their readings, but were able to read and comprehend longer sentences by the end of the experiment. The researchers concluded that ELL students needed four times as much time to understand the meanings and concepts that are embedded in English texts and paragraphs as they to understand the Turkish texts. They attributed this finding to the cognitive process of creating connections between words, and suggested that ELL students need to create connections between concepts and words in order to develop better reading comprehension.

A number of possible factors can be identified that cause ELL students' difficulties in comprehending English texts. Difficulty connecting relationships among the ideas in a text is the crucial obstacle to comprehension, as such connections are crucial to comprehending the overall meaning of the text. Gao, Thomson, & Shen (2013) conducted a study to investigate

the factors involved in ELL students' low level of understanding general and secondary ideas in English texts. They indicate that ELL students cannot recognize and elicit ideas from texts because they expend more effort acquiring new information than making connections among the units of new information. ELL students suffer from an inability to identify logical relationships between concepts in the text due to their limited ability to classifying the information based on specific criteria and characteristics. ELL students, they say, need to build new connections, based on the ones they've already created. This result suggests that ELL students have major difficulty creating connections based on previously existing connections. Gao, Thomson, & Shen recommend that ELL students perform active cognitive activities that involve building and creating accurate relationships between ideas and notions in the text.

Along similar lines, Tezci, Demirli, and Sapar (2007) conducted a study that compares ELL students' abilities to comprehend texts consisting of rich ideas and those containing fewer ideas. Their findings indicate that ELL students tend to better understand and comprehend texts consisting of fewer ideas than idea-rich texts. They attribute this to the higher cognitive load required for the rich, idea intensive English texts, whereas English texts containing fewer ideas are more amenable to idea connection because they pose a lower cognitive load. Importantly, ELL students made stronger connections and had better comprehension of ideas when working with texts that requires less cognitive load, and the converse was true as well: connections were weaker and comprehension of ideas lower when working with texts that posed a higher cognitive load.

Yang (2010) conducted a study that examined the factors related to the low level of academic achievement in ELL students. She found that ELL students recognize and comprehend few of the secondary ideas embedded in a text. She reported that the lower number of grasped ideas led to a significant misunderstanding of the general ideas in the

written text. She found that ELL students do not connect or exchange concepts and ideas among different texts. She attributed this lack of connection to the high level of cognitive ability required to make these extended connections among concepts, ideas, sentences, and paragraphs, and suggested using teaching strategies and techniques that encourage students to engage in more cognitive activities in order to increase ELL students' ability to connect ideas.

ELL Reading Comprehension in Jordan

A general Overview of Jordan

The Hashemite Kingdom of Jordan is a relatively small country located in the Middle East. Its population is 6.5 million people (Global Innovation Index, 2013). It shares strategically important borders with some countries in the region. It is a developing country whose natural resources are scarce, industry is quite limited, population is fast growing, and national debt is increasing. Based on the realities of its social and economic life, the Jordanian government has focused on its human capital and educational system as major resources of Jordan's economic prosperity.

Jordanian Educational System

Jordan is known for its high literacy rates and high school completion rates, both for males and females. The literacy rate in Jordan was estimated as high as 92.6% in 2010. This figure reflects the strong position of Jordan in education among Arab countries. A 2009 report on Jordan by the World Bank reports that Jordan has achieved full parity with other Arab nations in enrollment in primary and secondary schools, while transition rates to post-secondary education (i.e. higher education) are 79-85%. Reportedly, Jordan's rate of 2,000 researchers per million people is the highest among the countries within the Organization of Islamic Cooperation, whose member-states report 500 researchers per a million people on average (www.nature.com).

While the philosophy of Jordan's Ministry of Education is technology-focused (i.e. based on the premise that technology makes education effective, scientific, and interesting as well as understandable and efficient), they are now making it mandatory for Jordanian school students to be computer literate and capable of applying computer skills to other courses taught at school (Al-Zaidiyeen, Mei, & Fook, 2010; Majcher-Teleon & Slimene, 2009). Overall, there are 5,000 primary and secondary schools in Jordan, with 60% government-run, and the rest privately run; 930 of these schools are secondary institutions. The total student population in primary and secondary schools in Jordan is 1.4 million. Of these, 840,000 students study at primary schools, and 122, 000 students study at secondary schools (Samak, 2006, p.27).

The Jordanian educational system comprises pre-school education, which lasts for two years, elementary education, which continues for 10 years, and secondary academic or vocational education that runs for two years. Secondary education is followed by a General Certificate of Secondary Education Exam known as Tawjihi.

While the educational system of Jordan is recognized on the international level, and its secondary program is ranked at the top level by the world-class universities, it still has problems. Mona Smadi (2013), an assistant professor at Al Balqa Applied University, in her recently published article, "Education in Jordan: General Overview," outlines key problems faced by Jordan's educational system (Smadi, 2013). One of these problems includes the poor qualifications of teachers in many schools. She also mentions obsolete methods of teaching and evaluation, which focus on memorization rather than learning through communication and exploration. She also points out that there is a lack of creative and research projects, and a lack of individualized instruction. Teachers commonly apply frontal methods in the classroom, following a unified curriculum; students play a passive role. As a

result, free thinking is discouraged, and students lack opportunities to pursued activities based on their abilities or interests (Smadi, 2013).

Smadi's view is echoed in the USAID (2013) overview of education in Jordan. Among necessary improvements cited are: better equipping students with life and career skills, making education more meaningful and of higher quality, launching more kindergarten programs and enhancing schools in underserved communities (USAID, 2013). Similar problems are mentioned at the kinghussein.gov.jo website: "Jordan seeks to improve the quality of its teachers, books, curriculum, and facilities" and faces a continued demand for expansion, especially in higher education. The community college system also needs revamping so that it provides education relevant to the needs of the society (Kinghussein.gov.jo, 2013).

Additionally, a lack of funding for Jordanian school computer labs has been recognized as one of the recent challenges in the Jordanian education system. While the number of computers per student is sufficient (1 per 14 school students), the whole information and communication technology, commonly known as ICT, infrastructure is said to already be out of date. For instance, the current computers were provided to the Jordanian schools back in 2010). Internet connections needs to be improved, as well (Nuqudy, 2013).

Instruction of ELL Reading Comprehension in Jordanian Classrooms

The primary language in Jordan is Arabic, yet English is commonly spoken as well. English is common in Jordan's business, political, and administrative sectors, especially in metropolitan parts of the country. Moreover, English is oftentimes used informally by educated people and the elite across the country. The supplementary foreign language taught in some schools in Jordan is French, as French is spoken in a range of Arabic countries close to Jordan (e.g. Lebanon, Syria, Morocco, Libya, Tunisia, and Algeria) (Abdo & Green, 2010).

English has long been taught in Jordanian schools. English instruction in Jordan started back in the 1920s just as the Emirate of Trans-Jordan was founded. At that time, English was taught in only a few schools. Those schools lacked competent teachers, a curriculum, and set textbooks. Today English is taught in all schools in Jordan, including all remote towns and villages. Thousands of professionally trained instructors teach English using specific curriculum standards and adequate textbooks (Hamdan & Hatab, 2009).

The status of English in education has undergone a major change along with the change of its status in Jordanian society; English is the leading second language in Jordan. It enjoys a prestigious status and is the only compulsory language to be taught at school. A good illustration of the role of English in Jordanian society was given by Hamdan and Hatab (2009), who observed that the English language has become the primary language of job advertisements in Jordan. Reading these advertisements requires a solid command of English language.

In electronic media, six Jordanian radio stations broadcast in English while four others use both English and Arabic. Road signs, street names, and names of shops are in English in Amman and many other cities in Jordan. In addition, Jordan can boast two reputable English newspapers: The Jordanian Times, a daily paper since 1975; and The Star, a weekly newspaper since 1990. Jordanians generate much English content online in blogs, online newspapers, Twitter, Facebook, and on YouTube, etc. (Hamdan & Hatab, 2009).

The role of English in Jordanian education is also important. The demands of the science, medical, business, political, and tourist sectors have required its close integrated into the Jordanian education system and Jordan's culture. Compulsory English instruction begins at the kindergarten level and continues throughout all school years. Where kindergartens are an option, those children who attend them learn English (Al-Shourafa, 2012). Jordanian students enters the university have to complete some introductory coursework in English,

which ensures that students are adequately proficient in English. Al-Shourafa (2012) observes that "English … has become the language of instruction in the colleges of the whole scientific and medical major in Jordan" (p. 236). This focus on English, both in schools and universities, can be explained by its exclusive role in securing employment in Jordan or abroad, as well as generally enabling effective communication and ensuring increased opportunities for Jordanians (Abdo & Green, 2010).

Since the Jordanian students are native speakers of Arabic, they face a totally different language structure when they start learning English. Furthermore, the reigning educational culture in Jordan suffers from a focus on rote learning and the grammar-translation method of ELL instruction, excessive use of Arabic, large classes, lack of individualized approach, lack of interaction between teachers and students, and curriculum restrictions. It is noted that differences between Jordanian students' culture and British or American culture (i.e. social and religious factors) make the situation worse by hindering socio-cultural comprehension, lowering learning motivation and reducing effectiveness (Al-Shourafa, 2012; Alshirah, 2012; Al-Jamal, 2007; Al-Adwan & Smedley; 2012).

In addition to these challenges, or perhaps related to them, many ELL teachers in Jordan find themselves under-equipped and lacking proficiency as they attempt to help their students develop ELL reading comprehension skills. Al-Khajaya and Al-Khresheh (2012) found that the low ELL reading comprehension of Jordanian university students was caused by a lack of relevant ELL teaching techniques. They found that English teachers in Jordan suffer from a lack of innovative teaching strategies and methods, focusing their English teaching instead on traditional lecturing and rote memorization. The English majors who participated in the study were not able to identify the author's viewpoint, couldn't distinguish facts from opinions, assess views expressed by the author, or draw conclusions. Furthermore, the use of lecture as the most common method of ELL instruction in Jordanian colleges and

universities (as found in the study by Al-Zoubi, 2005) has led to learners seldom having their learning preferences respected, which demotivates them. It has been noted that ELL Jordanian students are unable to link ideas, notions, and meanings that are embedded in the reading text (Al-Zoubi, 2005).

Hussein (2012) found that a serious cause of low ELL reading comprehension ability of the Jordanian students was the ineffectiveness of study materials and teaching activities. The teaching activities aimed at teaching reading comprehension do not explore students' abilities to interpret literal meaning, as well as inferential and critical meanings, nor their ability to create connections among ideas. The textbook used to teach reading comprehension skills was found unable "to provide the students with the necessary cultural background" (Hussein, 2012, p. 244). Similarly, Moshira (2006) found that, because the level of ELL students' reading comprehension proficiency was so low, ELL teachers struggle to teach students how to effectively apply various ELL reading comprehension strategies for the purpose of improvement of reading comprehension. Jordanian ELL students' difficulty connecting the ideas and notions in the text leads them to poorly comprehend the reading materials. Connection between ideas is very important and essential to understanding and comprehending the materials. ELL students in Jordan are still in the low level of developing their skills in terms of building and recognizing the interactions between ideas in order to comprehend the sentences, paragraphs, and the overall idea of the text.

While the use of English has become a distinguishing feature of Jordan's cultural environment, at present a serious gap exists in the abilities of Jordanian students to acquire and effectively use it in both formal and informal (Al-Shourafa, 2012; Al-Kataybeh & Al-Shourafa, 2011; Hamdan & Abu Khatab, 2009). As Al-Shourafa (2012) notes, "Jordanian students sometimes have a challenging time acquiring the language, both in written and oral forms" (p. 237). The key reasons are gaps in ELL reading comprehension, specifically the

fact that many ELL students in Jordan cannot read the English text correctly and are unable to connect ideas in the sentences properly. They can not understand the English texts and written reading materials while they are reading them because they cannot understand the relationships between the meanings and ideas in the paragraphs. In addition, ELL Jordanian students cannot analyze English paragraphs nor elicit the general or secondary ideas effectively (Al-Shourafa, 2012; Smadi, 2013).

This argument had also been made by Al-Noman (2002), who found that the Jordanian ELL students performed poorly in terms of their reading comprehension and constructing of relationships among general ideas in the text, although they have been taught by using various instructional media, including flash cards, tape recorders, posters, etc. He reported that they need a cognitive tool or strategy that enables them to accomplish a sufficient level of ELL reading comprehension and understand the relationships between ideas. Similarly, Moshira (2006) found that the general level of ELL reading comprehension proficiency among ELL students was low because they struggle to grasp the connections between meanings and ideas in the sentences. In terms of language structure, ELL students' proficiency was average; in terms of vocabulary and reading comprehension, it was low, and in terms of linking meanings that are discussed in the paragraphs, it was weak.

Additionally, the excessive use of Arabic while teaching English is a serious problem because it interrupts students' ability to understand the text in the English way and reduces their ability to properly connect meanings. Another problem is crowded classrooms, which are ineffective for building ELL reading comprehension because students cannot get enough attention from the teacher to teach them the proper way to create connections between ideas while they are reading a text. Furthermore, the predominant use of traditional methods and rote memorization are serious drawbacks that contribute to the insufficient application of reading comprehension skills (Al-Shourafa, 2012).

In her research into ELL teaching and learning experiences in Jordan, Dina Al-Jamal from Mutah University in Jordan documented a range of serious deficiencies in the current ELL practices in Jordanian schools. Based on a sample of 126 high school students and 26 school teachers in Al-Karak, Jordan, using the methods of questionnaire survey and interview, Al-Jamal found that about 71% of high school students in Al-Karak were dissatisfied with the English language teaching, and she reported that roughly 86% feel awkward conversing in the English language, saying roughly 74% fell back to Arabic when communicating in English. She stated that around 71% were dissatisfied with the progress they'd made in their English skills. She found almost 74% of high school ELL students believe there are better ways to learn English than those used in Jordanian high schools. She mentioned that nearly 93% believe reform is needed in the way English is taught in Jordan. These factors explain the reasons for students' inability to link and connect ideas while reading English texts.

ELL students in Jordanian high schools indicate that their teachers focus intensively on grammar training and fail to develop a sense of the language and the connections among ideas (Al-Jamal, 2007). Furthermore, ELL students said that they felt nervous once they started speaking English because they were dissatisfied with their reading comprehension skills and content knowledge. In particular, they felt nervous when they had difficulty finding relevant words or expressions in English to express their ideas and viewpoints. Next, it appeared that ELL learning in Jordan was perceived by high school students as time-consuming and unrewarding, while the pedagogy is seen by them as inefficient and ineffective. In addition, Jordanian ELL classrooms are excessively centered on the teacher's authority at the expense of student engagement. ELL teaching is typically restricted to the content of a textbook with students focusing on remembering ELL lessons and preparing for exams, more than understanding and creating meaningful links between the ideas in the

passages. Hence, the teacher dominates in ELL classrooms with language acquisition boiling down to mere fact memorization. The student's role is passive with no recognition of general or secondary ideas contained in the text (Al-Jamal, 2007).

Furthermore, Al-Jamal (2007) found additional problems lowering the quality of ELL instruction in Jordan, including general frustration on the part of teachers, poor working conditions, low pay, large classes, and curriculum restrictions, which decrease students' ability to grasp the meaning in the text and develop personal perspectives, based on the ideas in the reading materials. In the Al-Jamal (2007) study, teachers reported a lack of necessary teaching materials, including videos, slides, and overhead projectors, etc, as well as insufficient equipment needed to employ new methods of teaching. Over 92% of ELL teachers in Jordan who took part in Al-Jamal's study recognized the need to improve their teaching methods, with only one third who self-reported using up-to-date methods of ELL instruction. Ironically enough, despite the fact that teachers acknowledged having put much effort into delivering ELL instruction, the majority of them (over 60%) were dissatisfied with high school students' learning outcomes, English reading comprehension skills, and ability to construct relationships among different levels of ideas.

The findings of a study conducted by Alshirah (2012) revealed a range of problems with current ELL teaching in Jordan. These include issues of teachers' competency, lack of innovative teaching methods, teachers' English language proficiency as well as an overall weakness in using English. ELL teachers suffer from the low effectiveness of training programs in Jordan, lack of motivation, low job satisfaction, unsatisfactory working environments, lack of interaction between students and teachers, parents and teachers, and principals and teachers, as well as among teachers themselves. Other problems include discipline issues, teacher workloads, teachers' burn-out syndrome, and a shortage of ELL learning materials in Jordanian schools. All these factors may impact ELL students'

classroom reading experiences, which in turn may influence their ability to create plausible connections between meanings and ideas that help them to comprehend the text.

As a result of her study, Al-Jamal (2007) has come to the conclusion that high school students in Jordan are neither competitive in language achievement tests nor proficient in communicative skills—in particular, reading and grasping ideas. The focus in ELL instruction in Jordanian high school classrooms is mainly on preparation for exams through "mechanical recitation, rigid grammar analysis, and monotonous drills" at the expense of development of students' communicative competence and skills of autonomous learning (Al-Jamal, 2007, p. 51). Hence, an urgent need exists to introduce effective learning strategies and focus more on autonomous learning in ELL instruction in Jordan's high schools. This action may help students overcome their inability to discover relationships between meanings and ideas in paragraphs.

Officially, reading comprehension is part of the curriculum in Jordanian ELL classrooms. Despite the fact it is recognized as one of the core ELL skills, it appears to be a major weakness of Jordanian students. Al-Khajaya and Al-Khresheh (2012) found that English majors in Jordanian universities were not able to identify the author's viewpoint, distinguish facts from opinions, assess the views expressed by the author, or draw conclusions. Based on the review of related studies, Al-Khajaya and Al-Khresheh (2012) concluded that the lack of relevant techniques of ELL teaching is the key problem here. The use of lecture as the most common method of ELL instruction in Jordanian colleges and universities (as found in the study by Al-Zoubi, 2005) has led to the situation when learners find their learning preferences seldom respected, which demotivates them.

Weak ELL reading comprehension and inability to link general notions have been problems among first-year university students, according to a study by Hussein (2012). Specifically, students in their first year in the English Department of Al-Zaytoonah Private

University of Jordan were found to lack the essential reading comprehension skills critical for the students understanding texts fully. For example, they lacked the ability to provide answers to questions, which requires the application of deep thinking and connection skills. While activities aimed at building reading comprehension focus on students interpreting the literal meaning, inferential and critical levels are explored only rarely. Furthermore, the textbook used to teach reading comprehension skills was found to be unable to train them to elicit the ideas from texts, connect them in meaningful way, and "to provide the students with the necessary cultural background" (Hussein, 2012, p. 244).

Seeking ways to improve reading comprehension instruction in ELL classrooms in Jordan, researchers have used innovative approaches. For example, Al-Qatawneh and Alodwan (2012) investigated the effect of applying GTM (Generative Teaching Model) to the process of ELL reading comprehension teaching. On a sample of 88 female high school students, using the ANCOVA statistical analysis tool, Al-Qatawneh and Alodwan (2012) found that using GTM in teaching significantly improved ELL reading comprehension skills of the students of the experimental group in terms of developing the understanding of meanings in the context.

In his turn, Al Odwan (2012a) explored how Jordanian high school students' ELL reading comprehension skills could be enhanced through cooperative learning and the use of directed reading thinking activity. Based on a sample of 42 high school students from one of Amman's public schools, Al Odwan (2012a) found that directed reading thinking activity significantly improved ELL reading comprehension skills and students' ability to link series of ideas together in the experimental group. This finding prompted Al Odwan (2012a) to recommend incorporating cooperative learning and directed reading thinking activity into the curriculum.

In another study, Al Odwan (2012b) suggests the employment of new strategies to teach English reading skills as a way to build up ELL reading comprehension and enhance speaking skills. For high school education, he makes the following recommendations for teaching reading and making reading material both intensive and extensive. He suggests that ELL reading materials be relevant to the needs of Jordanian students and correspond to their psychological specifics, because these standards help the students to effectively identify basic ideas. ELL reading materials should be relevant to students' age because this will fit their abilities and increase their achievement. Al Odwan also recommends that ELL reading materials have rich informational content and appropriate cultural background and understanding for Jordanian students. He says ELL reading materials should be filled with illustrations, contain pictures, and be colorful. He suggested that ELL reading materials be simplified and of reasonable length. Learning materials with these considerations enable students to increase their ability to understand relationships among ideas (Al Odwan, 2012b).

In a study by Tweissi (1998) from the Mutah University in Jordan, Tweissi explored the effects of simplification on reading comprehension and on building connections between paragraphs among ELL students. Based on a sample of 200 Omani learners of English, both male and female, Tweissi found that simplification generally has a positive impact on students' ELL reading comprehension and ability to create connections. The degree of positive impact depends on the quality of the ideas more than the quantity. Excessive simplification does not ensure improved reading comprehension.

Al-Shboul, Ahmad, Nordin, and Rahman (2013) explored the problems that underlie the process of acquisition of reading comprehension for ELL students in Jordan. Specifically, the qualitative study by Al-Shboul, Ahmad, Nordin, and Rahman (2013), based on a sample of ELL students at Al Yarmouk University in Jordan, found that one of the problems was generating new ideas from pre-identified ideas in text, and made the following

recommendations for improving ELL reading comprehension achievement results: move from a formal context to one that is informal; select error correction techniques with care and integrate them into regular instructional practice to reduce students' defensive reactions. encourage ELL students to explain what they learned. In addition, they recommended focusing on topics that are interesting to Jordanian ELL students, and that ELL reading materials be carefully selected to match students' level of reading comprehension and ELL readings skills (Al-Shboul, Ahmad, Nordin, & Rahman, 2013).

Alkhasawneh, Rahman, Ayub, and Daud (2012) have researched web-based teaching of ELL reading comprehension, focusing on teaching ELL students for whom Arabic was the first language to link the ideas between different texts. Importantly, they found web-based teaching to be an effective strategy for increasing reading comprehension because it develops students' ability to describe ideas and find commonalities and differences among them.

Cognitive Tools

Cognitive tools are used primarily to increase students' performance at higher-level mental processes and maximize their thinking skills. The cognitive tool concept gained importance and popularity in the scholarly literature back in the 1990s (Hutchins, 1995; Norman, 1993). It has been widely accepted in academia because a cognitive tool serves as more than a mere additional activity of an individual. Additionally, it plays the active role helping students combine the structuring, guiding, and transforming of knowledge into a continuous process (Hutchins, 1995; Al-Khajaya & Al-Khresheh, 2012).

Thus, the major advantage of cognitive tools is that they enable the user to achieving desired learning outcomes by more cognitively engaging in the learning process (Haugwitz, Nesbit, & Sandman, 2010). This strong engagement is achieved based on the fact that a part of the cognitive work requires the learner to go through a certain level of cognitive processes, which can be facilitated via a cognitive tool (Karasavvidis, 2004; Leonardi, 2012).

Additionally, cognitive tools extend students' thinking process, which helps students engage in a meaningful learning and cognitive process for acquiring new information (Rosenberg, 2010). Cognitive tools are recognized as instruments of knowledge-building that facilitate students' active engagement in mental processes that can be utilized in many different subjects and field domains (Novak, 2012). Cognitive tools enable learners to realize and conceptualize the learning content by involving the students in active thinking activities and a knowledge-generative process (Chiu, 2008). They are effective tools for helping learners to become actively and positively involved in complex cognitive activities, solve problems, think critically, and build new knowledge (Conceição, Desnoyers, & Baldor, 2008a; Novak, 2012).

Generally, learners need to apply intensive cognitive strategies in order to maintain the thinking skills necessary for knowledge construction. As they construct their own knowledge, they gain confidence, and as their ownership of the knowledge increases, so does their self-esteem (Haugwitz, Nesbit, & Sandman, 2010). Cognitive tools are intensively used in helping students develop and increase their critical thinking. They enable students to view and evaluate ideas from different perspectives via different strategies of thinking (Torres, Forte, & Bortolozzi, 2009).

Cognitive tools are considered very helpful in settings where self-paced learning and learner-centered approach are used, as they allow students to construct their own knowledge based on their individual abilities and prior knowledge, and have a strong likelihood of helping students developing their skills (Novak, 2012; Rosenberg, 2010). Because cognitive tools are under students' control and help students to interpret relationships and understand interaction between concepts, prior knowledge, and new knowledge, they are suitable learning techniques for enabling students to move between cognitive levels during the thinking processes (Leonardi, 2012; Nesbit & Sandman, 2010).

Concept Map as a Cognitive Tool

Concept Mapping and Concept Maps

Concept mapping is constructed, based on the cognitive tool concept within the context of the socio-cognitive theory (Vygotsky, 1978). Having considered the argument that tools serve as mediators of human cognitive activity, Vygotsky further developed it to incorporate cognitive tools, also. Within this approach, the role of a sign in any cognitive activity equals the role of the tool in physical reality. The brain constructs a learner's internal world, based on the real physical world. They are termed as cognitive instruments or tools, including, as Vygotsky classified them, human language, counting systems, algebraic systems, certain works of writing and art, schemes, mnemonic techniques, and lines as well as maps, diagrams, and any type of human conventional sign (Vygotsky, 1960/1981 in Karasavvidis, 2004).

Concept mapping is a learning, teaching, and knowledge construction strategy which had been utilized in education for almost three decades. Daley et al (2010) state that concept mapping is a mature topic within the context of educational research and that there exists an extensive research base that supports the application of this strategy in educational environments and other settings. Naturally, the core concept in the strategy of concept mapping is the concept map (Daley et al, 2010).

A concept map is defined by Novak and Gowin (1984, p.15) as "a schematic device for representing a set of concept meanings embedded in a framework of propositions." Essentially, concept maps act as graphical tools for knowledge organization and representation. They come in the form of larger pictures that comprise words in boxes, circles, hierarchies, or other constructions that represent the concepts. Lines that link two concepts show a relationship between them. This relationship is specified by the words on the line and also by linking phrases or linking words (Novak & Canas, 2008). Within this

structure, the concepts that are connected with linking words make up propositional statements.

Concept itself is defined as "a perceived regularity in events or objects, or records of events or objects, designated by a label" (Novak, 2012, p.229). For the majority of concepts, the label is represented by a word although, oftentimes, certain symbols are used: for example, + or % may be used, and, at times, concept map authors use more than one word. *Propositions* or *propositional statements* are defined as "statements about some object or event in the universe, either naturally occurring or constructed" (Novak, 2012, p. 229). Essentially, propositions are known to contain at least two concepts that are connected by the use of linking words or linking phrases to form some meaningful statement. These may also come under the name of semantic units or units of meaning (Novak & Canas, 2008).

Concept maps are a product of research by Joseph D. Novak and his colleagues (1977) from Cornell University on the nature of human learning and knowledge acquisition. In 1977, working towards his Ph.D., Novak introduced the idea that concepts are primary knowledge elements that are linked with one another by propositions (Canas et al, 2004). As a result of a 12-year longitudinal research study into how school children learned science concepts, the idea of the concept map was created, based on analysis of numerous interview transcripts and their translation into "a hierarchical structure of concepts and relationships between concepts, that is, propositions" (Novak & Canas, 2004, p.460).

The idea of the concept map was rooted in Ausubel's (1978) cognitive psychology. The focal message of the latter is that people learn by assimilating new concepts and propositions into the frameworks that already exist in their minds. Thus, any individual's knowledge may be represented in the form of a structure, which may also be described as an individual's cognitive structure (Ausubel et al, 1978). Novak and his colleagues, who sought an effective way to represent conceptual understanding by children, proposed the idea of

representing learning in the form of a concept map. Thus, concept maps emerge a new graphical tool that allowed learners to represent knowledge in a convenient and easy-to-grasp manner (Novak & Canas, 2008).

The concept map, at the end of its creation, represents the cognitive structure of its developer. As the map's author acquires new knowledge, new concepts continue to be added to the existing ones and deepen the meanings that are already present on the concept map. This map reflects how knowledge is structured individually; thus, concept maps have been utilized as tools to facilitate individual learning (Conceicao, Baldor, Desnoyers, 2007). Additionally, they have been used to identify group processes and trace the specifics of group learning (Daley et al, 2010).

There are several ways concept maps can be structured, depending on the relationships that exist between concepts. Four basic categories are distinguished in the literature, including hierarchy concept maps, systems concept maps, spider concept maps, and flowchart concept maps (Gao, 2007). In a concept map, the lower order concepts are subsumed under higher order concepts, with each concept differentiated into smaller and smaller parts. At the end, the concepts are linked with one another horizontally and vertically in order to demonstrate these ideas' integration (Doran, 2002). Within a concept map structure, the most general and most inclusive concepts are found at the top whereas the most specific and least general are found at the. This progression means, as Novak and Canas (2008) explain, that concept maps should be constructed with reference to a specific question, known as a focus question, that a learner seeks to explore or answer. In addition, a concept map may refer to events or situations being explored through knowledge organization in the form of a concept map, therefore generating the context for the concept map.

One more important feature of a concept map is the use of cross-links (Novak & Canas, 2008). Cross-links are relationships between given concepts in different domains of

the concept map. These cross-links show how a concept in one segment of the concept map relates to another segment displayed on the map. In the process of generating new knowledge, cross-links typically represent certain creative leaps on the part of the knowledge producer (Novak & Canas, 2008). Due to cross-links, a map turns into a non-linear structure, which is more complex. The use of cross-links enables the concept map developer to reflect the extent of knowledge synthesis and knowledge integration (Gao, 2007). Moreover, one of the key features of a concept map is hosting examples of those objects or events that assist in clarifying the meaning of the concept. These forms are not typically included in boxes or ovals since they do not represent concepts but reflect the events (Novak & Canas, 2008).

Today, concept maps are widely used in a variety of settings. They are viewed as effective tools for representing, communicating, and visualizing knowledge (Blecic, Cecchini, & Trunfio, 2007). In education, an increasing number of studies show that the use of concept maps help to achieve meaningful learning. This fact is based on an understanding that in the process of constructing a concept map, an individual attempts to link given concepts to make propositions, and the unique structure of those propositions is created (Canas et al, 2005). The result of this process reflects this individual's specific understanding of the knowledge area. According to Novak and Gowin (1984), concept mapping facilitates the learning process by teaching students how to learn through exploration of self-constructed knowledge and cognitive structures. The next subsection of the literature review will explore the theoretical foundation of concept mapping as a strategy of meaningful learning.

Concept Mapping as a Meaningful Learning Strategy

A review of the pertinent literature leads to the conclusion that concept maps are an effective way to organize and capture students' knowledge in numerous fields of study. Further research reveals another property of concept mapping, which is not less important. Concept mapping, as Novak and Canas (2011) rightfully note, "is also a process that

encourages meaningful learning and a better understanding of the nature of knowledge and the nature of human learning" (Novak & Canas, 2011, p.17).

Concept comprehension is a foundation of meaningful learning. Concepts are organized in the brain's cortical regions in the shape of cognitive structures. Human beings think in concepts, as explained by cognitivists: humans express their knowledge, feelings, and reactions to objects as well as events they encounter. Overall, it is believed that competent students are able to integrate thinking, feeling, and acting in a successful manner (Novak, 2010). This competency is achieved through the process known as meaningful learning, which depends both on the quality of knowledge organization in the student's cognitive structure and the level of commitment the student applies to the integration of new concepts and propositions with existing ones (Novak & Canas, 2011).

In his theory of meaningful learning, Ausubel (1968), a learning cognitivist from the United States, rejects the idea of rote memorization, emphasizing the need for understanding in order for learning to be meaningful. In order to be learned, knowledge must make sense to a learner. This goal is achieved once the new information becomes "anchored" in the relevant concepts that already existed in the cognitive structure of the learner's mind. In his book, Educational psychology: A cognitive view, Ausubel identifies the factor that has the most influence on meaningful learning: "The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly" (Ausubel, 1968, p. vi).

Another important point in Ausubel's (1968) theory is his proposition that a learning process should be filled with effective communication, which is a prerequisite for the student's achievement of meaningful learning and adoption of an independent approach to knowledge building (Harlen, 2005). During this process, the teacher's role may be to reduce

the gap between practice and theory and effectively stimulate learners to develop learning in meaningful and creative ways.

Novak's (1966) theory of education, based on his view of education as science and on Ausubel's (1978) theory of meaningful learning, suggests that meaningful learning is what underlies the integration of thinking, feeling, and acting, which leads commitment and responsibility-taking on the part of the learner. This endeavour diverges from the traditional understanding of learning as the rote memorization of study material. In practice, however, school learning traditionally has little to do with the integration of such aspects as thinking, feeling, and acting; nor does it typically involve the construction of powerful knowledge structures. As opposed to rote learning, meaningful learning, at its highest levels, becomes an engine for creativity (Novak & Canas, 2011).

Analyzing Ausubel's (1978) influence on Novak's (1966) work on concept mapping, Torres & Marriott (2006, p.11 in Torres & Marriott, 2009) distinguished three major ideas that guided Novak's theory. Those were as follows:

1) New meanings are developed through building on relevant, already existing concepts and propositions;
2) The organization of the cognitive structure must be developed based on a connective structure, where more inclusive and general concepts are at higher levels of the structure, and those that are more specific and, accordingly, less inclusive are below them;
3) Meaningful learning is about ensuring that those relationships that exist between concepts get more accurate and become better integrated with other propositions and concepts.

Based on this analysis, the concept map technique that was developed by Novak in the 1970s and theoretically rooted in the approach introduced earlier by Ausubel (1978), is a

resource with significant potential for learning and teaching processes. It enables the teacher to act as a mediator during the student's knowledge development. At the same time, the use of concept mapping helps the student to understand and apply deeper meaning to what he/she is currently learning. Thus, meaningful learning is achieved (Moreira, 2012).

Therefore, concept maps represent a useful tool that assists students in reflecting on their learning process, on the very structure of their knowledge, as well as on its production, or, as Novak and Gowin say, on their meta-knowledge (Novak & Gowin, 1999 in Marriott & Torres, 2008, p.47). Once they start reflecting on their learning, students become open to self-assessment, which significantly enhances their growth and facilitates reorganization of the learning and teaching process. As tools for meaningful learning, say Novak and Gowin, "concept maps are intended to represent meaningful relationships between concepts in the form of propositions." (Novak & Gowin, 1984, p.15).

Concept Map as a Cognitive Tool in English

As a cognitive tool applied in the process of teaching and learning in English in general, the concept map naturally functions as a tool through which learners can approach English with the purpose of understanding it and acquiring the knowledge that is embedded in English learning materials. In this regard, concept maps require a certain cognitive structure that provides the goal of the activity, the means for the activity to be performed, as well as the method by which these means can be used to achieve the ultimate learning goal (Karasavvidis, 2004).

Based on a review of the relevant literature and reputable studies, Grabe (2009) compiled a list of empirically validated strategies for learning English. It contains the following items: activating the learner's prior knowledge, producing answers to questions, working on elaborative interrogations, forming questions, monitoring, making associations, building mnemonic support, summarizing, constructing mental images, using graphic

organizers, and developing story grammars and text-structure awareness. Furthermore, the elements of learning English have been identified by Grabe (2009) as those that provide the strongest support for a successful learner of English. These strategies include making summaries, forming questions, giving answers to questions, doing elaborative interrogations, activating prior knowledge, monitoring comprehension, applying text-structure awareness, utilizing visual graphics as well as graphic organizers, and, finally, inferencing.

On a more specific level, the concept map is perceived as a cognitive tool in English because it sets a precise learning goal for the learning activity (i.e. representation of key concepts and relations among them). It provides specific explanations of how to realize the set goal (i.e. through representation of events in the text through visual diagrams). Also, it demonstrates the relation between the goal and the means because it suggests using a specific means to attain the goal (i.e. creating nodes for the given events and links that mark their relations). It designates the necessary procedures (i.e. determining what the given knowledge is, putting it in a node, creating a link to the principal concept, and repeating for other concepts as well). The learning context is also important; specifically, it should be taken into consideration whether students are constructing knowledge as individuals or while liaising with team-mates (Karasavvidis, 2004).

The benefits of concept mapping as a cognitive tool for English teaching and learning have been documented and empirically validated by many studies. Khajavi and Ketabi (2011) found in their research of concept mapping tool application to teaching English that concept mapping enhanced the self-efficacy of students compared to those students who were taught using the traditional approach. Coutinho (2009) compared the efficacy of concept mapping in English classrooms based on a sample of adult learners, and found that concept maps created by learners tend to be more diversified with regard to visual representations than ready-made concept maps designed by a teacher. This explains the higher scores of

students who created their own concept compared to those who used ready-made concept maps designed by the teacher.

Similarly, Chularut and DeBacker (2004) found that concept mapping benefited students of various proficiency levels in English, especially high-level ones. It increased students' self-efficacy and self-regulation and facilitated greater learning from English learning materials compared to students who did not use concept mapping.

Conlon (2009) found that high school ELL students improved their learning skills by using a concept mapping approach in their daily English learning. Though higher-level "credit" students benefited more, lower-level "general" students made good improvement as well.

Al-Qumoul (2005) completed a study that investigated the effects of concept mapping on English learning and knowledge acquisition among 10th graders. It was found that students who used concept mapping in learning English acquired knowledge better than those who studied the English content in the traditional manner. Nabah, Hussain, Al-Omari, & Shdeifat (2009) explored the effectiveness of teaching English through concept mapping and using concept maps to learn English content on a sample of 212 high school students. Because concept mapping is often viewed as a learning and teaching strategy, Nabah et al (2009) examined the ways concept mapping was employed effectively in ELL classrooms. They found that, while there are many other cognitive strategies in teaching and learning English, concept mapping is one of the primary strategies used for learning English. They also found that a growing number of researchers were turning to the potential benefits of concept mapping in learning English (Nabah et al, 2009).

Concept Map as a Cognitive Tool in English Reading Comprehension

In this study, a concept map is classified as a cognitive tool in light of cognitive theory. Just as a material tool plays a major role in a physical activity, a concept map, as a

cognitive tool, plays a major role in a learning activity. In fact, ELL reading comprehension can be said to be mediated by a concept map. However, the relationship between the student and the ELL reading comprehension is indirect, because the interaction of the two is mediated by a cognitive artifact, namely a concept map (Enright, 2008).

Basically, the key similarity between cognitive and material human tools, besides the fact that both are "products of human cultural-historical activity," is that the former possesses a reverse function (Daniels, 2011, p. 678). Furthermore, cognitive tools are found to be internally oriented (i.e. the sign cannot change anything in the given object of human cognitive orientation) while physical tools are found to be oriented externally (i.e. can be applied to the given object of human activity).

While a variety of reading strategy classifications may be found, the present study prefers to utilize the one suggested by Sheorey and Mokhtari (2001). Based on application of a cognitive framework, the scholars classified all reading comprehension strategies into cognitive, metacognitive, and supportive. Cognitive strategies are those in which the basis of reading comprehension is the learners' use of prior knowledge and various strategies while constructing meaning during the process of text comprehension (Pang, 2008). Also, cognitive strategies are defined as those internal processes that are utilized by learners while selecting and modifying specific ways of attending, remembering, thinking, and learning (Gagne, Brigg, & Wagner, 1998 in Barrett, n.d.).

Metacognitive strategies are based on students' awareness of how exactly they learn. While metacognition itself can be briefly defined as "thinking about thinking," the application of a metacognitive strategy involves students learning to think about how they can read best and which strategies to use in order to comprehend the text. Thus, if students are actively thinking about ongoing cognitive processes, they are found to be applying metacognition (Cohen & Cowen, 2007). Supportive strategies are those supportive actions

that are taken by readers to facilitate the understanding of the text (e.g. using a dictionary, taking notes, and highlighting text for better comprehension) (Sheorey & Mokhtari, 2001).

Scholars agree that among the strategies that show the greatest potential for improving ELL students' reading comprehension, graphic strategies stand out. Because graphic strategies may be applied during all key phases of the reading process, including the preparation or previewing stages, while reading, and when the student has finished reading (Dowhower, 1999). Essentially, graphic strategies enable readers to approach texts in a new way that differs from traditional text representation, which is linear. Graphic strategies allow both the text structure and relations between concepts to be illustrated. Visually, they give readers a clearer, more substantial view of what they are reading (Griffin, Malone, & Kamennui, 1995).

While scholars typically apply the term "graphic organizers" to various kinds of spatial learning strategies, including concept maps, flow diagrams, the Vee heuristic, and Venn diagrams (Baxendell, 2003; Hall, Strangman, & Meyer, 2003; Doran, 2002), others classify concept maps as a separate category along with graphic organizers and knowledge maps (Chang, Sung, & Chen, 2002). The term graphic organizers is a more general term inclusive of concept maps. It basically refers to any arrangement of graphic features and may be defined as a map representing a certain cognitive structure or particular thinking process. In their turn, concept maps, a subcategory of graphic organizers, show the relationships that exist among the most important concepts, which are typically placed at the very top (Baxendell, 2003; Doran, 2002).

The distinguishing feature of graphic organizers is their focus on transforming the linear text into a graphic non-linear visual presentation (Chang, Sung, & Chen, 2002). The resulting tree-like structure is proximate to the overall text structure and facilitates text retrieval and retention (Van Dijk & Kintsch, 1983). Considerable progress has been made in

the application of various graphic organizers that assist readers in text comprehension and memorization (Robinson, Katayama, Bubois, & DeVaney, 1998). Concept maps have been intensively applied because they help the students to overcome the complexity and recognize hierarchy of relationships between concepts in the text (Kevin, 2009).

ELL Reading Comprehension as a Cognitive Process

Many definitions have been formulated by various scholars to explain the meaning of ELL reading comprehension. ELL reading comprehension has been defined as "an interactive cognitive process involving various levels and types of reader knowledge for efficient processing of visually presented text" (Shiotsu, 2010, p.7). Kevin (2009) has described ELL reading comprehension as a cognitive activity that reflects the understanding of reading texts by recognizing the interactions and connections between words and sentences. Erkens, Prangsma, and Jaspers (2013) define ELL reading comprehension as a mental capacity a reader uses in order to grasp and perceive the reading text by actively engaging in multiple cognitive processes.

ELL reading comprehension is identified by (Khajavi & Ketabi, 2012) as the interaction between internal mental processes and external symbols that lead the reader to active cognitive engagement in the reading text. ELL reading comprehension *skills*, in turn, are defined as actions that are taken to construct meanings and knowledge. They are also defined as mental and cognitive processes that are consciously selected by learners to assimilate the information that is included in English reading tasks (Cohen, 1986).

Having reviewed a number of definitions of the ELL reading comprehension process from various scholars, I will define ELL reading comprehension as a mental multi-process in which a reader engages to recognize, extract, and construct meanings via active cognitive activities and involvement with readable texts.

There are numerous sub-skills that contribute to ELL reading comprehension. According to Chularut and DeBacker (2004), in order to achieve ELL reading comprehension, students must master the primary sub-skills of ELL reading comprehension. They name reviewing, listing, and enforcing as three of these sub-skills. Al-Qatawneh and Alodwan (2012) identify these same three sub-skills as the essential components of efficient, high-level reading comprehension. They emphasized the fact that ELL reading comprehension consists of three main skills that the students must master because they are inevitable components for performing a high level of ELL reading comprehension efficiency. Similarly, Rosenberg (2010) names these same three components—reviewing, listing, and enforcing—as necessary to mastering ELL reading comprehension. Furthermore, Bahr & Danserau (2005) argue that each of these skills is built upon the previous skill: reviewing is required for listing, and listing is necessary for enforcing. Thus, these three sub-skills are connected and sequential in terms of the activities required for reading comprehension; ELL learners must begin by reviewing, move on to listing, and end with enforcing.

Reviewing as a Sub-skill of ELL Reading Comprehension

The initial sub-skill of ELL reading comprehension is reviewing. The student starts learning ELL reading comprehension by engaging in the reviewing process at the beginning of the reading. There are certain practices and activities involved in performing the reviewing sub-skill. An ELL learner is apt to read the text by reading its words, sentences, paragraphs, signs, and punctuation marks (Chang, Sung, & Chen, 2002). An ELL student, as a text reviewer, maintains the flow of reading and follows the order of words in sentences. Text reviewing requires the ELL learner to recognize the words and written symbols very quickly. Recognition should be made within a few fractions of a second and must be effortless. The word recognition process should not be difficult because that would consume more cognitive load and overload the learner's mnemonic capacity (Hwang, Shi, & Chu,

2011). This initial reviewing phase requires ELL learners to understand the connections between words, sentences, and paragraphs, which requires that they recall the meaning of each individual word in order to understand and be aware of the connections between words, sentences, and paragraphs. Students need to indicate the meaning of each word in their minds or do a very fast translation for each single word (Leonardi, 2012; Bahr & Danserau, 2005; Al-Qatawneh & Alodwan, 2012).

Just as reading words necessarily requires the viewing, connecting, and reading of individual letters, reading sentences inevitably requires ELL learners to read individual words, and reading paragraphs requires students to read individual sentences. The reviewing process appears to start from small parts (i.e. letters and words) and move to more complex structures (i.e. sentences and paragraphs) (Hibbing & Rankin-Erickson, 2003). This process leads the students to recognize and elicit general information and ideas embedded in the text and learning content. Specifically, ELL students engage actively in the reviewing sub-skill by organizing and classifying the general information and ideas that they have recognized (Hwang, Shi, & Chu, 2011; Chularut & DeBacker, 2004).

Reviewing, as a cognitive activity, could be initiated using a cognitive tool. One effective cognitive tool is a concept map. During the initial (reviewing) phase of ELL reading comprehension, concept mapping plays an important cognitive role by helping students read the learning text in such a way that they can perform all or most of the relevant reviewing practices. For example, concept maps facilitate vocabulary acquisition, which is extremely important in the reviewing phase of ELL reading comprehension (Chang, Sung, & Chen, 2002). Concept mapping can also enhance students' ability to elicit general ideas and concepts, thus maximizing students' ability to extract the main information and basic points contained in a text. Concept mapping helps students recall the meanings of words by encouraging them to concentrate their attention on the text that they read. It enables them to

grasp the meaning and features of general ideas and concepts (Rosenberg, 2010). Concept maps help students create a space in their minds for each general idea in order to add details and sub-concepts to each main concept later in the listing phase of the comprehension process. Finally, concept mapping enhances ELL students' ability to reveal connections between words, sentences, and paragraphs by explaining their general meanings. It helps students to recognize the interactions and relationships between concepts in the text (Bahr & Danserau, 2005; Hwang, Shi, & Chu, 2011; Hibbing & Rankin-Erickson, 2003).

Listing as a Sub-skill of ELL Reading Comprehension

After ELL students have engaged in reviewing the text and reading materials, they move to the second step of ELL reading comprehension: listing. Listing is launched, based on a successful performance in reviewing text because all the three ELL reading comprehension sub-skills are sequential processes. Listing requires students to dig deeper in the text and grasp more meanings and secondary concepts relevant to the general notions and ideas they elicited in the first (reviewing) step. Grasping these additional meanings and concepts enables students to improve their understanding of the learning text by engaging them in elaboration of concepts, description of items, and acquisition of information that is embedded in the paragraphs (Khajavi & Ketabi, 2012; Al-Qatawneh & Alodwan, 2012).

Once ELL students have elaborated and identified the small pieces of the text, they begin the actual listing activity by eliciting information from the text and placing it under the right and proper general idea. The listing process is a high-level cognitive activity because students use multiple levels of the cognitive process, including grasping the text, identifying secondary meanings and concepts, making connections between the general idea and secondary concepts, elaborating concepts, describing items, acquiring information and, finally, listing the items under the appropriate general notion (Cassata-Widera, 2008; Bahr & Danserau, 2005).

Listing is considered a core sub-skill of ELL reading comprehension, based on the huge amount of cognitive processing and mental effort that is required throughout the listing process. Hence, it would be very beneficial to use a cognitive tool that enabled students to perform faster and more effectively the cognitive processing involved in the listing process. Concept mapping offers substantial benefits in helping students elicit information from texts. It also enhances their ability to perform listing activities and organize secondary items and concepts under the relevant general idea (Khajavi & Ketabi, 2012; Chang, Sung, & Chen, 2002).

The very important visual aspect of the concept map, promises a strong likelihood of improving students' ability to organize listed concepts and data based on their similar characteristics and schema (Khajavi & Ketabi, 2012). Well-organized and accurately listed concepts maximize ELL students' ability to retain knowledge and recall information (Cassata-Widera, 2008; Hwang, Shi, & Chu, 2011).

Enforcing as a Sub-skill of ELL Reading Comprehension

Enforcing is an essential sub-skill for achieving high ELL reading comprehension. In the enforcing phase of the reading comprehension process, students discover potential relationships between the listed concepts under a given general idea as well as among multiple general ideas (Rosenberg, 2010; Coutinho, 2009; Liu, 2011). Hence, enforcing can be seen as both a vertical and horizontal cognitive activity. On the one hand, it is a vertical cognitive process because it engages ELL students in discovering and creating connections between secondary concepts that are relevant to one general idea. On the other hand, it is a horizontal cognitive process because it enables students to identify relationships between secondary concepts listed under different general notions and ideas (Cho & Lee, 2007; Talebinejad & Negari, 2007).

Creating and discovering these relationships and connections between concepts and ideas enables students to construct solid, cohesive, and meaningful knowledge. It maximizes students' ability to establish relationships among concepts in such a way that they develop new knowledge structures. Enforcing helps students to develop a deep understanding of the topic because they know the concepts and elements of the topic (Ojima, 2004; Lin, 2003; Gobert & Clement, 1999; Novak, 1998).

Using concept mapping in the enforcing step of the reading comprehension process improves students' ability to construct new ideas and knowledge by enabling them to connect concepts in a meaningful way and produce new knowledge. In turn, the enforcing step enhances ELL students' skills in developing a cohesive, holistic, and deep understanding of the texts they read. At the end of the enforcing step, ELL students start a new reading with a fresh cycle of reviewing, listing, and enforcing to arrive at a comprehension of the next text reading (Ruddel & Boyle, 1989; Lin, 2003; Hwang, Shi, & Chu, 2011).

Computer-Assisted Concept Mapping in ELL Reading Comprehension

The construction of concept maps could be done using technology; just as the task of writing text can be done using a word processor, the creation of concept maps can be done using a computer (Canas et al, 2005). Research efforts to create powerful concept mapping software aim towards enabling learners and instructors to manage larger representations of complex segments of knowledge. The instructor, using concept mapping software, facilitates the process of sharing and collaboration in groups of students during map construction. The technology enables learners to revise and modify the structure of concept maps easily and edit them effectively (Stahl, Koschmann, & Suthers, 2008).

Various terms have been used to refer to computer-assisted concept mapping: electronic concept mapping, computer-based concept mapping, and computerized concept mapping (Tezci, Demirli, & Sapar, 2007). In recent scholarly literature, a number of studies

provide empirical validation of the benefits of the use of computer-assisted concept mapping for ELL reading comprehension purposes. One of the important contributions in the development of computer-assisted concept mapping is the research and popularization accomplished by Novak and Canas and their colleagues from the Institute of Human and Machine Cognition (IHMC) in the United States. The developers of the free Cmap Tools software, Novak, Canas, and their colleagues (2004) have not only empirically validated its effectiveness in a number of educational contexts, but have also solidly established computerized concept mapping as a cognitive tool for creating a knowledge modelling and sharing environment. They have discussed principles for building a new model of education, based on a computer-assisted concept map-centered learning environment (Novak & Canas, 2006; Canas & Novak, 2006) and have investigated the specifics of concept map implementation in the teaching and learning process and its role in facilitating meaningful learning (Canas & Novak, 2008).

Chang, Sung, and Chen (2002) have explored the impact of computer-based concept mapping on ELL reading comprehension abilities of fifth graders from an elementary school in Taiwan. Their findings provide evidence that computerized concept mapping enhances students' text comprehension capacity, particularly when a spatial learning strategy is combined with scaffolding or map construction.

Furthermore, a study by Iranian scholars Soleimani and Nabizadeh (2012) empirically validates the use of computer-assisted concept mapping via the Cmap Tools software to teach ELL reading comprehension in intermediate pre-university students. Soleimani and Nabizadeh have found that computerized concept mapping serves as an effective alternative to conventional ELL summarizing strategies. Both learner-constructed and fill-in-the-map computerized concept maps were found to be useful for enhancing ELL students' reading comprehension skills. The latter was found to be beneficial for development of ELL reading

comprehension ability in the target language, for example, international students learning English.

The benefits of software-based concept mapping approaches have been explored by Eppler (2006). Specifically, Eppler examined the complementary use of software-based concept maps, e.g., those created through Inspiration software. He reported that it enhanced students' motivation, understanding, attention, and recall while they were learning ELL reading comprehension. Next, Tezci, Demirli, and Sapar (2007) examined the benefits of electronic concept mapping for ELL teaching. Their study outlines the advantages of the use of computerized concept maps when teaching ELL reading comprehension, grammar, vocabulary, and speaking skills. Specifically, the authors recommend using SmartDraw and Inspiration software, as well as other kinds of concept mapping applications because "it will facilitate contextual comprehension, which is one of the most important objectives in language teaching" (Tezci, Demirli, & Sapar, 2007, p. 55).

Liu, Chen, and Chang (2010) found that computer-assisted concept mapping had a greater effect on the reading comprehension of low-level ELL students than on that of high-level learners. Moreover, they found that concept mapping that was designed to enhance ELL reading comprehension skills improved not only reading ability but also reading comprehension skills, such as reviewing, listing, and enforcing.

Concept mapping is a branch of computer-supported learning, also known as Computer-Supported Concept Mapping (CSCM) (Yang, 2010). CSCM is designed based on interplay between technology, learning, and concept mapping. It arose back in the 1990s as a response to the spread of software that made students learn and construct their knowledge in an active manner. As the potential of the Internet has grown, so has CSCM research been stimulated (Stahl, Koschmann, & Suthers, 2008). In CSCM, interactions between learners and computers are essential for constructing concept maps and building new knowledge by

specific computer environments. The primary focus is on meaning and "practices of meaning making in the context of joint activity" (Stahl, Koschmann, & Suthers, 2008, p.418).

Toward this end, many software applications have been found to be effective and helpful for CSCM. In CSCM, technology plays the role of mediating and effectively encouraging students in cognitive activities and practices that enhance their learning and, consequently, lead to constructing and acquiring new knowledge.

Cmap Software

A variety of software that has been developed of late helps to generate concept maps and provide considerable support in creating, manipulating, storing, and reusing of concept maps. In this section, the author examines a few selected samples of modern concept mapping software that are used in many educational settings.

Cmap Tools. This software is a kit that enables users of all ages to create concept maps and sustain effective collaboration, as well as sharing. This client-server based software was developed at the Institute of Human and Machine Cognition which is abbreviated as IHMC; the official website address is http://cmap.ihmc.us. Its major characteristics, as described by Canas et al (2004), include a low threshold, a high ceiling, considerable support for knowledge model construction, considerable support for sharing and collaboration, and modular architecture.

The high ceiling features of Cmap Tools refers to way the user interface allows users to focus on the challenge of knowledge map construction without being distracted by irrelevant activities (i.e. Cmap Tools design is basically nonintrusive). This design allows a simple and straightforward way to construct concept maps. It also refers to the simplicity and functionality of the user interface, which allows even children or inexperienced users to construct maps (Coutinho, 2009). According to Canas et al (2004) this user-friendliness has

led thousands of users, ranging from pre-schoolers to professionals, from more than 150 countries to construct knowledge models through Cmap Tools software.

The "considerable support for knowledge models construction" listed above refers to Cmap Tools' capacity for supporting the development and publication of numerous collections of interconnected concept maps and the resources associated with them. Cmap Tools supports both construction and browsing when publishing or navigating concept maps. Thus, it acts as a browser and editor at once. In order to display relationships among the concept maps of one set, Cmap Tools enables the user to link all concept maps via the simple operations of dragging and dropping. Therefore, it is possible to navigate from one map to another (Coutinho, 2009).

In addition, Cmap Tools users can create links to all types of related resources, including images, sound clips, videos, and texts. These resources complement the data in the map and are retrieved from the Internet. Other Cmap Tools features are the Views window, which enables the user to generate a hierarchy of folders for organizing concept maps, URLs, videos, web pages, XML or outlines. Topic Map is a function that imports and exports images and records the steps of the concept map construction in order to play them back if needed. Other features include a full-screen presentation module and a concept-suggester that mines the web for necessary concepts (Hanson, 2005; Canas et al, 2004).

Another outstanding feature of Cmap Tools is its considerable support for sharing and collaboration. Canas et al (2004) have noted that what makes Cmap Tools unique is the ease with which knowledge models can be shared, and collaboration established, through the Places function. From the user's perspective, a Place refers to a shared location that can be accessed through either the Internet or some Intranets. In these Places, knowledge models may be constructed collaboratively (i.e. with peers or with colleagues) and shared with others who are allowed to access, comment on, and browse other users' knowledge models.

The aim of this Cmap Tools is not restricted to simply enabling users to share while constructing knowledge models; it is also designed to facilitate public sharing of knowledge and encourage users to share. This aim was accomplished by the inclusion of the following two features in its design: first, the program automatically locates new Places that are installed within the network, which makes new knowledge models available to every user. Second, a Public Places feature is planned to be made available within the network, which will enable students to publish as well as share new knowledge models even if they are not linked to an organization that runs a CmapServer (Hanson, 2005). Cmap Tools operates on both Mac OS X and Microsoft Windows platforms. (Canas et al, 2004; Coutinho, 2009).

Inspiration. Inspiration, found at (www.inspiration.com), is a concept mapping software for students in grades 6 to 12. It is a visual learning tool that enables students to operate in diagramming and outlining environments in order to organize their ideas. Overall, Inspiration is used for brainstorming, organizing, and thinking activities. A commercial concept mapping tool, Inspiration's latest version (2010) was designed to assist students in grades 6 to 12 in comprehending information, communicating, creating, and generally improving their achievement (Baxendell, 2003).

The main feature of Inspiration is its support of the brainstorming function, which is available from the toolbar: it allows the user to adding notes to ideas, spell-check the notes, export them, present an idea as a direct hyperlink, attach a hyperlink to a given idea, and link another map to the idea. In addition, it allows the user to associating images of free text with a given map and provides set map layouts (e.g. web diagrams, Top Down Tree Diagrams, Right Tree diagrams, Left Tree Diagrams, Bottom-up Tree Diagrams, etc). Inspiration also allows the user to change the location of each idea by simply dragging it, offers a text outline view option and permits the user to import various text files, export a map as a graphic, save or export a map in MS Project format, or print a map (Liu, Chen, & Chang, 2010).

Additionally, Inspiration features an easy way to add new ideas to the extant concept map. Students select an idea and either click Create on the branch they want to add to, or simply press the Insert button. IT is also possible to add new ideas by dragging empty idea boxes from the palette of symbols and linking them to the map manually using the Link button. Students are able to set their own template as the default, and to alter the position, level, and order of the nodes. For younger students, namely K-5 learners, Inspiration was designed to develop thinking skills, promote understanding of mathematic concepts, and enhancing writing and reading skills. Inspiration operates on Mac OS X, Palm, and Microsoft Windows platforms (Baxendell, 2003).

GetSmart. The concept mapping tool GetSmart was designed to be used along with the National Science Digital Library (abbreviated as NSDL). Its main intended use is to develop curriculum and integrate technology support. GetSmart is used for search functions and improving knowledge visualization that is necessary for using a digital library. It supports both learning-oriented and learner-centered environments (Eller College of Management, 2013) and is a result of collaborative work between Virginia Tech and Al Lab at University of Arizona led by Dr. Hsinchun Chen. GetSmart typically comes in two basic versions: as a server-dependent and stand-alone program. The server-dependent version is more complex and requires a high level of programming. The stand-alone version of GetSmart comes as a simple concept mapper that is capable of drawing boxes and lines without focusing on much else, though it does host an additional module, enabling the user to search for keywords through the local repository. It uses Java and can be applied to any operating system that supports the Java virtual machine (Kevin, 2009).

Structurally, GetSmart represents a built-in relationship taxonomy. Within that taxonomy, users can label relationships as they see fit, though they must choose from the

relatively few generally applicable names for relationships provided by the software. Students also have the option of importing files, as well as URLs associated with concepts (Liu, 2011).

Thus, every concept may be further described with the help of these resources. The ability to associate resources with a concept may be viewed as a basic form of superimposed data, in which web pages or files are described by or linked to specific concepts. This superimposed information approach is one of the styles used for presenting as well as managing information described by Dr. David Meier and his companion Louis Delcambre as cited in Hanson (2005). Meier and Delcambre focus on arrangements where certain information refers to links and files in a base layer. Students can easily refer to those attachments from the layer that is superimposed. Within such arrangements, existing relationships in a given concept map may be utilized to describe other related concepts (Hanson, 2005).

The server-based version of GetSmart is a web-based application that enables students to access several resources. The basic feature of this software is deployed as a Java Applet. Clients interact with a shared concept map server through a web browser, which allows users to keep their concept maps within the main repository as well as see one another's work. The version that is web-based is deployed as a specific web-based service (Engelmann & Hesse, 2010).

SMART Ideas. The concept mapping software Smart Ideas offers a rich variety of features in comparison with Cmap Tools, Inspiration, and GetSmart. It provides a sophisticated selection of options for controlling the appearance of concept maps. The included style palette gives students a range of options for arranging concepts and relationships. A small but very expandable clipart library is available, which enables concepts to be represented as images in addition to their regular appearance as boxes and circles (Danish & Eneydy, 2006).

SMART Ideas software allows students to extend the basic concept map model in a variety of ways. In particular, multi-level diagrams make it possible for concepts to establish relationships with multiple concept maps. In addition, concepts may link to URLs, files, and various other attachments. SMART Ideas has cliplets, which are interactive widgets that function similarly to Java Applets.

Specifically, a cliplet can be a fully functional timer, a working clock showing the actual time, a pair of dice, or a calculator. Also, the available template library showcases tasks and projects for which one can use SMART Ideas, and can serve as a spring-board for generating a concept map that is visually appealing. Lastly, this software allows students to save concept maps in its own proprietary format or to convert the file to the Microsoft Word format (Hanson, 2005).

Other popular types of software used to generate concept maps are: Edraw Software (http://www.edrawsoft.com/concept-mapping-software.php), Coggle (http://coggle.it/), VUE (http://vue.tufts.edu/), yEd (http://www.yworks.com/en/products_yed_about.html), MindGenius, MindMapper, SmartDraw, Visual Mind, as well as ontology editors (e.g. Hozo (http://www.hozo.jp), Protege-2000 (http://protege.stanford.edu)).

For this study, Cmap Tools software was chosen to construct and create concept maps for several reasons: its features fit students' computer skills; it is a free application that can be installed easily; it features a low-threshold, high-ceiling design, provides considerable support for knowledge model construction, considerable support for sharing and collaboration, and is built on modular architecture.

The creation of concept maps can be both an individual and collaborative process (Engelmann & Hesse, 2010). The following sections will look into the theoretical foundations of collaborative and individualized learning and concept mapping. The next section will discuss the definitions, advantages, disadvantages, and results from studies.

Collaborative vs. Individual Learning

Individual learning is a common way of acquiring knowledge. In collaborative learning, knowledge is constructed by groups where learners "are working to extend the frontiers of knowledge in their community" (Chan, 2013, p.444). At the same time, collaborative learning can include individual learning, "but is not reducible to it" (Stahl, Koschmann, & Suthers, 2008, p.411). Interestingly, the key difference may be understood from the example by Chan (2013) in which she contrasts both approaches. In Chan's view, individual learning may be linked to school activities with set curriculums, objectives, and with standards as final objectives and end-states. On the other hand, she says, learning collaboratively helps students in knowledge creation. She emphasises the progress and steady pursuit of ideas that make it especially valuable in learning and research communities (Chan, 2013, p.446).

Collaborative learning as an educational paradigm focuses on learning through joint action. It promotes the exchange of information between learners during the process of socialization and cultural education within the group to which they belong (Torrez, Forte, & Bortolozzi, 2009). Collaboration is understood as a "coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem" (Roschelle & Teasley, 1995, p.70 in Stahl, Koschmann, & Suthers, 2008, p. 411).

On a simple level, collaborative learning is about two or more students attempting to learn some material together. Wilczenski, Bontrager, Ventrone, and Correia (2001, p.270) provide the following definition of collaborative learning: "Students working together without immediate teacher supervision in groups small enough that all students can participate collectively on a task."

On a more elaborate level, collaborative learning is grounded in the theoretical model of knowledge construction within a population through its members' active interaction,

namely, their sharing of experiences and capitalizing on one another's resources. In this context, collaborative learning uses methodologies that involve learners completing common tasks (Alcantara, Siqueira, & Valaski, 2004).

While focusing on common goals, individuals are accountable to one another and rely on other group members. The collaborative learning environment might include discussions through chat rooms, social media, and online forums. Indeed, unlike individual learning, collaborative learning requires learners to capitalize on other group members' skills and expertise through asking questions and assessing other people's ideas, as well as checking on the progress of other students (Chiu, 2008; Chen & Chiu, 2008).

Collaborative learning, as a knowledge construction approach to learning, reflects the current theoretical shift in education from individual to social perspectives on learning (Gogoulou, Gouli, Grigoriadou, Samarakou, & Chinou, 2007). Indeed, Erkens, Prangsma, and Jaspers (2013), observe that "recent educational research reemphasizes collaborative or cooperative learning" (Erkens, Prangsma, & Jaspers, 2013, p.235). Sfard (1998) has talked about two perspectives of learning, including participation in community tasks and knowledge acquisition. Paavola and colleagues (2004) have discussed a third view of learning, which they call "knowledge creation." The primary focus of collaborative learning is on inquiry within a community as a means of knowledge creation (Paavola et al, 2004). The definition provided by Alcantara et al (2004) goes even further, implying that interaction during teaching and learning is more important than content. Another essential point to mention is the responsibility of every member of the group for all other students' learning.

The current understanding of collaborative learning is rooted in the socio-cognitive approach (Chan, 2013). As Erkens et al (2013, p.235) have accurately observed, learning has been reformulated as "a social process of enculturation" with emphasis on recent constructivism-based or situated learning perspectives on human cognition and instruction.

This understanding originates from the Vygotskian tradition and Vygotsky's theory that the essence of learning is inherently social. Within this constructivist approach, collaboration plays the focal role in learning. In other words, authentic learning is known to take a place through active collaboration with other people; the learning environment as a social setting supports the learner in his/her attempts to construct knowledge and cognitive skills. Therefore, as noted by Erkens et al (2013), learning, whether it happens at school or not, is about advancing collaboratively through social interaction. It is also about advancing through social knowledge construction within a given community of learners.

These discussion lead to the clear, functional definition of collaborative learning formulated by Alcantara, Siqueira, and Valaski (2004, p.172): Collaborative learning is "a set of methods for use in groups to develop learning skills, personal knowledge and social relationships, where each member of the group is responsible for his or her own learning and that of the rest of the group." In collaborative learning, as distinct from individual learning, group activities and collaboration occupy a central role both inside and outside the classroom. This difference between the traditional or individual learning paradigm and the collaborative style presupposes that learner involvement extends beyond extant models, and suggests that students should develop good awareness of their own process of learning (Gogoulou, Gouli, Grigoriadou, Samarakou, & Chinou, 2007).

Collaborative vs. Individual Concept Mapping in ELL Reading Comprehension

Essentially, this study aims to explore the effectiveness of concept mapping in enhancing reading comprehension skills, including the sub-skills of reviewing, listing, enforcing as well as overall reading comprehension (Chularut & DeBacker, 2004; Al-Qatawneh & Alodwan, 2012; Rosenberg; 2010). In ELL classrooms, concept mapping strategies are applied on both individual and collaborative levels (De Simone et al, 2001). Collaborative concept mapping or, in other words, concept mapping done in a group setting,

is defined as a process in which at least two individuals are involved in sustained and mutually coordinated efforts to create one or more concept maps for the purposes of learning and the construction of knowledge. Liu, Chen, Shih, Huang, and Liu (2011) have found that using the collaborative mapping strategy to teach ELL reading comprehension skills benefits high-level ELL students more than lower-level ones, while De Simone, et al have found that, in teaching communication skills, collective concept-mapping was more beneficial and motivating for ELL students than individual (De Simone et al, 2001).

Khajavi and Ketabi (2012) have found that ELL reading comprehension skills of intermediate-level ELL students were greatly improved by the use of concept mapping. In particular, based on a sample of 60 Iranian students, they found that collaborative concept mapping facilitated text-comprehension skills, summary skills, and the ability to learn new vocabulary through reading. In addition, self-efficacy was higher in the collaborative concept mapping group than in the group that was taught by individual concept mapping. This claim indicated that concept mapping may be used to effectively increase motivation in ELL students. Based on this study and other current research, it appears likely that concept mapping may increase both the motivation of ELL Jordanian students and their ELL reading comprehension skills.

De Simone et al (2001) have found that collaborative concept mapping was more beneficial than individual concept mapping for learners in terms of ELL reading comprehension development and motivation. Liu (2011), however, found that individual concept mapping was more beneficial for learners whose level of English proficiency is high, whereas collaborative concept mapping was more beneficial for lower-level learners. Incidentally, these findings by Liu (2011) contradict Haugwitz, Nesbit, and Sandman (2010) who found that concept maps benefit students with lower verbal capacity more than learners with higher verbal abilities. The contradiction between the previous studies suggests the

likelihood of both collaborative and individual concept mapping impacting ELL reading comprehension.

The benefits of individual concept mapping in ELL reading comprehension, and as a powerful tool for improving of the process of learning as well as learner attitudes, has already been established (Mukama, 2010; Berionni & Baldon, 2006; Littrell, 1999; Horton et al, 1993). Furthermore, practitioners and researchers have shown an interest in utilizing concept maps on an individual level as well as at a group level to facilitate the construction of knowledge (Chan, 2013; Cress & Kimmerle, 2008; Bereiter & Scardamalia, 2007; Stahl, 2006; Scardamalia, 2002).

A range of studies on computerized collaborative concept mapping have established its benefits in learning various subjects by students of various levels. In particular, Xu (2006) has shown the effectiveness of computerized concept mapping in combination with cooperative learning strategies in teaching reading skills in a second-grade classroom, and Conceicao, Desnoyers, and Baldor (2008) have found that concept mapping combined with collaborative learning facilitates information handling by adult learners in an online setting.

A recent study by Gao, Thomson, and Chen (2013) confirmed the effectiveness of collaborative concept mapping in facilitating knowledge construction yet found that "the activity itself does not automatically generate high quality interaction or products" (p.11). In particular, it was found that new knowledge was created only when neither peer pressure nor time constraints were salient in the collaborative environment. Kotsopoulos (2010), however, found that the existence of some kind of pressures was beneficial for students who used it as an opportunity to display critical thinking as well as problem solving skills, and for development of students' individual skills.

An overview of collaborative concept mapping research reveals conflicting results. On the one hand, the findings show that the concept mapping strategy applied to group work

enabled learners to interact more with the concepts, and to establish more relationships among these concepts (for example, in Boxtel et al, 2002). It also led groups to develop the verbal skills necessary for interaction (Roth & Roychudhury, 1994). On the other hand, contrasting findings by other scholars include a study by Chiu (2003) that made it clear that students spent a considerable amount of time preparing for actual collaboration and coordinating the procedure rather than discussing the concepts, propositions, or relationships. Similarly, Carter (1998) found a lack of improvement in learner activity through the use of collaborative concept mapping. Specifically, Carter (1998) found that students who worked in pairs had difficulty establishing relationships between various concepts as well as placing those concepts in a hierarchy.

Collaborative and Individual Concept Mapping in Jordanian ELL Classrooms

Concept mapping has become a subject of interest for a growing number of Jordanian scholars. Al-Qatawneh (2009) from Tafila Technical University in Jordan reviewed the literature on the effects and potential benefits of concept mapping on curriculum planning and ELL reading comprehension. Al-Qatawneh (2009) concluded that the use of concept mapping helps teachers of English plan their curriculum in an effective manner and enhances students' ELL reading comprehension. When learning how to understand the text, students utilize the strategy of concept-mapping to create springboards "to what the student has to read" (Al-Qatawneh, 2009, p.50). This process helps them to express their thoughts and generate more convincing texts.

In a more recent empirical study, Al-Qatawneh (2012) confirmed the benefits of concept mapping in teaching ELL reading comprehension to Jordanian school students. In a study of 56 female 10th grade students who studied at Khelda Secondary School for Girls in Amman, Jordan, Al-Qatawneh found through group observation that students learning ELL reading comprehension using the concept mapping approach were more engaged than those

taught in a traditional way. The students taught by concept mapping communicated, interacted, and shared information more smoothly than the traditional group. As a result, Al-Qatawneh (2012) concluded that the concept-based model of ELL instruction "motivates and engages students in ELL reading comprehension study" (Al-Qatawneh, 2012, p.6).

Along with the growing interest in the use of concept mapping, the effects and opportunities of computer use in ELL classrooms has also been a subject of interest for ELL researchers in Jordan. Nabah et al (2009) did a comparative study between Jordanian ELL students who were taught using individual computer-assisted concept mapping and students taught using collaborative computer-assisted concept mapping. They provided statistically-verified evidence that the students in the first group, who used individual computerized concept mapping to learn the selected reading material, were more successful than the students in the second group, who studied the same topic using the collaborative computer-assisted concept mapping.

Nabah et al (2009) provides the following explanations for this difference in high school students' reading comprehension achievements; Computer Assisted Language Learning (CALL) programs allow for catering to each learner's individual peculiarities as they adjust to the learner's personal learning pace. CALL also enables learners to use computer software individually at any place and time, enabling them to receive quick feedback, based on their individual performance, as well as motivating them via attractive material layout and interactive opportunities. At the same time, it was also found that male students benefitted more from CALL while learning reading comprehension than female students (Nabah et al, 2009).

Meanwhile, collaborative concept mapping for ELL reading comprehension has been found to be effective by other Jordanian researchers. Bataineh and Bani Hani (2011) found, based on a sample of 73 sixth graders and 100 teachers from the north of Jordan, that the use

of collaborative concept mapping enhances ELL reading comprehension skills. Students from the experimental group outperformed the students in the control group by a statistically significant margin. Specifically, important improvement was found among high achieving and average students, with the percentage of high-achieving students in the experimental group growing from 11% to 76% after the experiment (Bataineh & Bani Hani, 2011). The authors observed that the success may be attributed to the positive interaction between learners, which increased students' motivation to learn and made them eager to succeed. The concept mapping software used in the study introduced the opportunity of self-paced learning, provided "a superior visual representation of the materials in the program" and extensive exposure to the target language, enabled the students to use "the animated feedback feature," and was rather simple to use through an easy navigation options, which pertains first of all to low-achieving and average learners (Bataineh & Bani Hani, 2011, p.13).

Al-Shourafa (2012) found that students' self-reported results indicate that the prevailing majority of them improved their ELL reading comprehension skills after the use of individual computerized concept mapping. He found that it was easy to learn English through computer-assisted individual concept mapping. He also reported that computers can be a useful teaching tool and argued that it was more effective and easier to learn the target language via computer than from a textbook. Students felt more confident in their ELL reading comprehension skills and found that they improved their self-learning skills as well. Al-Shourafa says students got a view of an environment that was closer to real-life English and did not have problems understanding instructions. They improved their interaction skills, both with their teacher and classmates, by computer-intensive engagement in reading comprehension skills.

Conceptual and Theoretical Framework

A detailed review of the pertinent literature has provided support for the conceptual foundations of computer-assisted concept mapping in both individual and collaborative settings. These foundations address concept mapping as a cognitive tool that is capable of meeting the needs of ELL students in reading comprehension challenges. The following theories have informed the current study: constructivism, cognitive theory, information processing theory, Ausubel's assimilation theory, and the theory of metacognition.

Constructivism and Scaffolding

According to the constructivist approach, students participate in various activities that involve the construction of new concepts or ideas, based on existing knowledge. Learning is viewed as an active process, which includes the involvement of learners as necessarily active constructors of their own knowledge (Almasi & Fullerton, 2012). Furthermore, constructivism posits that learners construct their understanding of knowledge idiosyncratically (Trowbridge & Wandersee, 1994). Concept mapping relates to the constructivist approach in that learners serve as active constructors of knowledge. Concept maps are thought to act as a scaffold that assist in learners in arranging knowledge and structuring it, despite the fact that this structure may be formed step by step with only small pieces of the concepts interacting. Thus, it has been found that concept mapping may facilitate application of existing knowledge to new contexts, and improve retention of acquired knowledge over the long run (Baxendell, 2003). The reading comprehension sub-skill of enforcing is more influenced by constructivist theory because it requires a higher level of cognitive practice than the reviewing and listing sub-skills. Listing requires the constructing of understanding in order to elicit ideas and concepts from a text. Reviewing is considered as a less constructive skill because it involves the ELL student in viewing the words and sentences more than creating relationships or eliciting concepts.

Initially, the concept of scaffolding was introduced by Vygotsky (1978) within his social development theory. Vygotsky wrote, "Every function in the student's functional development appears twice: first, on the social level, and later, on the individual level" (Vygotsky, 1978, p.57). Cultural tools in combination with social interaction help shape learners' cognitive development and facilitate learning. Working collaboratively enables learners to perform at higher cognitive levels than when they work individually. This is particularly evident in situations where a member of a given social group works within his or her Zone of Proximal Development (ZPD). The latter is defined as a range which integrates both the time and space within which a learner may solve a learning problem, given structured assistance from an instructor. This concept is known as a scaffolding learning (Bereiter & Scardamalia, 2007).

Cognitivism

Cognitive theory attempts to explain the mental processes of learning on a cognitive level (i.e. with focus on the unobservable mental activities). Basically, cognitivism centers on the cognitive aspect of learning with a focus on how individuals perceive, explain, memorize, and reflect on the events that they experience in a learning setting (Omrod, 2004). Cognitive theory is interested in all processes that happen in the mind of a learner; they constitute the subject of study for cognitivists. According to the implications of this theory, the very notion of the concept map was developed where the latter emerged as a tool of knowledge representation. Novak (1972) has argued for using the concept map as a tool for organizing learning concepts and connecting them, in the belief it can help learners visualize a particular knowledge structure in a graphic way or, to be more precise, by way of a diagram. According to the implications of cognitive theory, the concept map is utilized as an instrument of structuring, guiding, and transforming knowledge, based on cognitive foundations (Carter, 1998).

Ausubel's (1968) Assimilation Theory

Ausubel's assimilation theory was formed based on the concept of meaningful learning. The latter, as Ausubel (1968) defines it, takes place when a learner ties new knowledge to those concepts that he or she already possesses, in a conscious and explicit manner. Information is absorbed meaningfully by being stored in long-term memory. This information is sorted in order to be stored in association with related and similar pieces of information. Unlike rote learning, meaningful learning is based on making information meaningful and on attempts to understand it in relation to what an individual already knows (Chiu, 2008; Sheorey & Mokhtari, 2001).

By contrast, rote learning, according to Novak (2002), does not involve the integration of new knowledge with existing knowledge. This is based on the rapidity with which rote-learned knowledge is forgotten if not rehearsed repeatedly, and of the learner's inability to grasp contexts. In addition, the learner's cognitive structure is not modified by the removal of faulty ideas. Thus, rote learning, in which a learner memorizes information without connecting it to existing knowledge, is the opposite of meaningful learning, in which "the most important single factor influencing learning is what the learner already knows" (Ausubel, 1968, p.419).

Theory of Metacognition

The central concept within the theory of metacognition is metacognition itself, which is being thoughtful and aware about thinking. The term was introduced by Flavell back in 1976. It describes an individual's awareness of those mental processes that occur in a learner's mind, an awareness that finds expression in the understanding that learners are capable of planning and adjusting their learning (Fisher, 1998). Hence, metacognition may be defined as awareness of the learning process or an ability to think about thinking.

Metacognition has also been described as "higher-level thinking that involves active control over the thinking processes involved in learning" (Lawanto, 2008, p.2).

Paris and Winograd's (1990) view of metacognition revolves around two crucial functions: cognitive self-appraisal (CSA) and cognitive self-management (CSM). Self-appraisal during the learning process involves a personal judgment a learner makes about his or her ability to pursue a cognitive goal. Self-management is the ability to maintain executive control and it determines how exactly metacognition assists in orchestrating extant cognitive elements of problem solving (Paris & Winograd, 1990). Once a learner is capable of planning, regulating, and evaluating his or her learning, he or she is recognized as being good at self-management (Gao, Thomson, & Shen, 2013).

Metacognition is known to be embedded in a learner's cognitive development and to encompass the knowledge that evolved with the learner's experience. In this sense, metacognition is complimentary to cognition and vice versa. It is believed that metacognition improves, once relevant instruction is provided (i.e. it is possible to teach students to reflect on their knowledge) (Paavola, Lipponen, & Hakkarainen, 2004). An alternative view of the metacognition posits two basic components: metacognitive knowledge and metacognitive regulation. These components enable a more detailed view of metacognition. Specifically, metacognitive knowledge is thought to integrate a learner's knowledge about himself/herself with knowledge about other factors that may influence performance (which is categorized as declarative knowledge). Metacognitive knowledge is necessary for strategic knowledge, which is also known as procedural knowledge. Metacognition requires knowledge of why and where these strategies should be used, which is known as conditional knowledge (Chan, 2013; Carter, 1998).

Metacognition is inherent to a learner's monitoring his/her own cognition. It involves a range of planning activities, awareness and monitoring of task performance and

comprehension as well as assessment of monitoring process strategies and efficacy (Cress, & Kimmerle, 2008). The insights a learner experiences during the process of monitoring and regulation cognition contribute to the development and refinement of metacognitive knowledge. As for cognitive knowledge, it acts as a facilitator of the ability to act as a regulator of cognition. Therefore, metacognition has empirical features that are relevant to concept mapping. It enables students to organically create, assess, and represent their understanding of knowledge (Chiu, 2008).

Information Processing Theory

Information processing theory focuses on the ways people process the information they obtain. Specifically, information processing theory investigates how humans receive various stimuli from the environment, place what they received into their memories, and recall the learned information when they need it (Bereiter, & Scardamalia, 2007). Initially, information processing theory tended to describe human learning as analogous to a computer processing information. Here, the brain was thought to perform the role of hardware and the mind as the software; memory was perceived as the human mental capacity to store as well as retain and recall data in a smooth and sequential manner. Further research has shown, however, that the human memory system and thinking process were more complicated than their computer processing counterparts (Almasi, & Fullerton, 2012).

One of the most important developments in the history of information processing theory was Atkinson and Shiffrin's (1968) proposition that the memory system may be divided in three major components: sensory, short-term, and long-term memories. The model of multiple storage proposed by Atkinson and Shiffrin (1971) represented the human information processing system as follows: information is acquired by people through their senses from the environment and then processed via what Atkinson and Shiffrin call the sensory memory. The latter receives this information and stores it transiently. In turn,

temporary storage of the information is provided by another mental processing unit, the short-term memory. A decision is made as to whether the information should be discarded or transferred to permanent storage. If it is deemed worthy of permanent storage, that storage is provided by the long-term memory, from which it can be retrieved later on.

Concept mapping, if viewed through the lens of information processing theory, becomes an approach to help learners store data within their long-term memory. It assists learners in identifying the relationships that exist among new and existing concepts. Hence, concept maps, enable learners to comprehend and encode new information. By visualizing the concepts and relationships, learners are able to locate gaps and misconceptions that they may have. Additionally, the visualization process acts as an effective means of amassing knowledge because it helps the learner receive the stimuli and encode the information for the purposes of increasing the students' short-term memory storage capacity (Novak, 1993).

Operational Terms and Definitions

Cognitive Tool

This tool is a teaching technique with which learners think and interact during the process of knowledge construction. It serves to bring learners' expertise to their performance (Kim & Reeves, 2007). Cognitive tools enhance students' engagement in learning practices and cognitive activities. They assist learners with critical thinking and cognitive learning activities that are complex by nature. With these tools, learners construct knowledge themselves instead of simply memorizing information. Cognitive tools are also described as learning tools that serve to facilitate cognitive processing and develop thinking skills (Jonassen, 1994).

Concept Map

Concept maps are cognitive tools that help learners visualize and share knowledge and serve to develop learners' cognitive models, which support future acting or thinking. It is a

two-dimensional organized graphic representation of specific knowledge (Novak & Gowin, 1984). In the form of diagrams, concept maps show relationships among different concepts as networks of linked nodes. Specifically, ideas are represented as nodes and related to other nodes such as ideas via link labels to achieve meaningful learning (Ausubel, 1968).

Concept Mapping

Concept mapping is a learning strategy that enables learners to externalize thinking in a visual-verbal representation with the aim of improving their understanding of the learning material (Novak, 1998). Concept mapping makes it possible for learners to extract essential information, connect ideas, and visually represent them in a structured manner (De Simone et al, 2001).

Individual Concept Mapping

Individual concept mapping is a learning technique that allows the student to work and learn individually by designing and creating concept maps (Kwon & Cifuentes, 2009). It requires the learner to construct and engage in the concept mapping, according to the learner's pace and prior knowledge. The individual construction of concept maps represents student's individual knowledge acquisition (Conceição, Desnoyers, & Baldor, 2008a).

Collaborative Concept Mapping

Collaborative concept mapping is a collaborative group process where two or more learners are involved in the creation of a concept map for the purposes of learning and constructing knowledge (Chiu, 2008). It results in the construction of a concept map. Students work in small heterogeneous groups in a cooperative learning mode (Okebukola & Ogunniyi, 1984).

Meaningful Learning

Meaningful learning is one of key concepts of the Cognitive Theory developed by Ausubel (Ausubel, 1968; Ausubel et al, 1978). It is based on the understanding that students

learn meaningfully by anchoring new propositions and concepts in those they already know (Lawanto, 2008).

Reading Comprehension

This term refers to reading with understanding, with the text's meaning being actively constructed by the reader (Almasi & Fullerton, 2012; Duke & Carlisle, 2011). Specifically, reading comprehension is the process of construction a text's meaning via involvement and interaction with what is written. It consists of three major parts: the reader who is doing this comprehension; the text which needs to be comprehended; and, finally, the activities (i.e. processes, purposes, and consequences associated with comprehension). Reading comprehension consists of three cognitive sub-skills: reviewing, listing, and enforcing (Snow & Sweet, 2003).

English Language Learners (ELL)

This term is used to describe learners who study English by teaching English to non-native speakers in an environment, which is either a country where English is a native language (e.g., the United States) or in countries where English is not the first language, but it plays a special role, for example, India, Jordan, Nigeria (Hussein, 2012).

Computer-assisted or Computerized Concept Mapping

This refers to concept mapping that is supported and mediated by a computer, and typically involves the use of specific software, for instance Inspiration, SemNet, EDGE Diagrammer, or IHMC Cmap Tools (Clariana, Engelmann, & Yu, 2013). Computer-assisted concept maps are known to facilitate learners' ability to effectively arrange concepts and, thus, achieve meaningful learning. They are referred to as mind-tools or tools that use computer software to engage learners in the process of high-order, critical, and constructive thinking about what they are studying (Jonassen, 1996).

Cmap Tools

Cmap Tools is a specific software program that helps students to design and construct concept maps while they are engaging in ELL reading comprehension learning. It has many functions that enable the students to edit and revise their concept maps digitally (Hanson, 2005). This software helps students save concept maps they create and retrieve them as many times as needed. It helps students practice their cognitive abilities by engaging in cognitive tasks that develop their ELL reading comprehension skills (Canas et al, 2004).

Summary

The literature review done in this chapter shaped the understanding of a concept map as a cognitive learning tool used for knowledge construction in a variety of educational settings. While students base their understanding of new learning material on their prior knowledge, they can develop their new knowledge process with the help of concept mapping. Computerized concept mapping has been widely applied in classrooms. Not only does it allow the learner to acquire knowledge individually, but it also produces good results when applied in a group setting. Scholars recognize the advantages of concept mapping in various settings and its contribution to building students' capacity for meaningful learning.

The use of concept mapping software in teaching and learning ELL reading comprehension is an innovative strategy within the field of language learning. Widely used to improve students' reading comprehension skills, concept mapping has received little attention from ELL instructors who want to improve their students' ELL reading skills. However, interest in the use of concept mapping in ELL classrooms is growing, as evidenced by the wide range of emerging studies in the field. Whereas some of the effects of concept mapping software on ELL reading comprehension have been studied in detail, it is still unclear which learning mode, individual or collaborative, is more effective in teaching ELL reading comprehension using Cmap Tools software.

The literature review and theoretical framework sections also describe the growing interest in the application of concept mapping for increasing ELL reading comprehension in Jordan. A growing number of studies conducted by Jordanian ELL scholars focus on the need to use technology in ELL classrooms as a way to revamp the current teaching and learning methods and the philosophy of education in Jordan. This review accepts claims that Jordanian schools have a sufficient technical base to implement computerized concept mapping in ELL classrooms. Despite the fact that data was found regarding the insufficient level of technology supply in Jordanian schools, the existing base appears adequate for the use of the concept mapping software. Unlike the traditional, individual-centred, rote approach to learning, concept mapping will likely offer Jordanian students an innovative approach to learning where every student plays the role of knowledge creator. While learning meaningfully, Jordanian students may get an opportunity to explore and expand their creativity.

The literature review and theoretical framework also outlined the theories that underpin the practical application of collaborative and individual computerized concept-mapping in an ELL classroom. While the theoretical framework of concept mapping is rooted in Ausubel's (1978) assimilation theory and his concept of meaningful learning, other theories provide further explanation of concept maps as a meta-cognitive and constructivist learning tool. Moreover, they allowed the researcher to explore the use of concept maps from the perspective of the information processing specifics of the human mind.

Overall, the literature review and theoretical framework have equipped the researcher with the theoretical knowledge necessary for the empirical part of the study. It created a holistic understanding of concept mapping as an educational strategy and revealed the benefits of its application in the ELL context. The next chapter will focus on the research methodologies considered for the study and explain the choice of the selected methodology.

CHAPTER III

METHODOLOGY

Research Purpose

As Yin (2009) explains, every study falls into one of three types, based on the nature of its stated purpose or on the nature of the research problem. Specifically, the purpose of scholarly research may be exploratory (i.e., when the problem is ambiguous), explanatory (i.e. when the problem is defined clearly), or descriptive (i.e., when the problem is structured) (Yin, 2009). This study falls under the category of "explanatory" because, as in Yin's characterisation, it was designed when the researcher clarified the initial problems. Furthermore, research studies that are explanatory in nature are done once the researcher finds that the existing theory on the subject is clear enough and is easy to determine (Hair et al, 2003), which is the case in this study.

The problem of this study was defined as a structured problem. Accordingly, this research had an explanatory purpose it seeks to establish the existing causal relationship between given variables. In this case, the research investigated a situation or problem with the aim to explain the relationship that may be found between given variables (Hair et al, 2003; Zikmund, 2000).

The key purpose of this quantitative study was to evaluate the effectiveness of collaborative and individual computer-assisted concept mapping for teaching ELL reading comprehension to Jordanian high school students. More specifically, it looks at whether the use of the Cmap Tools software increases ELL reading comprehension performance and facilitates the development of ELL reading comprehension skills.

For this study, the quantitative approach was chosen because it had the ability to transform the collected information to numbers that will later be analysed statistically. Moreover, the quantitative approach tends to be rather structured and formalized, which suited the focus of this study on a few variables within a large number of entities.

Overall, the selection of the quantitative approach for this study was justified, as this method enabled the researcher to achieve the objectives of the current study through a pre-determined approach and numeric data (Creswell, 2009). Also, this method was adopted for this study because it was characterized by utterly unbiased data collection. Ross (1999) has observed that the quantitative method is associated with such procedures that protect the data analysis from the harm done by biased data collection.

Research Questions of Study

This quantitative research was designed to assess the effectiveness of the use of collaborative and individual concept mapping in teaching and learning ELL reading comprehension and to provide recommendations for improvements that can benefit the reading comprehension teaching and learning process in the Jordanian context. The selected methodology addresses the scarcity of current studies to fill the existing gap in research comparing the effectiveness of collaborative and individual concept mapping in the given context. Therefore, and in the light of the stated problem and objectives, the following research questions have been developed:

- RQ 1: What is the impact of using concept mapping in facilitating ELL students' development of reading comprehension skills?
- RQ2: What is the difference between using collaborative concept mapping and individual concept mapping in facilitating ELL students' reading comprehension skills?

Hypothesis of the Study

The current research proceeds from the following research hypothesis: integration of computer-assisted concept mapping into ELL learning may enhance English text comprehension in both collaborative and individual learning environments.

Accordingly, the hypotheses of the research were divided into two categories based on the two relative study questions:

Hypotheses pertaining to question one were as follows:

- 1: H_0 – There will be no difference in the ELL students' reviewing skill in reading comprehension between the ELL students who use concept map as a cognitive tool and the ELL students who do not use concept maps;
- 2: H_0 – There will be no difference in the ELL students' listing skill in reading comprehension between the ELL students who use concept map as a cognitive tool and the ELL students who do not use concept maps;
- 3: H_0 – There will be no difference in the ELL students' enforcing skill in reading comprehension between the ELL students who use concept map as a cognitive tool and the ELL students who do not use concept maps;
- 4: H_0 – There will be no difference in the ELL students' overall reading comprehension performance on the posttest between the ELL students who use concept map as a cognitive tool and the ELL students who do not use concept maps.

Hypotheses pertaining to question two were as follows:

- 5: H_0 – There will be no difference in the ELL students' reviewing skill in reading comprehension between the ELL students who use collaborative concept map as a cognitive tool and the ELL students who use individual concept maps;

- 6: H_0 – There will be no difference in the ELL students' listing skill in reading comprehension between the ELL students who use collaborative concept map as a cognitive tool and the ELL students who use individual concept maps;
- 7: H_0 – There will be no difference in the ELL students' enforcing skill in reading comprehension between the ELL students who use collaborative concept map as a cognitive tool and the ELL students who use individual concept maps;
- 8: H_0 – There will be no difference in the ELL students' overall reading comprehension performance on the posttest between the ELL students who use collaborative concept map as a cognitive tool and the ELL students who use individual concept maps.

Research Method Paradigm

The current study utilizes the positivist paradigm. As Myers and Avison (2002) observe, in a positivist study authors make an assumption about an objectively given reality, which may be described by certain measurable properties that are assumed to be independent of both the researcher and the research instruments. The studies that utilize the positivist paradigm basically seek to test theory as they strive to enhance the predictive understanding of the research phenomena (Myers & Avison, 2002).

This study needed to employ the positivist paradigm because it investigated the impact of collaborative and individual concept mapping on the reading comprehension skills of Jordanian high school ELL students. The positivist paradigm in this study allowed the researcher to test the hypotheses and answer the questions of the study through data collection and statistical data analysis (Orlikowski & Baroudi, 1991).

Classified within the post-positivist paradigm, this research required quantitative data collection and quantitative data analysis. According to Creswell (2009), this type of worldview, by implementing a reductionist approach, centers on theory verification. This

study required the researcher to analyse data regarding the reviewing, listing and enhancing components of reading comprehension, as well as overall reading comprehension, following the use of the Cmap Tools software. This study evaluated the changes that might occur in these ELL reading comprehension skills of Jordanian high school ELL students. This research involved one independent variable and four dependent variables. The independent variable was concept mapping. Three levels of concept mapping were employed as an independent variable, including control group, collaborative, and individual concept mapping levels. There were four dependent variables: reviewing, listing, enforcing, and overall reading comprehension. The following diagram, Figure 1, represents the design of the study and shows the independent and dependent variables and their levels.

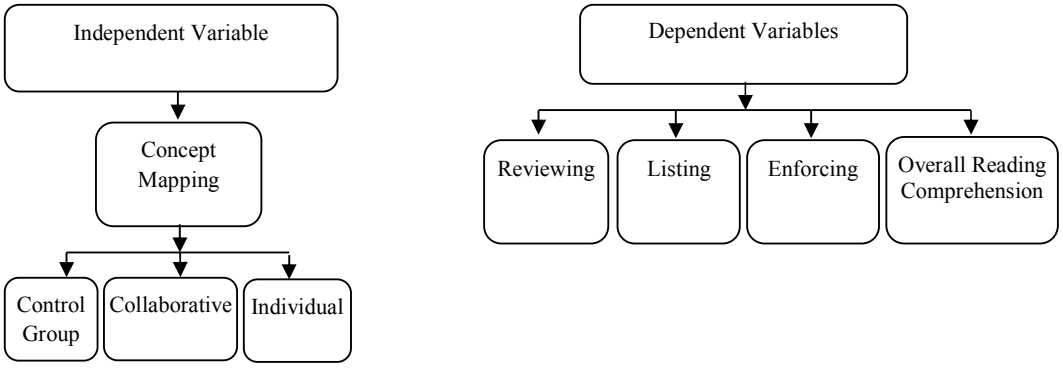

Figure 1. Diagram of Study Design.

Additionally, it was suggested that a quasi-experimental research design be applied to data collection and analysis. This design focused on determining the causes of investigated phenomena. Specifically, the quasi-experimental design used is similar to the experimental one but does not require any random pre-selection process while selecting sample groups on which to test necessary variables.

Research Design

This study had two focal questions with four hypotheses for each question, and explored the possibility of using concept mapping in facilitating the development of ELL

students' reading comprehension skills. Furthermore, it tested the effects of individual concept mapping in facilitating ELL students' development of reading comprehension skills, compared with the traditional way of teaching.

The subjects of this study were selected from a high school in. To enhance the consistency of the study, it was suggested that three groups, two of them experimental and one control, be included and instructed by the same high school English teacher. It was suggested that the experiment last for 10 weeks.

Before the experiment began, there was an introductory training session for the cooperative English teacher, the raters (i.e., the cooperative English teacher and another English teacher), and the ELL students who took part. The cooperative English teacher participated in three training sessions, including learning about concept mapping, collaborative learning, and the three skills of ELL reading comprehension. The raters received training on using and filling out the rubric of ELL reading comprehension skills. Since the author was the expert in these four areas, these two trainings were conducted and executed by the author and were delivered by a long distance communication technology, Skype.

Before the ELL students started the orientation training week, all three groups were given the same overall reading comprehension pretest, which was taken individually by the subjects (see appendix B). Then, subjects received orientation training on three topics: concept mapping, collaborative learning, and the three skills of ELL reading comprehension. The cooperative English teacher conducted the training of the ELL students, based on the training that he had already received from the author of this study.

After the training was conducted, the experiment began. The subjects were divided into three groups, based on the pre-grouped classes in the school, including two experimental groups and one control group. The first group was instructed with the help of collaborative

concept mapping. Students worked in sub-groups, and each sub-group consisted of five to six students. The second group was instructed with the help of individual concept mapping. Students worked and constructed concept maps individually. The third group, the control group, was taught using the traditional method of teaching with no concept mapping throughout the entire ten weeks of the experiment. Figure 2 presents the three groups of the study and shows the structure of the experiment.

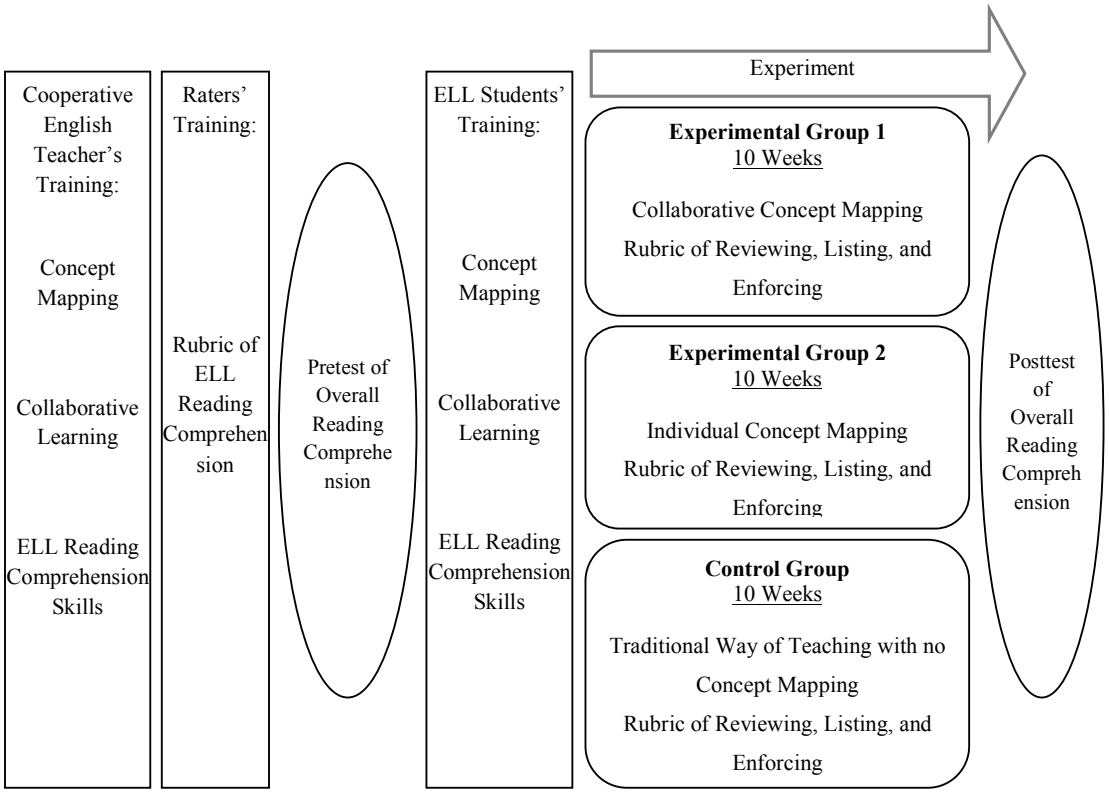

Figure 2. Diagram of Study Experiment Structure.

The subjects in all three groups were given passages and tasked with analyzing and eliciting certain concepts, ideas, and facts. The two experimental groups used laptops or personal computers equipped with Cmap Tools software. Since the third group was taught using the traditional way of teaching with no concept mapping, it was considered the comparison or control group. The cooperative English teacher and the additional rater used a rubric based on the Likert scale to observe and measure the weekly improvement of each

subject in the three basic skills of reading comprehension: reviewing, listing, and enforcing (see appendix A).

Afterwards, subjects in all three groups were given the same overall reading comprehension posttest, which was taken individually (see appendix D). This helped to measure the subjects' progress in reading comprehension. It allowed the researcher to assess the impact of collaborative and individual concept mapping on students' reading comprehension in the target language.

Timeline of the Study

The following table (Table 1), shows the timeline of the study, listing procedures and the dates they took place, along with notes that clarified additional details. Notably, the school week in Jordan consists of five days, which starts on Sunday and ends by Thursday.

Table 1. Timeline of Study.

Procedure	Date	Note
Cooperative English Teacher's Training	Saturday January 25th, 2014	Completed by the researcher via Skype
Raters' Training 1st Time	Sunday January 26th, 2014	Completed by the researcher via Skype
Raters' Training 2nd Time	Thursday January 30th, 2014	Completed by the researcher via Skype
Pretest	Tuesday February 25th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Students' Training Began	Wednesday February 26th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Students' Training Ended	Sunday March 2nd, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Start of Experiment	Monday March 3rd, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Rubric 1 (Two Raters)	Thursday March 6th, 2014	Completed by the trained cooperative English teacher and the second rater according to researcher's instructions
Rubric 2	Thursday March 13th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Rubric 3	Thursday March 20th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Rubric 4	Thursday March 27th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Rubric 5 (Two Raters)	Thursday April 3rd, 2014	Completed by the trained cooperative English teacher and the second rater according to researcher's instructions
Rubric 6	Thursday April 10th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Rubric 7 (Teacher & Researcher)	Thursday April 17th, 2014	Completed by the trained cooperative English teacher and supervised by the researcher
Rubric 8	Thursday April 24th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions

Table 1. cont.

Procedure	Date	Note
Rubric 9	Thursday May 1st, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Rubric 10 (Two Raters)	Thursday May 8th, 2014	Completed by the trained cooperative English teacher and the second rater according to researcher's instructions
Experiment End	Thursday May 8th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions
Posttest	Sunday May 11th, 2014	Completed by the trained cooperative English teacher according to researcher's instructions

Research Sample

The research sample consisted of 106 high school learners. They were divided into three groups, including two experimental groups of 32, 36, and one control group of 38. This study was conducted in the International Pioneers Academy school (IPA), which is in Amman, Jordan. This school was chosen partly on the basis of its large student population, which comprised 214 high school students and 618 students from other grades. Additionally, this school has an English teaching vision that focuses on the importance of developing reading comprehension for its high school students. However, the students do not achieve a sufficient level of ELL reading comprehension. Hence, this school was selected for the quality of students' reading comprehension in addition to its significant population size. It was deemed representative of other high schools in Jordan with fewer students in attendance. This high school has two computer labs that were utilized during the experiment; each lab contains 39 computers. A third reason this school was chosen was that the cooperative teacher was working there as an English teacher.

All the students were from the same social class and lived in the same geographical region, Amman, which is the capital of Jordan. Therefore, they shared many common geographic and sociolinguistic features. This sample was chosen because it had the greatest need to enhance its ELL reading comprehension skills; the students in this grade were

preparing to enter colleges and universities. The subjects were informed of the purpose of the study and its procedures before they participated in the study.

Students of this sample were between 17 and 18 years. All of the subjects in this study were males due to the standards of high school in the Jordanian educational system and the policy of the collaborative high school. They had studied English since first grade, and had also studied computer science. They all had basic skills in using computers and software because they were required to write and submit their homework electronically. Based on school records, all the students in the study sample were in good physical health with no physical challenges or handicaps.

Teenage students like those in the study tend to have an active social interaction among their friends (Al Odwan, 2012). They use proper Arabic language with a Jordanian accent as a medium for their social communication. Students at this age are very active and adept at acquiring social communication skills, including listening, writing, facial expression, body language, emotional engagement, and reading comprehension (Al Odwan, 2012; Tweissi, 1998). Students in high school are required to use reading comprehension for academic purposes and social communication (Al-Qatawneh & Alodwan, 2012).

Research Instruments

Some specific instruments and research tools were used during this study. The instruments used were reading-text materials from units two, three, and four of the English textbook. The researcher developed the overall ELL reading comprehension pretest (see appendix B), the rubric for rating sub-skills of reading comprehension (see appendix A), and the overall ELL reading comprehension posttest (see appendix D). The cooperative English teacher installed the Cmap Tools software on the computers, and the students used it during the experiment.

The cooperative English teacher used the traditional method to teach the control group ELL reading comprehension. The English teacher taught the students units two, three, and four from the English textbook assigned for this level. The teacher used the English textbook, whiteboard, markers, and sheets of paper while teaching the ELL students in the control group. The text materials, passages, and paragraphs from the textbook that were taught to all groups had increasing difficulty and complexity throughout the in intervention's weeks. By the interventions' time, the reading materials were embedding more new vocabularies, longer sentences, bigger paragraphs, and high level and more information embedded in the text.

The teacher provided the students in the two experimental groups with some instruction in using Cmap Tools software, which students can download free and install on their laptops and computers. This software is designed to enable students to create concept maps, based on the instructional materials, and was utilized by the students in this study to design, construct, save, edit, and share their concept maps. Cmap Tools has many functions that students used when they were designing concept maps. It enabled the teacher to evaluate the concept maps that students had submitted and add feedback and comments digitally. The English teacher encouraged students in both experimental groups to use Cmap Tools software to design concept maps while they were practising and exercising ELL reading comprehension.

The students in all three groups took the overall reading comprehension pretest before the experiment. The pretest items were designed and created based on the reading materials in the Students Textbook. The researcher and the cooperative English teacher composed and created the questions of the pretest. An expert in the overall ELL reading comprehension reviewed and improved it. The total of the overall reading comprehension pretest was out of 10 points. The proficiency levels of the pretest were identified by referring to the Teacher's Guide Book, the Textbook Assessment, and the cooperative English teacher. The success

proficiency level of the ELL overall reading comprehension pretest was 6.5 out of 10 points and the proficiency descriptions were as follow: 9 to 10 excellent, 8.00 - 8.99 above average, 6.5 - 7.99 average, 3.5 – 6.49 below average, and 0 – 3.49 extremely poor (see appendix B). The teacher used a rubric of sub-skills of ELL reading comprehension throughout the experiment. Based on the Teacher's Guide Book, the Textbook Assessment, and the proficiency description of the sub-skills' rubric, the proficiency levels and descriptions of each reading comprehension skill were identified. The success proficiency level of reviewing skill was 7.3 out of 10 points and the proficiency descriptions were as follow: 9.5 to 10 excellent, 8.00 - 9.49 above average, 7.3 - 7.99 average, 6 - 7.29 below average, and 0 - 6 extremely poor. The success proficiency level of listing skill was 8.5 out of 15 points and the proficiency descriptions were as follow: 13 to 15 excellent, 10.5 - 12.99 above average, 8.5 - 10.49 average, 7.5 - 8.49 below average, and 0 - 7.49 extremely poor. The success proficiency level of enforcing skill was 10 out of 20 points and the proficiency descriptions were as follow: 16 to 20 excellent, 13.5 - 15.99 above average, 10 - 13.49 average, 8 - 9.99 below average, and 0 - 7.99 extremely poor (see appendix A). The rubric was based on the Likert scale. After the experiment, the students in all three groups took the overall reading comprehension posttest. The posttest items were designed and created based on the reading materials in the Students Textbook. The researcher and the cooperative English teacher composed and created the questions of the posttest. An expert in the overall ELL reading comprehension reviewed and improved it. The total of the overall reading comprehension posttest was out of 10 points. The proficiency levels of the posttest were identified by referring to the Teacher's Guide Book, the Textbook Assessment, and the cooperative English teacher. The success proficiency level of the ELL overall reading comprehension posttest was 6.5 out of 10 points and the proficiency descriptions were as follow: 9 to 10 excellent, 8.00 - 8.99 above average, 6.5 - 7.99 average, 3.5 – 6.49 below average, and 0 –

3.49 extremely poor (see appendix D). The pretest, rubric, and posttest were reviewed by a cooperative content expert, who ensured their quality and a high level of internal and external validity.

Data Collection and Research Procedure

This study was conducted in the second semester of the academic year 2013-2014. It was suggested by the researcher that the experiment should last for 10 weeks. The 106 subjects were divided into three groups, including two experimental groups of 32 and 36 and one control group of 38. The two experimental groups were instructed with the help of concept mapping—collaborative for the first group and individual for the second group. The control group was taught using the traditional method of teaching.

Concept maps were used by the subjects of the study in the two experimental groups for the purposes improving their ELL reading comprehension skills. The subjects in the collaborative group worked on the concept mapping in sub-groups, while those in the individual group worked on the concept mapping individually. The subjects in both experimental groups were given passages and tasked with analyzing and eliciting certain concepts, ideas, and facts using personal computers with Cmap Tools software. Prior to the experiment, the participants in both of the experimental groups were trained on the use of the Cmap Tools concept mapping software.

All participants of the three study groups took the same overall reading comprehension pretest (see appendix B) individually. This pretest established a baseline for the participants' overall ELL reading comprehension. During the teaching experiment, the subjects in the collaborative setting constructed concept maps using the Cmap Tools software in sub-groups which was already installed on the computers, while those in the individual setting constructed concept maps individually, using the Cmap Tools software. The subjects in the control group were taught reading comprehension by the traditional method. All three

groups were given passages and required to analyze and elicit the concepts, ideas, and facts of the passages.

The raters (i.e., the cooperative English teacher and another English teacher) used a rubric (see appendix A) for measuring and assessing students' reading comprehension sub-skills, including reviewing, listing, and enforcing. The cooperative English teacher used the rubric once a week during the experiment, for a total of 10 times. Another English teacher (serving as an additional rater) used the rubric three times during the experiment: during the weeks one, five, and ten, simultaneously with the cooperative English teacher. The ELL students in collaborative and individual concept mapping groups were asked to cognitively perform the reviewing, listing, and enforcing skills by reading the texts and engaging in concept mapping activities. However, the ELL students in the control group asked to perform the reviewing, listing, and enforcing skills by using the traditional way. The cooperative teacher and the rater observed the ELL students individually while they were cognitively engaging in the reading comprehension sub-skills and filled out the rubrics. The researcher contacted the cooperative teacher daily via Skype throughout the experiment to ensure the intervention. In the week seven, the researcher travelled to Jordan, visited, supervised, and monitored the experiment to ensure the participants' performance and the experiment procedures. The researcher received the data from the completed rubrics weekly.

After the end of the teaching experiment, the subjects in all three groups took the same overall reading comprehension posttest individually (see appendix D). This action helped to measure the subjects' progress in overall reading comprehension and thus allowed the researcher to assess the impact of the traditional way of teaching and concept mapping in two different settings on learner skills of reading comprehension in the targeted English language.

Data Analysis

This study sought to determine whether traditional teaching methods or the use of concept mapping were more successful in enhancing ELL reading comprehension skills in Jordanian high school ELL students. That determination was made by a comparison of the pretest, rubric, and posttest results. The research data was analysed using statistical quantitative analysis methods, including independent samples *t*-test and one-way ANOVA. The researcher used SPSS to analyze the gathered quantitative data.

The independent samples *t*-test and one-way ANOVA were used because they fit the study design, being suitable for comparing groups and populations and evaluating mean differences between their performances, and because they are recommended for comparing and evaluating results between groups that have different treatments and conditions (Haslam & McGarty, 1998).

In this study, the independent samples *t*-test equation that was used was the dependent samples *t*-test for two essential reasons: 1) the researcher tested the three groups at the end of the intervention period, and 2) the researcher compared experimental group 2 (i.e., individual concept mapping), against the control group (traditional method of teaching with no concept mapping). Furthermore, one-way ANOVA was used because the individual concept mapping group was compared to the control group in terms of their achievements on the pretest and posttest. Moreover, one-way ANOVA is used because the collaborative concept mapping group was compared to the individual concept mapping group in both of pretest and posttest. The three groups were matched on similar components and variables and compared based on specific variables.

Thus, by using the independent samples *t*-test and one-way ANOVA, the researcher was able to compare the performances of the three groups and use data elicited from the pretest, rubric, and posttest to investigate the best way of using concept mapping in teaching

ELL reading comprehension skills. The researcher calculated α values, means, standard deviations, and correlations of improvement in each particular skill for each individual student (Cohen, Manion, & Morrison, 2000).

Research Reliability and Validity

In scholarly research, reliability functions as an indicator of the internal consistency of the selected methods of data collection and data analysis (Saunders, Lewis & Thornhill, 2007). Similarly, Zikmund and Babin (2010, p.334) describe reliability as "an indicator of a measure's internal consistency." For this study, the researcher asked the students to take the posttest after conducting the experiment, at the end of the semester. By administering the posttest, the researcher ensured consistency and ascertained the results of the intervention. The researcher calculated the correlations between the posttest and pretest. The correlation values of each question indicate the strength of reliability.

In order to increase the reliability of this study, two raters filled out rubrics. The cooperative English teacher and another English teacher both were certified and qualified to teach English for ELL students. Both raters has their Bachelor degree in English Literacy. Both raters have extensive experiences in teaching ELL and particularly high school ELL students. Both raters received training in using and completing the rubric. Having two qualified evaluators increased the reliability of the gathered data, and, as a consequence, this strengthened and ensured the reliability of the study.

Validity is the degree to which "a theory, model, concept, or category describes reality with a good fit," and there may well be occasions when aspects arise that do not fit with objective reality (Gummesson, 2000, p.93). Research validity has a multi-faceted nature. Validity was ensured in this study by following certain pre-determined procedures in the collection of the data.

The pre- and posttest questions were formulated, based on the English textbook and reading materials that were assigned for ELL students by the Jordanian Ministry of Education. This procedure contributed to ensuring and maintaining the validity of the content. In addition, the researcher calculated the standard deviation for each question of the tests in order to ascertain that the questions were suitable and fit all the students participating in the study.

In order to maintain internal and external validity, the study instruments were reviewed and improved through consultation with a cooperative ELL content expert, Dr. Anne Walker, a professor of Elementary Education and ELL Education at the Teaching and Learning department at the University of North Dakota. She pursued her M.Ed. in Teaching English to Speakers of Other Languages (TESOL) and her Ph.D. in Curriculum and Instruction with a specialization in Literacy Education for Linguistically and Culturally Diverse Students and Educational Policy Studies. She has an extensive experience teaching English as a Second Language (ESL)/ELL overseas for different levels of students. Dr. Anne Walker has a long experience helping schools in improving their ELL programs. She works with the North Dakota state government in developing special standards, policies, and assessment that can be used for K-12 ELL arena. She trained international EFL teachers and conducted research of international professional development in TESOL and rural ELL education. Revisions were made to the instruments based on the expert's recommendations. This procedure ensured that all items and questions in the pretest, rubric, and posttest were well designed and measured the target skills.

According to Patzer (1996), internal validity can be explained as the extent to which the study is capable of protecting its dependent variable from impact by extraneous factors. Hence, and for the purpose of protecting the data, this study gathered data through the three

study groups, and the collected data were analyzed using quantitative statistical analysis methods, one-way ANOVA and the independent samples *t*-test.

External validity, which refers to the extent to which the research outcome can possibly be generalized (Patzer, 1996), was also maintained. As Zikmund and Babin (2007) observe, insufficiency of external validity negatively impacts the reliability of research. The procedures of this study were carefully documented in order to protect its external validity.

Orientation Training Plans

In order to prepare the cooperative teacher, cooperative raters, and ELL students to proceed with the experiment, they needed introductory training in order to introduce them to the necessary experiences and skills that were necessary to start the actual study experiment. The training consisted of three parts: training for the cooperative teacher, training for the cooperative raters, and training for the ELL students in the collaborative control and experimental groups.

Training Plan for the Cooperative Teacher

The cooperative English teacher, needed training on three essential skills before going through the actual intervention. First, the use of concept mapping in teaching was a brand new teaching strategy he had not used in the past, so he needed enough training to master it during the experiment while teaching the collaborative and individual experimental groups.

Second, because the cooperative English teacher had used the traditional method to teach ELL in his past classrooms, it was a big leap to switch to the collaborative learning style. Teaching students in collaborative groups (i.e. ELL students in the collaborative experimental group) required training in specific skills. Third, it was the first time the cooperative English teacher taught the discrete ELL reading comprehension skills of reviewing, listing, and enforcing. Hence, he needed sufficient training to enable him to teach theses ELL reading comprehension skills with a high level of competency.

Procedures for Cooperative Teacher's Training

In order to conduct the introductory training of the cooperative teacher, certain steps and procedures needed to take a place as follows:

Use of concept mapping in teaching. The author led a one-on-one training session in the use of concept mapping in teaching. This training took approximately 90 minutes, and was delivered via Skype due to the distance between the author and the cooperative English teacher. The cooperative teacher was taught the definition of concept mapping and informed of the rationale for using concept mapping in influencing ELL students' development of reading comprehension and the impact of concept mapping on students' learning outcomes.

The basis and principles of teaching with concept mapping were introduced to the cooperative English teacher. The trainer presented five different examples of concept maps and discussed them. The cooperative English teacher watched a video about the use of concept mapping in teaching and its implementation in the classroom. The trainer introduced software that could be used in designing concept maps. The cooperative teacher received one-on-one training in the use of Cmap Tools software to design and create concept maps.

Using of collaborative learning in teaching. The author provided one-on-one training by instructing the cooperative English teacher on the use of the collaborative learning strategy in teaching. This training took approximately 100 minutes and was delivered via Skype due to the distance between the author and the cooperative English teacher. The cooperative English teacher was taught the definition of collaborative learning, the rationale for using it in teaching and the impact it has on students learning outcomes.

The basis and principles of collaborative learning techniques were explained to the English teacher. The trainer presented some collaborative learning situations that could be implemented in classrooms. The cooperative English teacher watched a video about the collaborative learning strategy and its implementation in the classroom. The trainer also

introduced some strategies that could be used in designing a collaborative learning environment.

Teaching the discrete ELL reading comprehension skills of reviewing, listing, and enforcing. The author instructed the cooperative English teacher on the teaching of the discrete ELL reading comprehension skills of reviewing, listing, and enforcing. This training took approximately 120 minutes and was delivered via Skype due to the distance between the author and the cooperative English teacher. The trainer introduced the definition of ELL reading comprehension and provided reasons for focusing on ELL reading comprehension in teaching ELL students, and explained the impact of such a focus on ELL students' reading comprehension.

The trainer then divided ELL reading comprehension into three basic skills and gave a description of each. The basis and principles of using concept mapping were to help in the application of the three reading comprehension skills of reviewing, listing, and enforcing. The trainer presented some examples of teaching ELL reading comprehension divided into those three skills.

The cooperative English teacher watched a video about teaching ELL reading comprehension skills and their implementation in the ELL classroom. The cooperative teacher was given one-on-one training in teaching these three reading comprehension skills in an ELL classroom.

Training Plan for the Cooperative Raters

The rubric of ELL reading comprehension skills was used to observe and measure students' improvement in the ELL reading comprehension skills of reviewing, listing, and enforcing. Two raters used the rubric: the cooperative English teacher and a second cooperative English teacher. The second cooperative English teacher used the rubric three

times during the experiment: during the weeks one, five, and ten (in total, the rubric was utilised ten times during the ten weeks, one time per a week for each ELL student).

The introductory training for the raters enhanced their ability to use the rubric to measure ELL students' reading comprehension. Furthermore, this training was necessary to bridge the gap between ratings given by the two raters. This training decreased and diminished the differences in their ratings of the students.

Procedures for Raters' Training Plan

Certain steps and procedures were followed in order to develop the raters' ability to rate ELL students' reading comprehension skills and properly fill out the rubric. The author conducted one-on-one training, instructing the raters on the use of the rubric in measuring ELL students' reading comprehension skills of reviewing, listing, and enforcing. This training took approximately 60 minutes and was delivered via Skype due to the distance between the author and the cooperative English teacher.

The raters were trained on the use of a rubric in observing and measuring skills. The trainer explained the rationale for using a rubric in measuring ELL students' reading comprehension and the impact it had on the accuracy of measurements of ELL students' reading comprehension. The raters watched a video about the use of rubrics in ELL classrooms and the skills necessary to do so.

Moreover, the raters observed the trainer while he modelled a student performing some ELL reading comprehension skills. The trainer presented to the raters seven relevant examples of filling the rubrics. The raters used the rubric to measure the trainers ELL comprehension skills individually and filled out the rubric form according to their observations. The trainer compared the ratings in the two rubrics skill by skill. The raters completed this training and filled out the rubric several times until they demonstrated very

close ratings, bridging the differences that might appear in their ratings, and made their scores more credible and valid.

Training Plan for the ELL Students

The ELL students were given introductory training during orientation week. This training fell into three main categories: concept mapping, collaborative learning, and ELL reading comprehension skills.

Since both the experimental groups (i.e. collaborative and individual groups) were taught using concept mapping as a new teaching and learning strategy, they were given orientation training to learn more about concept mapping as a strategy for learning and constructing knowledge. This introductory training helped the ELL students in both experimental groups make a smooth transition from the traditional teaching style, which they had experienced in the past, to the concept mapping strategy.

In addition, the collaborative group received training on collaborative learning as a strategy for learning in a more social environment. The ELL students had not used a collaborative learning style in their past learning experiences. This orientation training helped those in the collaborative group to know more about working in groups in a learning environment. The traditional method of teaching focuses on teaching vocabulary and grammar more than focusing on improving ELL students' reading comprehension. Hence, it was essential for all three groups—the two experimental groups and the traditional group—go through introductory training to learn more about ELL reading comprehension skills of reviewing, listing, and enforcing.

Procedures for ELL Students' Training Plan

This introductory training involved learning about three basic categories: concept mapping, collaborative learning, and ELL reading comprehension skills. A series of training steps and procedures were followed for each of these three categories, as follows:

Concept mapping (Collaborative and individual groups). The cooperative English teacher trained the ELL students in the utilization of concept mapping in learning. This training took approximately 120 minutes and was conducted in two sessions.

Session one (60 minutes). ELL students were taught the definition of concept mapping. The cooperative English teacher introduced reasons for using concept mapping in learning and described the impact it had on students' learning outcomes. The activities and practices of using concept mapping in learning were introduced to the ELL students. The cooperative English teacher presented some examples of concept maps.

Session two (60 minutes). The cooperative English teacher introduced software that could be used in designing concept maps. The cooperative English teacher also showed the ELL students how to use concept maps to perform reviewing, listing, and enforcing functions by going through three examples. For the reviewing skill, ELL students read passages to grasp the basic idea. In the listing skill, the ELL students listed the main ideas from the passages in the concept maps. During the enforcing skill, the ELL students labelled the interrelationships among the ideas. The ELL students practiced using Cmap Tools software in designing and creating concept maps.

Collaborative learning (Collaborative group). The cooperative English teacher led an introductory training by instructing the ELL students on engagement in a collaborative learning setting. This introductory training took approximately 120 minutes, and was divided into two sessions.

Session one (60 minutes). ELL students were taught about learning from each other in a social learning environment. They learned about their roles and responsibilities while they were working in groups, and were informed of the ground rules of group learning, along with the basic practices and responsibilities of learning by using the collaborate learning technique.

Session two (60 minutes). The cooperative English teacher presented to the ELL students some collaborative learning strategies that may be implemented in classrooms later. The ELL students watched a video about engagement in a collaborative learning setting and its practices in the classroom. The cooperative English teacher introduced six strategies that could be used to engage in a collaborative learning environment, including contribution, discussions, debates, demonstrations, presentation, and sending and receiving feedback from others. The ELL students practiced collaborative learning and working in groups in actual situations by working on three topics familiar to them: olive picking, shopping malls, and swimming. The cooperative English teacher asked the ELL students to work on some questions and activities in groups regarding to the three given topics.

ELL reading comprehension skills of reviewing, listing, and enforcing (Traditional, collaborative, and individual groups). The cooperative English teacher instructed ELL students in all three groups (traditional, collaborative, and individual) on the ELL reading comprehension skills of reviewing, listing, and enforcing. This orientation training took approximately 60 minutes. Students were taught the definition of ELL reading comprehension. The cooperative English teacher introduced the rationale for focusing on ELL reading comprehension in teaching ELL students and the impact of that focus on ELL students' reading comprehension. The cooperative English teacher divided the ELL reading comprehension into three basic skills, to simplify it, and gave a description of each specific skill. He then showed the ELL students three examples of each ELL reading comprehension skill. The ELL students watched a video, learning about ELL reading comprehension skills. The ELL students then practiced some simple activities in ELL reading comprehension skills, such as reading sentences, eliciting any kind of ideas, choosing a word and explaining the meaning, and presenting their initial understanding of the general idea.

CHAPTER IV

DATA ANALYSIS AND RESULTS

After aggregating the data, the researcher used SPSS to run the independent sample *t*-test and one-way ANOVA to examine the hypotheses and answer the study questions. There were two study questions with four hypotheses for each question.

The data came from two sources: tests and rubrics—specifically pretests and posttests taken individually by the ELL students and data aggregated from the rubrics used by the raters to assess the ELL students individually. The interrater agreement rate was 81.15 for the question one and 83.60% for the question two. The overall interrater agreement rate for all the rubrics, all three groups and both questions was 82.38%.

Concept Mapping Group vs. Control Group Pretest Analysis

To ensure equivalency between the compared groups, (i.e., individual concept mapping group vs. control group with no concept mapping), the researcher ran a one-way ANOVA to compare these two groups and extract the ELL overall reading comprehension pretest analysis of the first question.

The primary reason for doing the overall ELL reading comprehension pretest was to determine the level of overall ELL reading comprehension of the students in both the individual concept-mapping and control groups before they completed the assigned tasks and activities. The pretest consisted of 10 questions with one point for each individual item, for a total of 10 points. The pretest items were designed and created based on the reading materials in the Students Textbook. The researcher and the cooperative English teacher composed and created the questions of the pretest. The success proficiency level of ELL overall reading

comprehension pretest was 6.5 out of 10 points. An expert in ELL reading comprehension reviewed and improved it. Overall, 36 students were taught using individual concept mapping in their earning, and 38 students were taught using the traditional method of teaching.

The results from one-way ANOVA test indicated that the groups were not significantly different: $F(1, 72) = 0.05$, $p = 0.83$. Importantly, the ELL students in the individual concept mapping group achieved non-significantly different than the ELL students in the control group on the overall ELL reading comprehension pretest ($M = 4.14$, $SD = 1.82$; $M = 4.05$, $SD = 1.51$). Moreover, the standardised mean effect size indicated at a small change over time ($d = 0.03$). This indicated that the equivalency and homogeneity were existed between the students in the individual concept mapping group and the control group, which meant that the students in both groups had the same level of the overall reading comprehension before being involved in the experiment.

Table 2. Pretest One-Way ANOVA of Individual Concept Mapping Group vs. Control Group.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
PretestTotal	Between Groups	0.14	1.00	0.14	0.05	0.83*
	Within Groups	200.20	72.00	2.78		
	Total	200.34	73.00			

* $p > 0.05$

Research Question 1

The question two asked, "What is the impact of using concept mapping in facilitating ELL students' development of reading comprehension skills?" To answer this question, the researcher ran the independent sample *t*-test for the null hypotheses one, two, and three, and conducted a one-way ANOVA for the null hypothesis four.

Null hypothesis one. 1: H_0–There will be no difference in the ELL students' reviewing skill in reading comprehension between the ELL students who use concept map as

a cognitive tool and the ELL students who did not use concept maps. A trial was conducted in which 36 students used individual concept mapping in their learning (i.e., individual concept mapping group), and 38 students did not (i.e. control group). The interrater agreement rate was 80.24%. The students were rated using the reviewing section of the rubric (see Table 3).

Table 3. Group Statistics on Reviewing Skills of Individual Concept Mapping Group vs. Control Group.

Group Statistics

	Group	N	Mean	Std. Deviation
ReviewingWeek1	Individual Concept Mapping	36	5.31	1.88
	Control	38	4.92	1.58
ReviewingWeek2	Individual Concept Mapping	36	5.81	1.55
	Control	38	5.24	1.46
ReviewingWeek3	Individual Concept Mapping	36	6.39	1.40
	Control	38	5.61	1.52
ReviewingWeek4	Individual Concept Mapping	36	6.94	1.33
	Control	38	6.21	1.63
ReviewingWeek5	Individual Concept Mapping	36	7.75	1.11
	Control	38	6.37	1.65
ReviewingWeek6	Individual Concept Mapping	36	8.14	1.31
	Control	38	6.79	1.71
ReviewingWeek7	Individual Concept Mapping	36	8.42	1.25
	Control	38	6.95	1.45
ReviewingWeek8	Individual Concept Mapping	36	8.56	0.94
	Control	38	7.16	1.52
ReviewingWeek9	Individual Concept Mapping	36	8.83	1.06
	Control	38	7.47	1.54
ReviewingWeek10	Individual Concept Mapping	36	8.31	1.53
	Control	38	7.03	1.53
TotalReviewingAllWeeks	Individual Concept Mapping	36	7.44	1.15
	Control	38	6.37	1.35

The researcher tested the assumption of equal variances between the group using Levene's test and found that the group variances were equivalent (see Appendix H). The independent samples *t*-test indicated that the groups were significantly different: $t\ (72) = 3.66$, $p < 0.001$. Specifically, those who received the concept mapping training scored significantly higher than those who did not ($M = 7.44$, $SD = 1.15$ vs. $M = 6.73$, $SD = 1.46$).

Moreover, the standardised mean effect size indicated at a small-moderate change over time ($d = 0.39$). The null hypothesis was therefore rejected, and the alternative hypothesis, that concept mapping improves reviewing skills, was accepted.

Table 4. Independent Samples T-Test of Reviewing Skills of Individual Concept Mapping Group vs. Control Group.

Independent Samples Test				
		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
ReviewingWeek1	Equal variances assumed	0.95	72	0.34
ReviewingWeek2	Equal variances assumed	1.63	72	0.11
ReviewingWeek3	Equal variances assumed	2.31	72	0.02
ReviewingWeek4	Equal variances assumed	2.12	72	0.04
ReviewingWeek5	Equal variances assumed	4.21	72	0.00
ReviewingWeek6	Equal variances assumed	3.79	72	0.00
ReviewingWeek7	Equal variances assumed	4.65	72	0.00
ReviewingWeek8	Equal variances assumed	4.74	72	0.00
ReviewingWeek9	Equal variances assumed	4.41	72	0.00
ReviewingWeek10	Equal variances assumed	3.59	72	0.00
TotalReviewingAllWeeks	Equal variances assumed	3.66	72	0.00*

* $p < 0.001$

Figure 3 shows the trend of the calculated means; both groups were close at the start points. There was consistent improvement for both groups from the first week to the week four, with the individual concept mapping group showing an advantage. This parallel improvement was due to the fact that reviewing skill started individually and based on the individual capabilities at the early level and the fact that concept mapping requires higher engagement in cognitive processes.

During the week five, individual concept mapping group had an abrupt improvement and met the success proficiency level at 7.3 out of 10 points, which equate 7.75, and then both groups had the same rate until the week nine. The reviewing skills means of the individual concept mapping group were significantly higher than the those of the control

group after the third week to the end of the intervention. This significant improvement can be explained by the positive role of the individual concept mapping strategy in increasing the text recognition, reading flow, and engaging intensively in contemplating the words and concepts in paragraphs.

Additionally, there was a sudden decline at the last week of the intervention in both the individual concept mapping group and the control group. This decline can be interpreted by the high complexity of paragraphs, long sentences, advanced vocabulary, and the intensive information were embedded in the text. Moreover, it was the last week of the semester and there was a high pressure on the students before the school's final exams.

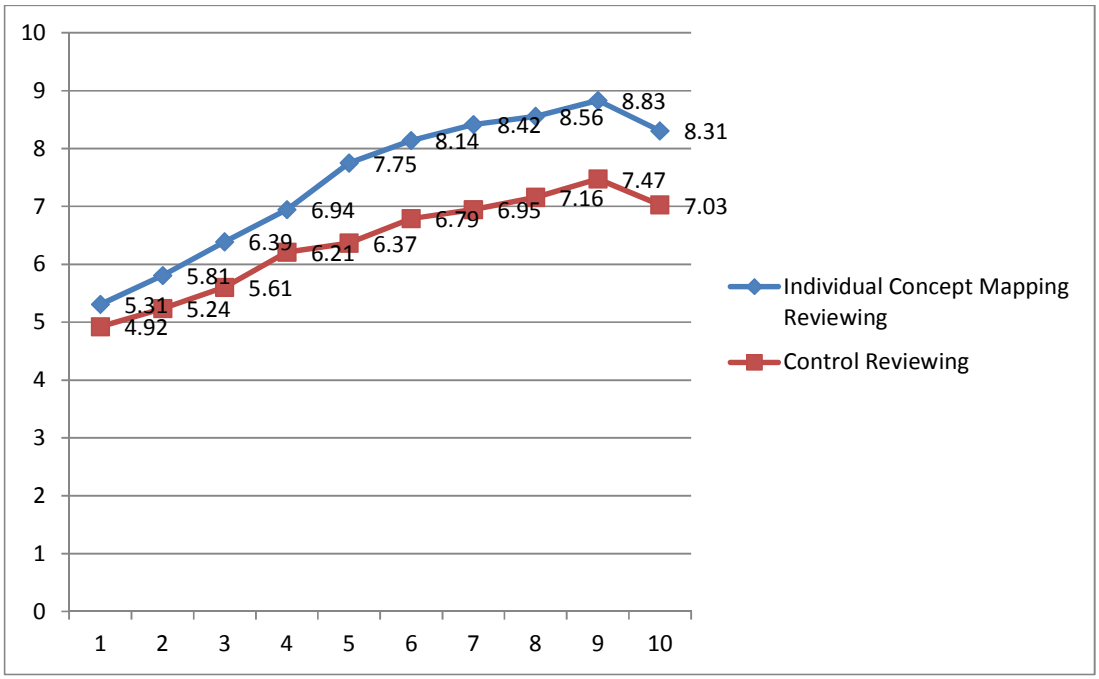

Figure 3. Reviewing Skills of Individual Concept Mapping vs. Control Group.

Null hypothesis two. 2: H_0–There will be no difference in the ELL students' listing skill in reading comprehension between the ELL students who use concept map as a cognitive tool and the ELL students who do not use concept maps. To test the null hypothesis two, a trial was conducted in which 36 students used the concept mapping strategy individually in their learning, and 38 students used the traditional way of learning.

Importantly, the interrater agreement rate was 81.09%. The students in both groups were rated using the listing items from the rubric (see Table 5).

Table 5. Group Statistics on Listing Skills of Individual Concept Mapping Group vs. Control Group.

Group Statistics

	Group	N	Mean	Std. Deviation
ListingWeek1	Individual Concept Mapping	36	7.17	2.40
	Control	38	6.89	2.26
ListingWeek2	Individual Concept Mapping	36	7.81	2.46
	Control	38	7.08	2.35
ListingWeek3	Individual Concept Mapping	36	8.14	2.32
	Control	38	7.32	2.51
ListingWeek4	Individual Concept Mapping	36	8.58	2.39
	Control	38	7.29	2.59
ListingWeek5	Individual Concept Mapping	36	9.08	2.44
	Control	38	7.42	2.54
ListingWeek6	Individual Concept Mapping	36	9.53	2.20
	Control	38	7.45	2.34
ListingWeek7	Individual Concept Mapping	36	10.19	2.19
	Control	38	7.87	2.38
ListingWeek8	Individual Concept Mapping	36	10.58	2.42
	Control	38	8.32	2.48
ListingWeek9	Individual Concept Mapping	36	11.06	2.50
	Control	38	8.87	2.46
ListingWeek10	Individual Concept Mapping	36	11.33	2.41
	Control	38	9.16	2.68
TotalListingAllWeeks	Individual Concept Mapping	36	9.35	2.23
	Control	38	7.77	2.32

The researcher examined the assumption of equal variances between the group using Levene's test and found that the group variances were equivalent (see Appendix I). The independent samples *t*-test showed that the groups were significantly different: $t\ (72) = 2.99$, $p < 0.001$. Particularly, the ELL students who utilized concept mapping strategy scored significantly greater than the ELL students who did not ($M = 9.37$, $SD = 2.23$; $M = 7.77$, $SD = 2.32$). Moreover, the standardised mean effect size indicated at a small-moderate change over

time ($d = 0.33$). Therefore, the null hypothesis was rejected, and the alternative hypothesis, the concept mapping improves listing skills, was accepted.

Table 6. Independent Samples T-Test of Listing Skills of Individual Concept Mapping Group vs. Control Group.

Independent Samples Test				
		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
ListingWeek1	Equal variances assumed	0.50	72	0.62
ListingWeek2	Equal variances assumed	1.30	72	0.20
ListingWeek3	Equal variances assumed	1.46	72	0.15
ListingWeek4	Equal variances assumed	2.23	72	0.03
ListingWeek5	Equal variances assumed	2.87	72	0.01
ListingWeek6	Equal variances assumed	3.93	72	0.00
ListingWeek7	Equal variances assumed	4.37	72	0.00
ListingWeek8	Equal variances assumed	3.98	72	0.00
ListingWeek9	Equal variances assumed	3.79	72	0.00
ListingWeek10	Equal variances assumed	3.67	72	0.00
TotalListingAllWeeks	Equal variances assumed	2.99	72	0.00*

* $p < 0.001$

The charts in Figure 4 describe the behaviors of both groups. Although they had very close entry levels, the individual concept mapping group showed a consistent improvement in listing skills throughout all 10 weeks, whereas the control group showed no obvious improvement in listing skills until the week seven of the experiment.

Specifically, the rate of improvement was different and the individual concept mapping group almost half a point per week, which equates to 4.16 and their total improvement after 10 weeks was 11.33 compared to 7.17. Moreover, in the first three weeks of the intervention, the two groups were not statistically different, but by week four, the individual concept mapping group was significantly higher.

The individual concept mapping group achieved the success proficiency level of listing skill after the week four, which was 8.5 out of 15 points, by achieving 8.58 and

continued improving to reach 11.33. Whereas, the control group did not achieve the success proficiency level until the week nine, by have improvement rate of 8.87.

However, by week seven, the control group began going up by about the same gains each week of the intervention but still significantly lower than the improvement of the individual concept mapping group.

This trend behavior might be explained by the fact that the individual concept mapping strategy helped the ELL students in the individual concept mapping group performing listing activities by mastering the sub-skills of elaborating, describing, and listing relevant concepts, that were not achieved by using the traditional way of learning.

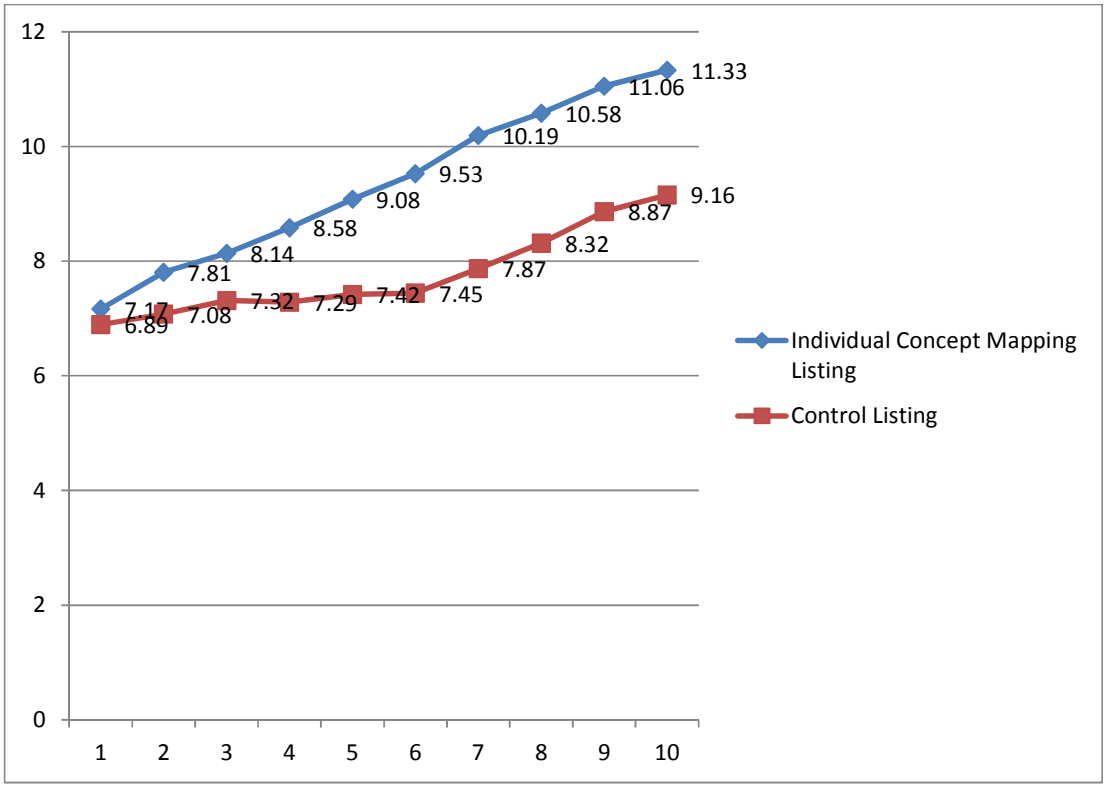

Figure 4. Listing Skills of Individual Concept Mapping vs. Control Group.

Null hypothesis three. 3: H_0–There will be no difference in the ELL students' enforcing skill in reading comprehension between the ELL students who use concept map as a cognitive tool and the ELL students who do not use concept maps.

In order to test the null hypothesis three, a trial was conducted in which 36 ELL students used concept mapping individually in their learning, and 38 students did not use it. The rate of the interrater agreement was 83.21%. Both groups were rated using the enforcing items from the rubric (see Table 7).

Table 7. Group Statistics on Enforcing Skills of Individual Concept Mapping Group vs. Control Group.

Group Statistics				
	Group	N	Mean	Std. Deviation
EnforcingWeek1	Individual Concept Mapping	36	7.56	2.47
	Control	38	7.08	2.36
EnforcingWeek2	Individual Concept Mapping	36	7.69	2.94
	Control	38	7.05	2.54
EnforcingWeek3	Individual Concept Mapping	36	7.94	3.11
	Control	38	6.92	2.36
EnforcingWeek4	Individual Concept Mapping	36	8.25	3.07
	Control	38	6.84	2.27
EnforcingWeek5	Individual Concept Mapping	36	8.17	3.18
	Control	38	6.97	2.35
EnforcingWeek6	Individual Concept Mapping	36	8.47	3.09
	Control	38	7.18	2.43
EnforcingWeek7	Individual Concept Mapping	36	8.53	3.01
	Control	38	7.18	2.39
EnforcingWeek8	Individual Concept Mapping	36	9.11	3.43
	Control	38	7.34	2.53
EnforcingWeek9	Individual Concept Mapping	36	10.06	3.85
	Control	38	7.68	2.99
EnforcingWeek10	Individual Concept Mapping	36	12.11	4.15
	Control	38	9.16	3.29
TotalEnforcingAllWeeks	Individual Concept Mapping	36	10.04	3.49
	Control	38	7.34	2.38

The researcher tested the assumption of equal variances between the group using Levene's test and found that the group variances were not equivalent (see Appendix J). The independent samples *t*-test indicated that the groups were significantly different: $t\ (61) = 4.12$, $p < 0.001$. Importantly, those who had been taught by using the concept mapping

strategy outperformed significantly higher than those who did not (M = 10.04, SD = 3.49; M = 7.34, SD = 2.38). Moreover, the standardised mean effect size indicated at a small-moderate change over time (d = 0.41). Accordingly, the null hypothesis was rejected, and the alternative hypothesis, that concept mapping improves enforcing skills, was accepted.

Table 8. Independent Samples T-Test of Enforcing Skills of Individual Concept Mapping Group vs. Control Group.

Independent Samples Test				
		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
EnforcingWeek1	Equal variances not assumed	0.85	71	0.40
EnforcingWeek2	Equal variances not assumed	1.00	69	0.32
EnforcingWeek3	Equal variances not assumed	1.59	65	0.12
EnforcingWeek4	Equal variances not assumed	2.23	64	0.03
EnforcingWeek5	Equal variances not assumed	1.83	64	0.07
EnforcingWeek6	Equal variances not assumed	1.99	66	0.05
EnforcingWeek7	Equal variances not assumed	2.12	67	0.04
EnforcingWeek8	Equal variances not assumed	2.52	64	0.01
EnforcingWeek9	Equal variances not assumed	2.95	66	0.00
EnforcingWeek10	Equal variances not assumed	3.38	67	0.00
TotalEnforcingAllWeeks	Equal variances not assumed	3.86	61	0.00*

* $p < 0.001$

Figure 5 shows a unique and important case. Although both groups had the same start point, they experienced very parallel performance with few improvements during the first three weeks, with a sudden improvement of the individual concept mapping group during the week four. The possible reason of the parallel improvement rates at the first three week was due to the high level of required cognitive engagement at the early period. After having enforcing activities by using individual concept mapping for enough period of time, a noticeable improvement can be achieved.

Later on, both groups had the same rate of improvement from the week five to the week eight. The most considerable improvement in enforcing skills occurred during the period of the week eight to week 10, at the end of the experiment. A significantly high improvement occurred after the week eight, with advantage of the individual concept mapping group, which was an extremely late improvement. Furthermore, the rate of improvement was different and the individual concept mapping group almost quarter a point per week during the first eight weeks, which equates to almost 0.91, but their improvement from the week eight to the week 10 of the intervention was 3.58.

Importantly, the ELL students in the individual concept mapping group achieved the success level of proficiency, which was 10 out of 20 points, at the week nine, by having their rate of improvement at 10.06. On the other hand, the students at the control group had not achieved the success proficiency level during the intervention.

This late significant improvement occurred at a late time of the intervention because the ELL students in both groups needed longer time and more enforcing activities to master the required cognitive process of enforcing, but with advantage of the individual concept mapping group.

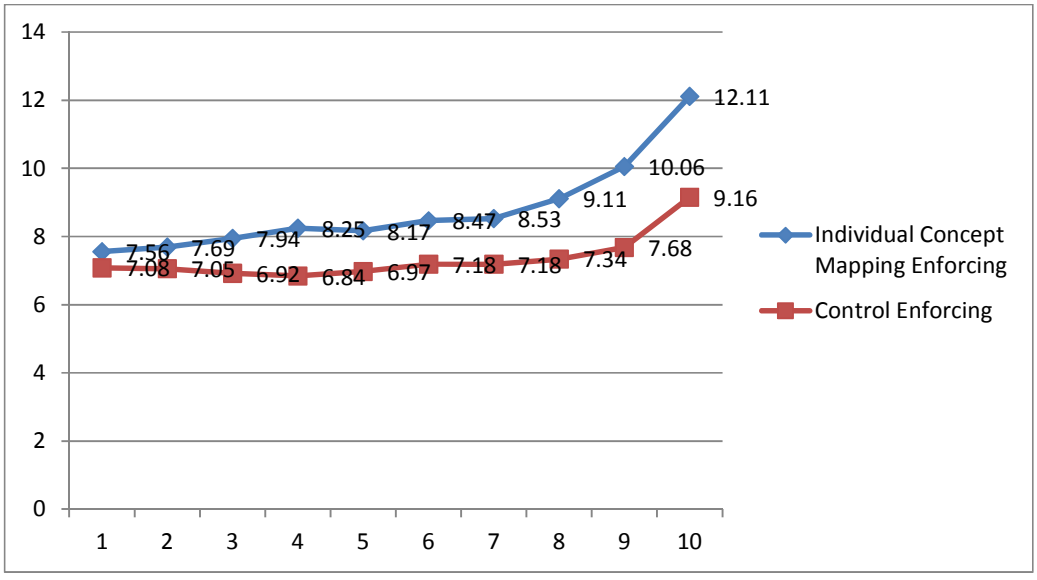

Figure 5. Enforcing Skills of Individual Concept Mapping vs. Control Group.

Notably, Figure 6 shows a consistent improvement in both the individual concept mapping group and the control group in terms of their performance on rubric totals from all weeks of intervention. Furthermore, the chart shows that the trend of the individual concept mapping group was stronger than the trend of the control group.

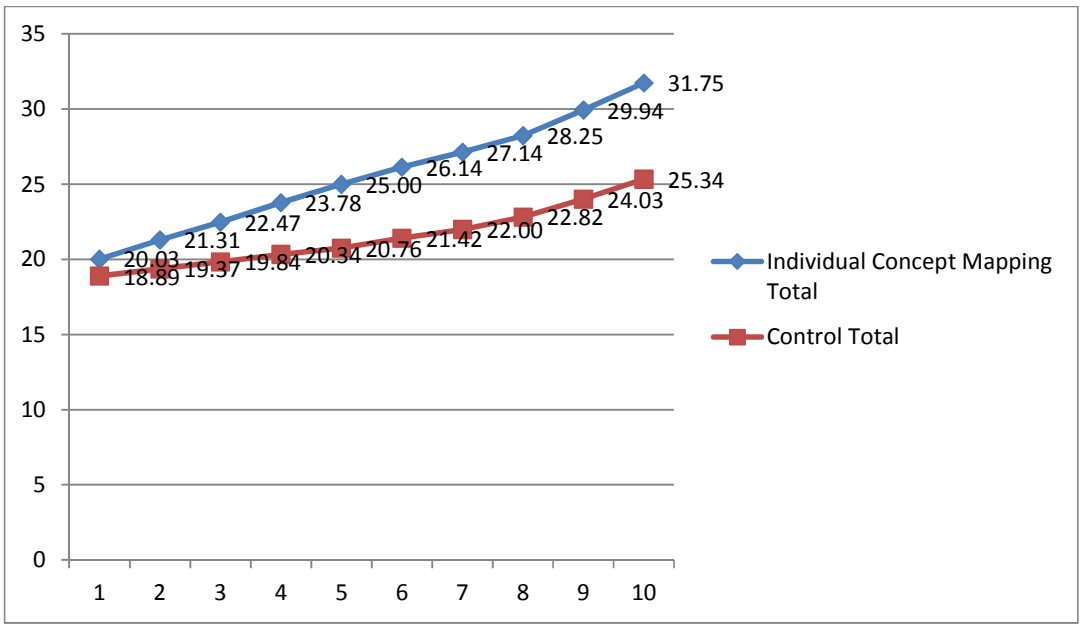

Figure 6. Rubric Totals from All Weeks of Individual Concept Mapping vs. Control Group.

Null hypothesis four. 4: H_0–There will be no difference in the ELL students' overall reading comprehension performance on the posttest between the ELL students who use a concept map as a cognitive tool and the ELL students who do not use concept maps.

The main research goal of the overall ELL reading comprehension posttest was to measure the overall ELL reading comprehension of the students in the individual concept mapping group and the control group. The posttest was given after the students had engaged in the intervention tasks and activities. It consisted of 10 questions, each worth one point, for a total of 10 points. The posttest items were designed and created based on the reading materials in the Students Textbook. The researcher and the cooperative English teacher composed and created the questions of the posttest. The success proficiency level of ELL

overall reading comprehension posttest was 6.5 out of 10 points. An expert in ELL reading comprehension reviewed and improved it.

To test the null hypothesis four, the researcher conducted a one-way ANOVA. 36 students used individual concept mapping in their learning while 38 students did not. All students in both groups (i.e. the individual concept mapping group and the control group) went through the overall posttest of ELL reading comprehension.

The results from one-way ANOVA test indicated that the groups were significantly different: $F(1, 66) = 16.93$, $p < 0.001$. Specifically, the ELL students in the individual concept mapping group achieved significantly higher than the ELL students in the control group on the overall ELL reading comprehension posttest ($M = 7.09$, $SD = 1.61$; $M = 5.47$, $SD = 1.63$). Moreover, the standardised mean effect size indicated at a small-moderate change over time ($d = 0.45$). Based on these results, the null hypothesis was rejected, and the alternative hypothesis, that concept mapping improves the overall reading comprehension, was accepted.

Table 9. Overall Reading Comprehension Posttest One-Way ANOVA of Individual Concept Mapping Group vs. Control Group.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
TotalPosttest	Between Groups	44.54	1.00	44.54	16.93	0.00*
	Within Groups	173.69	66.00	2.63		
	Total	218.24	67.00			

* $p < 0.001$

Collaborative Group vs. Individual Group Pretest Analysis

As a pretest analysis of the question two, in order to ensure an equivalent baseline between the collaborative and individual groups, the researcher conducted a one-way ANOVA to compare the two groups (i.e. the collaborative group and the individual group) that used concept mapping as a strategy in learning ELL reading comprehension.

The main purpose of this overall ELL reading comprehension pretest was to measure the overall ELL reading comprehension of both groups before they engaged in the designed tasks and activities. It consisted of 10 questions, each worth one point, for a total of 10 points. The pretest items were designed and created based on the reading materials in the Students Textbook. The researcher and the cooperative English teacher composed and created the questions of the pretest. The success proficiency level of ELL overall reading comprehension pretest was 6.5 out of 10 points. An expert in ELL reading comprehension reviewed and improved it. 32 students used collaborative concept mapping in their learning, and 36 students used individual concept mapping. They took the pretest of overall ELL reading comprehension.

The results from one-way ANOVA test showed that the groups were not significantly different: $F(1, 66) = 0.06$, $p = 0.81$. Particularly, the ELL students in the collaborative concept mapping group achieved non-significantly different than the ELL students in the individual concept mapping group on the overall ELL reading comprehension pretest ($M = 4.03$, $SD = 1.89$; $M = 4.14$, $SD = 1.82$).

Moreover, the standardised mean effect size indicated at a small change over time ($d = 0.03$). This indicated that the equivalency and homogeneity were existed between the students in the collaborative concept mapping group and the individual concept mapping group, which meant that the students in both groups had the same level of the overall reading comprehension before being involved in the intervention.

Table 10. Pretest One-Way ANOVA of Collaborative vs. Individual Concept Mapping Groups.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TotalPretest	Between Groups	0.20	1.00	0.20	0.06	0.81*
	Within Groups	227.27	66.00	3.44		
	Total	227.47	67.00			

* $p > 0.05$

Research Question 2

The question two of the study asked "What is the difference between using collaborative concept mapping and individual concept mapping in facilitating ELL students' reading comprehension skills?" There were four null hypotheses that needed to be investigated and tested. For this purpose, the researcher used SPSS software to run an independent sample *t*-test for the null hypotheses five, six, and seven, and conducted a one-way ANOVA for the null hypothesis eight.

Null hypothesis five. 5: H_0–There will be no difference in the ELL students' reviewing skill in reading comprehension between the ELL students who use concept maps as a cognitive tool collaboratively and the ELL students who use concept maps individually.

In order to test the null hypothesis five, a trial was conducted in which 32 students utilized concept mapping collaboratively in their ELL reading comprehension learning while 36 students used concept mapping individually. The rate of the interrater agreement was 83.16%. The reviewing skills of the students in both groups were assessed by two raters, utilizing the reviewing section of the assigned rubric (see Table 11).

Table 11. Group Statistics on Reviewing Skills of Collaborative vs. Individual Concept Mapping Groups.

Group Statistics

	Group	N	Mean	Std. Deviation
ReviewingWeek1	Collaborative Concept Mapping	32	5.53	1.52
	Individual Concept Mapping	36	5.31	1.88
ReviewingWeek2	Collaborative Concept Mapping	32	5.84	1.22
	Individual Concept Mapping	36	5.81	1.55
ReviewingWeek3	Collaborative Concept Mapping	32	6.38	1.07
	Individual Concept Mapping	36	6.39	1.40
ReviewingWeek4	Collaborative Concept Mapping	32	7.13	0.83
	Individual Concept Mapping	36	6.94	1.33
ReviewingWeek5	Collaborative Concept Mapping	32	7.88	0.98
	Individual Concept Mapping	36	7.75	1.11
ReviewingWeek6	Collaborative Concept Mapping	32	8.63	0.91
	Individual Concept Mapping	36	8.14	1.31

Table 11. count.

Group Statistics				
	Group	N	Mean	Std. Deviation
ReviewingWeek7	Collaborative Concept Mapping	32	9.03	1.03
	Individual Concept Mapping	36	8.42	1.25
ReviewingWeek8	Collaborative Concept Mapping	32	9.06	1.13
	Individual Concept Mapping	36	8.56	0.94
ReviewingWeek9	Collaborative Concept Mapping	32	9.03	1.06
	Individual Concept Mapping	36	8.83	1.06
ReviewingWeek10	Collaborative Concept Mapping	32	9.44	0.88
	Individual Concept Mapping	36	8.31	1.53
TotalReviewingAllWeeks	Collaborative Concept Mapping	32	7.79	0.81
	Individual Concept Mapping	36	7.44	1.15

The researcher tested the assumption of equal variances between the group using Levene's test and found that the group variances were not equivalent (see Appendix O). The independent samples *t*-test indicated that the groups were non-significantly different: $t\ (63) = 1.05$, $p = 0.15$. Those who had been taught by using the collaborative concept mapping scored non-significantly different than those who had been taught by using individual concept mapping strategy ($M = 7.79$, $SD = 0.81$; $M = 7.44$, $SD = 1.15$). Moreover, the standardised mean effect size indicated at a small change over time ($d = 0.17$). Hence, the null hypothesis, no significant difference between using collaborative and individual concept mapping on improving reviewing skills, was retained, and the alternative hypothesis was rejected.

Table 12. Independent Samples T-Test on Reviewing Skills of Collaborative vs. Individual Concept Mapping Groups.

Independent Samples Test				
		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
ReviewingWeek1	Equal variances not assumed	0.55	65	0.59
ReviewingWeek2	Equal variances not assumed	0.11	65	0.91
ReviewingWeek3	Equal variances not assumed	-0.05	65	0.96
ReviewingWeek4	Equal variances not assumed	0.68	60	0.50

Table 12. count.

Independent Samples Test				
		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
ReviewingWeek5	Equal variances not assumed	0.50	66	0.62
ReviewingWeek6	Equal variances not assumed	1.79	62	0.08
ReviewingWeek7	Equal variances not assumed	2.22	66	0.03
ReviewingWeek8	Equal variances not assumed	1.99	60	0.05
ReviewingWeek9	Equal variances not assumed	0.77	65	0.45
ReviewingWeek10	Equal variances not assumed	3.80	57	0.00
TotalReviewingAllWeeks	Equal variances not assumed	1.46	63	0.15*

* $p > 0.05$

The charts in Figure 7 indicated that both groups started at the same level, and performed at very close levels until the week five of the experiment. During the week three, a performance crossover occurred in advantage of collaborative concept mapping group. Namely, the crossover occurred because practicing reviewing in social environment enabled the ELL students to exchange and revise their reviewing performance.

Starting from the week five to the week nine, they showed a very small difference in their performance, which was not significant, because reviewing was suitable to be performed in social and individual environments as well. In collaborative concept mapping settings, the students can get benefited and simulate the desired performance from other students' performance in the same group or in other groups. However, the ELL students in individual concept mapping settings can build, improve, and master their reviewing performance by using self-assessment and instructor-assessment accompanied with self-confidence.

Both groups achieved the success proficiency level of reviewing, which was 8.3 by the week five. The collaborative concept mapping group reached 7.88 and the individual concept mapping group accomplished 7.75. By achieving the proficiency level at week five,

that indicated that the students in both groups had parallel improvement rate of reviewing skill.

The improvement rate of the collaborative concept mapping group was 3.5 and 3.52 for the individual concept mapping for the period of week one to the week nine of the intervention. At the week 10, the collaborative concept mapping group increased its reviewing performance, but the individual concept mapping group decreased its reviewing performance unexpectedly. This behaviour can be explained by the fact that complex reading materials, high level of vocabularies, and intensive information were embedded in the reading text at the last week of the intervention. The individual concept mapping strategy was unable to help the ELL students overcome this obstacle, but the collaborative concept mapping strategy did. Collaborative concept mapping strategy enabled the students to perform high level of cognitive processing and perform intensive reviewing practices.

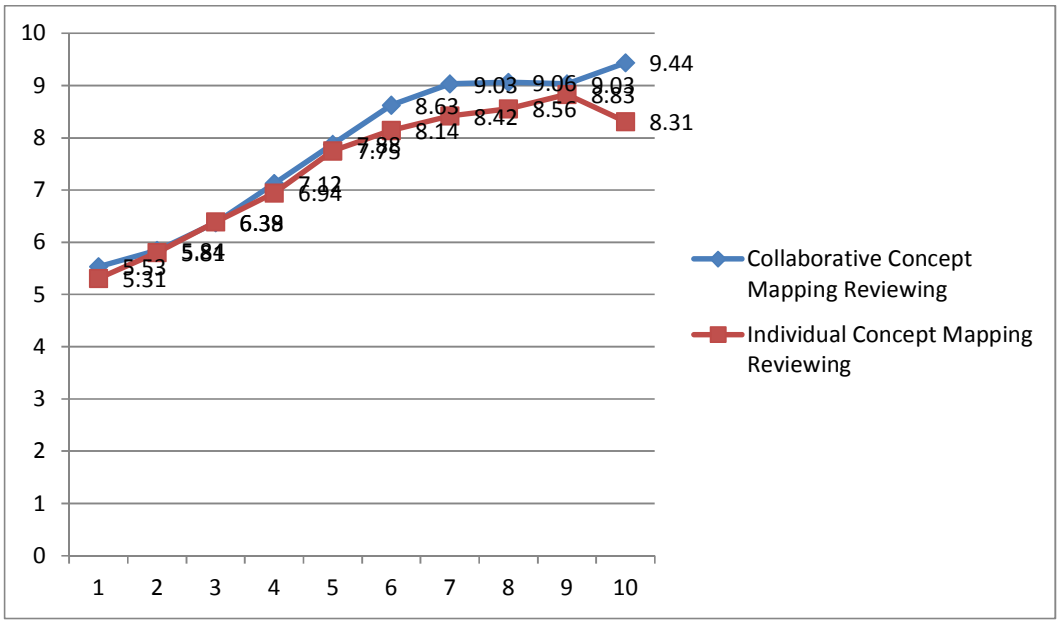

Figure 7. Reviewing Skills of Collaborative vs. Individual Concept Mapping Groups.

Null hypothesis six. 6: H_0–There will be no difference in the ELL students' listing skill in reading comprehension between the ELL students who use collaborative concept map as a cognitive tool and the ELL students who use individual concept maps.

To test this hypothesis, a trial was conducted in which 32 students used collaborative concept mapping in their learning, while 36 students used individual concept mapping. The rate of the interrater agreement was calculated to be 83.48%. The students' use of the ELL listing skill in both concept mapping groups was evaluated using the listing items from the rubric (see Table 13).

Table 13. Group Statistics on Listing Skills of Collaborative vs. Individual Concept Mapping Groups.

Group Statistics

	Group	N	Mean	Std. Deviation
ListingWeek1	Collaborative Concept Mapping	32	6.28	1.95
	Individual Concept Mapping	36	7.17	2.40
ListingWeek2	Collaborative Concept Mapping	32	7.50	1.98
	Individual Concept Mapping	36	7.81	2.46
ListingWeek3	Collaborative Concept Mapping	32	8.19	1.73
	Individual Concept Mapping	36	8.14	2.32
ListingWeek4	Collaborative Concept Mapping	32	8.88	1.86
	Individual Concept Mapping	36	8.58	2.39
ListingWeek5	Collaborative Concept Mapping	32	9.59	1.85
	Individual Concept Mapping	36	9.08	2.44
ListingWeek6	Collaborative Concept Mapping	32	10.09	1.55
	Individual Concept Mapping	36	9.53	2.20
ListingWeek7	Collaborative Concept Mapping	32	10.81	1.45
	Individual Concept Mapping	36	10.19	2.19
ListingWeek8	Collaborative Concept Mapping	32	11.91	1.65
	Individual Concept Mapping	36	10.58	2.42
ListingWeek9	Collaborative Concept Mapping	32	12.56	1.74
	Individual Concept Mapping	36	11.06	2.50
ListingWeek10	Collaborative Concept Mapping	32	12.56	1.85
	Individual Concept Mapping	36	11.33	2.41
TotalListingAllWeeks	Collaborative Concept Mapping	32	9.84	1.55
	Individual Concept Mapping	36	9.35	2.23

The researcher tested the assumption of equal variances between the group using Levene's test and found that the group variances were not equivalent (see Appendix P). The independent samples *t*-test showed that the groups were non-significantly different: $t\ (63) =$

1.06, $p = 0.29$. Particularly, the ELL students who used the collaborative concept mapping strategy performed non-significantly different than the ELL students who used the individual concept mapping strategy ($M = 9.84$, $SD = 1.55$; $M = 9.35$, $SD = 2.23$). Moreover, the standardised mean effect size indicated at a small change over time ($d = 0.13$). Therefore, the null hypothesis, no significant difference between using collaborative and individual concept mapping on improving listing skills, was retained, and the alternative hypothesis was rejected.

Table 14. Independent Samples T-Test on Listing Skills of Collaborative vs. Individual Concept Mapping Groups.

Independent Samples Test				
		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
ListingWeek1	Equal variances not assumed	-1.68	66	0.10
ListingWeek2	Equal variances not assumed	-0.57	65	0.57
ListingWeek3	Equal variances not assumed	0.10	64	0.92
ListingWeek4	Equal variances not assumed	0.56	65	0.58
ListingWeek5	Equal variances not assumed	0.98	64	0.33
ListingWeek6	Equal variances not assumed	1.24	63	0.22
ListingWeek7	Equal variances not assumed	1.39	61	0.17
ListingWeek8	Equal variances not assumed	2.66	62	0.01
ListingWeek9	Equal variances not assumed	2.91	63	0.01
ListingWeek10	Equal variances not assumed	2.37	65	0.02
TotalListingAllWeeks	Equal variances not assumed	1.06	63	0.29*

* $p > 0.05$

Figure 8 indicates some unique trends. Although the individual concept mapping group had a higher start point than the collaborative concept mapping group, there was a cross point at the week three of the experiment in advantage of the collaborative concept mapping group, which was non significant. This crossover occurred because the students

built their listing skills individually, and then they became ready for engaging in social activities that enabled them to maximize their listing skills.

The individual concept mapping group fairly outperformed the collaborative group in the week one and week two due to the small difference in the entry levels of the two groups. Between the week three and week seven, both groups improved almost equally but with advantage of the collaborative concept mapping group. They had the same improvement rate because the listing skill required a specific level of cognitive engagement mastery which was achieved in both strategies of concept mapping.

Both groups achieved the success proficiency level of listing, which was 8.5 by the week four. The collaborative concept mapping group reached 8.88 and the individual concept mapping group accomplished 8.58. By achieving the proficiency level at week four, that indicated that the students in both groups were developing their listing skills in parallel.

From the week one to the week seven, the improvement rate was for both groups about half a point. Whereas, the improvement rate for both groups after the week seven of the experiment was around a point. However, starting from the week seven and after, the collaborative concept mapping group notably outperformed the individual concept mapping group because social concept mapping maximized their abilities of extracting, classifying, and identifying concepts.

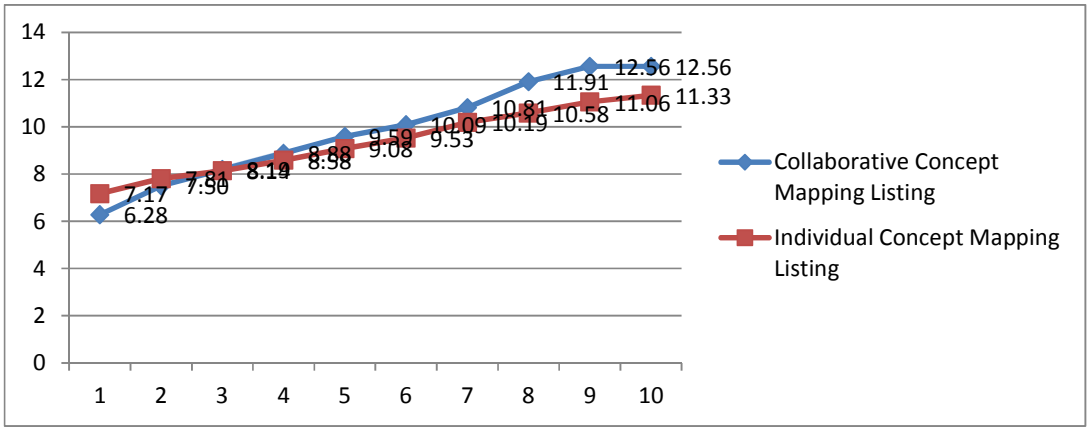

Figure 8. Listing Skills of Collaborative vs. Individual Concept Mapping Groups.

Null hypothesis seven. 7: H_0–There will be no difference in the ELL students' enforcing skill in reading comprehension between the ELL students who use collaborative concept maps as a cognitive tool and the ELL students who use individual concept maps.

32 students used collaborative concept mapping in their learning, and 36 students used individual concept mapping. The rate of the interrater agreement was 84.17%. The enforcing skills of both groups were rated using the enforcing section of the rubric (see Table 15).

Table 15. Group Statistics on Enforcing Skills of Collaborative vs. Individual Concept Mapping Groups.

Group Statistics

	Group	N	Mean	Std. Deviation
EnforcingWeek1	Collaborative Concept Mapping	32	7.84	2.82
	Individual Concept Mapping	36	7.56	2.47
EnforcingWeek2	Collaborative Concept Mapping	32	7.69	2.55
	Individual Concept Mapping	36	7.69	2.94
EnforcingWeek3	Collaborative Concept Mapping	32	7.75	2.63
	Individual Concept Mapping	36	7.94	3.11
EnforcingWeek4	Collaborative Concept Mapping	32	7.66	2.65
	Individual Concept Mapping	36	8.25	3.07
EnforcingWeek5	Collaborative Concept Mapping	32	8.03	2.52
	Individual Concept Mapping	36	8.17	3.18
EnforcingWeek6	Collaborative Concept Mapping	32	8.28	2.49
	Individual Concept Mapping	36	8.47	3.09
EnforcingWeek7	Collaborative Concept Mapping	32	9.28	2.69
	Individual Concept Mapping	36	8.53	3.01
EnforcingWeek8	Collaborative Concept Mapping	32	10.06	3.06
	Individual Concept Mapping	36	9.11	3.43
EnforcingWeek9	Collaborative Concept Mapping	32	11.34	3.47
	Individual Concept Mapping	36	10.06	3.85
EnforcingWeek10	Collaborative Concept Mapping	32	12.91	4.73
	Individual Concept Mapping	36	12.11	4.15
TotalEnforcingAllWeeks	Collaborative Concept Mapping	32	9.08	2.77
	Individual Concept Mapping	36	8.79	3.09

The researcher tested the assumption of equal variances between the group using Levene's test and found that the group variances were equivalent (see Appendix Q). The

independent samples *t*-test showed that the groups were non-significantly different: $t\ (66) = 0.41$, $p = 0.68$. Particularly, those who used the collaborative concept mapping performed non-significantly different than the those who used the individual concept mapping strategy ($M = 9.08$, $SD = 2.77$; $M = 10.04$, $SD = 3.49$). Moreover, the standardised mean effect size indicated at a small change over time ($d = 0.05$). Therefore, the null hypothesis, no significant difference between using collaborative and individual concept mapping on improving enforcing skills, was retained, and the alternative hypothesis was rejected.

Table 16. Independent Samples T-Test on Enforcing Skills of Collaborative vs. Individual Concept Mapping Groups.

Independent Samples Test				
		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
EnforcingWeek1	Equal variances assumed	0.45	66	0.65
EnforcingWeek2	Equal variances assumed	-0.01	66	0.99
EnforcingWeek3	Equal variances assumed	-0.28	66	0.78
EnforcingWeek4	Equal variances assumed	-0.85	66	0.40
EnforcingWeek5	Equal variances assumed	-0.19	66	0.85
EnforcingWeek6	Equal variances assumed	-0.28	66	0.78
EnforcingWeek7	Equal variances assumed	1.08	66	0.28
EnforcingWeek8	Equal variances assumed	1.20	66	0.23
EnforcingWeek9	Equal variances assumed	1.44	66	0.15
EnforcingWeek10	Equal variances assumed	0.74	66	0.46
TotalEnforcingAllWeeks	Equal variances assumed	0.41	66	0.68*

* $p > 0.05$

An in-depth look at Figure 9, makes it clear that the enforcing skills of both the collaborative and individual concept mapping groups were growing closely and parallel throughout all 10 weeks of intervention. The development of the enforcing skill had two crossovers (i.e. week two and week six). The improvement was not clear before the week seven, and while it was clear in both the collaborative and individual concept mapping groups

from the week seven to the end of the experiment, it was still not significant. Based on the chart of enforcing skills in collaborative and individual concept mapping groups, the two groups' performance remained very similar until the week seven. This behavior was caused by the fact that enforcing skill required a specific period of time to be established and mastered regardless the concept mapping strategy.

From the week seven to the end of the experiment there was a small difference in performance, with the collaborative concept mapping group showing an advantage. Once the student mastered and effectively engaged in cognitive process, the concept mapping strategy can impact the improvement rate.

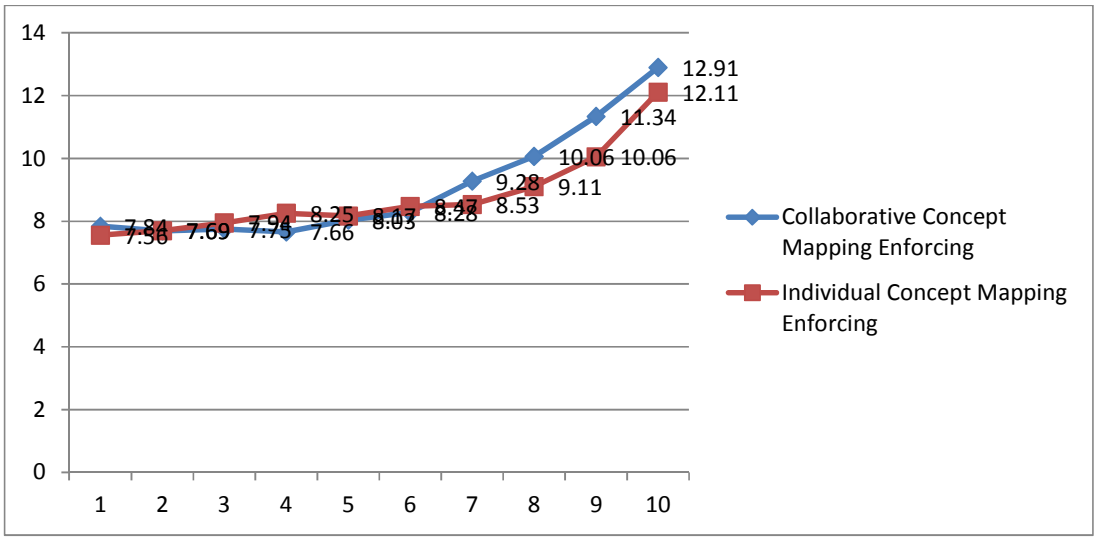

Figure 9. Enforcing Skills of Collaborative vs. Individual Concept Mapping Groups.

The charts in Figure 10 present two very close trends in collaborative and individual concept mapping groups' totals. Although the performance of the groups was equivalent to begin with, a slight difference emerged after the fifth week of the intervention and the trends diverged until the end of the experiment.

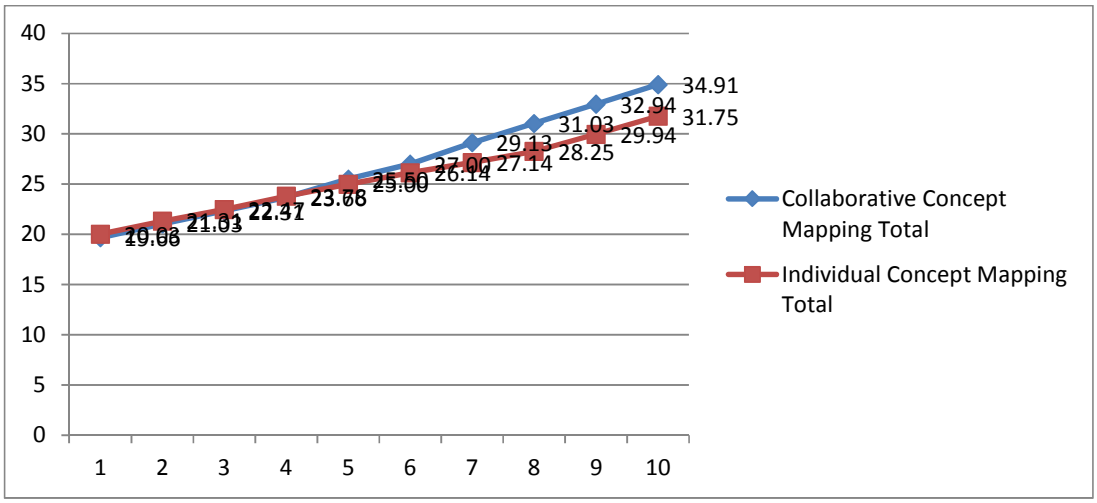

Figure 10. Rubric Totals from All Weeks of Collaborative vs. Individual Concept Mapping.

Null hypothesis eight. 8: H_0–There will be no difference in the ELL students' overall reading comprehension performance on the posttest between the ELL students who use collaborative concept maps as a cognitive tool and the ELL students who use individual concept maps.

The purpose of this overall ELL reading comprehension posttest was to help the researcher to measure the development of overall ELL reading comprehension of both groups (i.e., collaborative vs. individual concept mapping groups) after they had completed the experiment tasks and activities. The overall ELL reading comprehension posttest consisted of 10 questions, each worth one point, for a total of 10 points. The posttest items were designed and created based on the reading materials in the Students Textbook. The researcher and the cooperative English teacher composed and created the questions of the posttest. The success proficiency level of ELL overall reading comprehension posttest was 6.5 out of 10 points. An expert in ELL reading comprehension reviewed and improved it. The researcher analyzed the collected data by running a one-way ANOVA.

32 students used collaborative concept mapping as a tool for learning overall ELL reading comprehension, and 36 students used individual concept mapping. Both groups took the overall ELL reading comprehension posttest.

The statistical data from one-way ANOVA test indicated that the groups were non-significantly different: $F(1, 66) = 2.90$, $p = 0.09$. Specifically, the ELL students in the collaborative concept mapping group achieved non-significantly different than the ELL students in the individual concept mapping group on the overall ELL reading comprehension posttest ($M = 7.69$, $SD = 1.57$; $M = 7.03$, $SD = 1.61$). Moreover, the standardised mean effect size indicated at a small change over time ($d = 0.2$). Based on these results, the null hypothesis, no significant difference between using collaborative and individual concept mapping on improving the overall reading comprehension, was retained, and the alternative hypothesis was rejected.

Table 17. Overall Reading Comprehension Posttest One-Way ANOVA of Collaborative vs. Individual Concept Mapping Group.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TotalPosttest	Between Groups	7.37	1.00	7.37	2.90	0.09*
	Within Groups	167.85	66.00	2.54		
	Total	175.22	67.00			

* $p > 0.05$

CHAPTER V

DISCUSSION

Summary of Results

The results of this study showed several important findings, which I describe here along with relevant explanations. The collected data was organized, analyzed, and explained using independent samples *t*-test and one-way ANOVA test between the groups.

This study investigated the impact of concept mapping on the development of ELL reading comprehension skills, and found that the use of concept mapping had a statistically significant positive impact on the reviewing, listing and enforcing sub-skills of reading comprehension. Most importantly, the use of concept mapping was found to have a significant positive influence on overall ELL reading comprehension, compared to traditional teachings methods.

In addition, this study examined the difference between collaborative and individual concept mapping as tools for facilitating ELL students' reading comprehension skills, and no significant difference was found in the reviewing, listing, and enforcing sub-skills of reading comprehension between students using concept mapping collaboratively with other students versus those using concept mapping individually. Nor was any statistically significant difference found between the two groups in overall ELL reading comprehension.

Discussions

Discussion of Question 1

In order to accurately answer the question one of the study, four relevant research null hypotheses were examined. Based on the pretest data analyzed using a one-way

ANOVA, both groups were found to be equivalent in the reviewing, listing, and enforcing sub-skills of the overall ELL reading comprehension ($M = 4.14$, $SD = 1.82$; $M = 4.05$, $SD = 1.51$), $F(1, 72) = 0.05$, $p = 0.83$.

Discussion of hypothesis 1. To address the null hypothesis one of Question one, an independent sample *t*-test was generated, which revealed that the mean reviewing scores of the individual concept mapping group were significantly higher than those of the control group throughout all 10 weeks of intervention, ($M = 7.44$, $SD = 1.15$; $M = 6.73$, $SD = 1.46$), $t(72) = 3.66$, $p < 0.001$. These results showed that the individual concept mapping group had outperformed the control group in terms of the reviewing sub-skill of ELL reading comprehension.

A close look at the charts in Figure 3 shows consistently and significantly higher performance by the concept mapping group from the week one to the week nine of the intervention. Both charts show a sudden decrease at the week 10. Although that, the concept mapping group's chart is still significantly higher than the control group's chart. The researcher attributes this higher performance to several important factors. The students in the individual concept mapping group created concept maps to develop their ELL reviewing skills. Creating these concept maps helped students recognize text elements such as letters, words, sentences, paragraphs, punctuation marks, etc. This explanation aligns with Chang, Sun, & Chen's (2002) claim that the concept mapping strategy helps ELL learners increase their textual recognition abilities, which, in turn, enables them to more readily recognize the words, signs, and concepts of the written text.

The researcher attributes the increased reviewing skills of the individual concept mapping group to the extraordinary degree to which concept mapping helps students maintain the flow of reading and follow the order of words within sentences. Specifically, the researcher emphasizes that concept mapping enables ELL students to recognize the

words and written symbols in the text more efficiently than traditional teaching methods, by encouraging them to concentrate on scanning the items in the text, which automatically requires them to engage in more reading. This observation is supported by Hwang, Shi, & Chu (2011), who maintain that concept mapping helps ELL learners to engage in the process of recognizing items and identifying details embedded in the reading text. This process leads ELL learners to engage intensively in contemplating the words and concepts in paragraphs.

Furthermore, the researcher attributes the constantly improving performance of individual concept mapping group members to the fact that concept mapping requires higher engagement in cognitive processes, with less memorization employed in recognizing and identifying words. Students in the study constructed visual maps that helped them to view key words in visual form. Hence, they did not have to remember every single key word in the text because they already had it in a visual structure. This explanation aligns with the explanation introduced by Al-Qatawneh & Alodwan (2012) and Bahr & Danserau (2005) of the process by which readers use concept mapping to identify the meaning of the text, and the benefits of concept mapping in helping students focus on eliciting the important concepts in a text. The researcher believes that identifying the meanings of words made students aware of the general ideas of the text, which led to better reading comprehension. The researcher strongly believes that concept mapping helped the students in this study to engage in a very effective process for recognizing words and their meanings in order to generate a comprehensive understanding of the reading material.

Moreover, the researcher attributes the large statistical difference between the two groups to the way concept mapping enabled the students in the individual concept mapping group to process text recognition from a very simple level to a more complicated level: reading letters enabled them to recognize words, reading words enabled them to recognize sentences, reading sentences enabled them to recognize paragraphs, etc.

Returning to Figure 3, in addition to explaining the consistently and significantly higher performance of the concept mapping group from the week one to the week nine of the intervention, the researcher attributes the sudden decline at the last week of the intervention in both the individual concept mapping group and the control group to the high complexity of the paragraphs that were assigned to be studied at the week 10. Many words were longer than the students had grown used to reading during the previous nine weeks. Furthermore, the paragraphs themselves were longer, and many words were very technical and required more time to read. As a result, reviewing these more complex and unfamiliar texts imposed a higher cognitive load on the students, which caused the lowered mean of their reviewing scores during the last week of the intervention.

Implications of hypothesis 1. The results of the hypothesis one suggest the following beneficial implications: Individual concept mapping could be a very useful strategy in terms of improving ELL students' vocabularies. ELL students who use concept mapping can focus on vocabulary by drawing concept maps that present the vocabularies of the texts. These visual structures can significantly help the ELL students to recognize words easily because they connect words and their meanings. Increasing their vocabularies enables ELL students to review more written material and better understand the general idea or notion of the text.

Individual concept mapping can help ELL students by showing them visual structures of vocabularies they may encounter later in the texts. As they read multiple texts and large numbers of paragraphs, this visualization enables them to improve their reviewing and identify more vocabulary, which results in better reading flow. Moreover, using individual concept mapping in reviewing enables ELL students to focus more on the recognition of words and meanings, which, in turn, generates a better and more comprehensive understanding of the written text.

An important implication is possibly explained by the difficulty of the paragraphs the students were assigned to read during the last week, which included complex structures, intensive information, and a huge number of new words. These unsuitable reading materials confused the ELL students and caused the low level of performance for both groups. Thus, it is important, when developing ELL reading comprehension, to consider the difficulty of reading materials. ELL students need to move to each successive level of difficulty only after mastering the previous level, without skipping required information and vocabulary. Moving steadily from simple words and sentence structures to more complex ones is critical in teaching reviewing as ELL reading comprehension.

Discussion of hypothesis 2. Regarding the null hypothesis two of Question one, the increases in the individual concept mapping group's mean values for the listing skill were consistently and significantly greater than those of the control group, ($M = 9.37$, $SD = 2.23$; $M = 7.77$, $SD = 2.32$), $t\ (72) = 2.99$, $p < 0.001$ (see Figure 4), which indicates a clear advantage on the part of the students who used individual concept mapping to develop the listing skill of ELL reading comprehension.

The charts in Figure 4 show very close entry levels for the two groups. The concept mapping group showed consistent improvement in the listing skill and outperformed the control group through all 10 weeks. The mean values of the control group's chart tended to be convergent, with no significant improvement until the week six of the intervention. Starting with the week seven, the control group's chart showed improvement until the end of the intervention period. This behavior might be explained by the fact that the listing activities required the control group students to master the sub-skills of elaborating, describing, and listing relevant concepts. Mastering these necessary sub-skills using the traditional way of teaching requires significant time and effort because they demand a massive amount of cognitive engagement in the required processes of identifying the

concepts in the text and classifying them in multiple levels and classes. After being faced with listing tasks for an extended period of time (six weeks), the cognitive abilities of the control group students started improving. Despite this improvement, however, the students in the control group still demonstrated lower listing performance than those in the concept mapping group.

Based on the generated results, the researcher found that the significantly higher performance of the individual concept mapping group over the control group was a result of some specific focal reasons. The researcher attributed the significant difference to the higher level of cognitive processing required to perform the listing skill successfully. Concept mapping enabled the students immerse themselves in the reading texts in order to grasp more detailed meanings and secondary concepts. Each set of detailed meanings and concepts were relevant to the general idea that was elicited in the reviewing process. Hence, the researcher believes that the individual concept mapping enabled the students to improve their understanding of the written texts more than the students who used the traditional method of learning.

The researcher explains that phenomenon further by emphasizing the role of individual concept mapping in elaborating concepts and describing the information of the text. Individual concept mapping facilitated the classification of the concepts, facts, and details embedded in the text in an understandable manner. The ELL students in the study read the text and extracted the items, listing them in a meaningful way. This process revealed to the students extra details about the concepts and notions in the texts. The researcher refers to this result as the ability of individual concept mapping to help students organize and acquire the information embedded in the texts. This explanation aligns with the findings of Cassata-Widera (2008), who emphasizes the role of concept mapping in describing the meanings based on their common characteristics and schema. Elaborating items and

classifying concepts enable concept map users to access the embedded information and facts in the reading materials.

Overall, the researcher felt that individual concept mapping enabled students to elicit a higher number of concepts and information than the traditional way, and that it developed students' listing skills by organizing this additional information under the correct general ideas. The researcher attributes this result to the high level of cognitive activity that took place during listing activities using concept mapping, in which students worked at several cognitive levels, such as identifying secondary concepts, specifying shared features between groups of concepts, and classifying items. Moreover, concept mapping maximized students' performance in the elaboration and description of secondary concepts to a much greater degree than traditional teaching methods. The researcher suggests that the concept mapping group students' increased ability to elaborate, describe, and list relevant concepts under the proper general idea is a result of being required to elaborate on the interrelationships between the concepts. This interpretation agrees with the discussion of Bahr & Danserau (2005) regarding the cognitive processes required for performing a successful ELL listing skill, including: identifying secondary facts in the text, creating patterns, describing, and grouping information.

Implications of hypothesis 2. Based on the discussion of the results of the hypothesis two, there are clearly some beneficial implications for ELL reading comprehension situations. Concept mapping can be used to help instructors and teachers analyse their ELL students' writings. This implementation represents the use of listing via a concept mapping strategy because it helps the reader to perform a high-level critical reading by generating an insightful and comprehensive understanding of the meanings and information in the text.

Furthermore, listing through the use of concept mapping can be a very helpful assessment tool for an instructor to assess ELL students' reading processes by evaluating

their ability to identify main ideas, facts, and other relevant details in the text. Hence, this implementation increases the reliability of the instructors' evaluations, as well as informing instructors how to facilitate ELL students' improving their reading skills.

The chart of listing scores of both the individual concept mapping group and control group represents a unique case that could happen in developing listing as an ELL reading comprehension skill. The groups' entry levels were very close. The individual concept mapping group showed consistent improvement in listing skills throughout all 10 weeks. On the other hand, the control group showed no improvement until the week seven of the experiment.

This difference shows the impact of concept mapping. Importantly, designing concept maps required the students in the individual concept mapping group to immerse themselves in performing listing sub-skills, including eliciting, elaborating and classifying concepts and items. Designing concept maps in a visual structure required them to engage in both cognitive and physical performance rather than being restricted to mere cognitive performance, as students in the control group were. Moreover, designing concept maps required the ELL students to describe the interrelationships among the ideas embedded in the text, which may have helped them avoid missing some ideas or information. The combination of cognitive and physical performance drove the ELL students to produce an artefact that visually represented the items imbedded in the text. This production might have prompted and helped them to engage in a deeper, more mindful learning process, whereas the students in the control group were not forced to produce an artefact of the structure of the text's contents. Furthermore, the control group students were still engaging in the listing task. The only difference was that it was on listing concepts, rather than having to elaborate on the relationships, which limited their improvement of that skill. This might account for the students in the concept mapping group demonstrating an immediate improvement as soon as

the intervention began, and continuing to show consistent improvement on their listing performance throughout the 10 weeks of the experiment. The control group's poorer performance was probably a result of them taking more time and effort to develop the listing technique to the degree that it aided their reading comprehension, a development that came only at the week seven of the experiment.

Discussion of hypothesis 3. In terms of the null hypothesis three of question one, it seems beyond question that the individual concept mapping group significantly outperformed the control group on the enforcing sub-skill of reading comprehension, given the results in Figure 5 ($M = 10.04$, $SD = 3.49$; $M = 7.34$, $SD = 2.38$), $t\,(61) = 4.12$, $p < 0.001$.

The trends of the enforcing scores of the two group, as shown in Figure 5, represent an important case. Although the groups share the same starting point, they show very parallel performance, with a few improvements, until the week eight, which was an extremely late improvement. The greatest improvement in enforcing skills occurred during the period of the week eight to week 10, at the end of the experiment.

Among possible factors impacting the development of enforcing skills in both groups, the researcher found a series of reasons that might have caused the significant difference in the development curves. A practical explanation of this behavior can be the high level of cognitive processing required to perform the enforcing sub-skill in both groups. The ELL students in the individual concept mapping group practiced enforcing using concept maps, which helped them to practice higher levels of cognitive processing with more use of the enforcing sub-skill, whereas students in the control group had no opportunity either to practice the enforcing sub-skill or to create connections among concepts, due to the traditional teaching style in which they were taught.

The researcher interprets this result as indicating that students developed better enforcing skills by discovering potential connections between concepts under many different

general ideas. The high level of cognitive processing necessary for employing the enforcing sub-skill required students in the individual concept mapping group spend a considerable period of time master enforcing. Training in, and gaining mastery of, the enforcing sub-skill consumed seven weeks. All the previously mentioned factors caused and explained the late drastic improvement in enforcing skills after the week eight of the intervention.

The work of Rosenberg (2010) and Liu (2011) supports this interpretation by emphasizing the role of concept mapping in the development of students' organizing, describing, connecting, discovering, and summarizing abilities. They indicate that while students are constructing concept maps for their learning, they are also unintentionally engaging in the discovery of potential internal relationships among concepts. Discovering such relationships can be helpful for comprehending a text, depending on the strength of the connections.

The researcher attributes the superior performance of the individual concept mapping group to the large amount of cognitive processing required while students were connecting concepts and generating new knowledge. The process of creating these connections enabled the students to develop a solid and cohesive understanding of the reading materials; this solid understanding led, in turn, to a high level of enforcing performance. This behavior meant that the knowledge constructed by students themselves was more vital and consistent and, accordingly, their reading comprehension was better. The researcher believes that constructing new knowledge on their own helped these students to retain that knowledge, and to more easily recall and use it in various situations. Constructing a concept map at the enforcing level posed many cognitive challenges that needed to be solved. Students consistently created connections between the words and sentences they read. This creation of connections helped students to understand the words, sentences, and paragraphs they read, and introduced them to the next text. As Coutinho (2009) has explained, the challenge occurs

when students try to construct new knowledge, based on creating or discovering relationships between concepts. Enforcing by concept mapping facilitates knowledge construction and uses this new knowledge to develop a better understanding of the text.

The researcher offers the interpretation that these cognitive challenges essentially maximized students' ability to identify and elaborate connections between concepts in such a way that the students could create a new visual knowledge structure. This skill, called enforcing, was much more effectively developed by individual concept mapping throughout the intervention than by the traditional way of teaching. The researcher asserts furthermore that the use of concept mapping significantly increased students' graphic organization and connection strategies. These strategies helped students to connect concepts in a way that enabled them to understand the text more comprehensively than the students who were taught by the traditional method. Using graphic strategies while creating the concept maps enabled the students to engage in the cognitive process with less cognitive load and saved their cognitive faculties for performing the more cognitively demanding enforcing sub-skill of ELL reading comprehension. In addition, the concept mapping strategy played an important role in enabling students to articulate the interrelationships among the items, concepts, facts and ideas in the written text. These instructional benefits of concept mapping helped the students develop their enforcing skills and, as a result, improve their overall reading comprehension.

Implications of hypothesis 3. The results for the hypothesis three led to an important implication for the use of individual concept mapping to develop the enforcing sub-skill of reading comprehension. ELL students can benefit greatly from using this strategy to develop their skills in identifying new connections among concepts in order to better comprehend written texts.

Using concept mapping to perform enforcing has great potential for helping ELL students to comprehend and grasp texts in more consistent and understandable way. This strategy has a dual benefit. ELL students can increase their reading comprehension as they try to understand diverse reading materials in order to analyze an author's goal. At the same time, the knowledge gained using the enforcing technique, made possible by concept mapping, is more understandable, logical, and makes better sense for students themselves.

It is also worth noting that it is absolutely necessary to assign more time for the enforcing skill than for the other two skills, because mastering the necessary cognitive processing requires more effort and practice on the part of students.

Discussion of hypothesis 4. Regarding the last null hypothesis of the first question, results from the one-way ANOVA indicate many causal factors behind the significantly higher achievement of the ELL students in the individual concept mapping group versus those in the control group on the overall ELL reading comprehension posttest ($M = 7.09$, $SD = 1.61$; $M = 5.47$, $SD = 1.63$), $F(1, 66) = 16.93$, $p < 0.001$. The charts in Figure 6 indicate consistent improvement for both the individual concept mapping and control groups in terms of their rubric totals from all weeks of intervention.

However, the chart shows that the trend of the individual concept mapping group was stronger than the trend of the control group. The researcher interprets these results by focusing on the fact that concept mapping is an elaboration strategy. This elaboration strategy focused on the way that the ELL students learned throughout the 10 weeks of intervention. The students in the individual concept mapping group developed their ability to grasp the knowledge in the text, which led them to develop their overall ELL reading comprehension, which the posttest showed. Cohen & Cowen (2007) have suggested that using the concept mapping strategy in learning can increase students' ability to comprehend the text and grasp the ideas in it.

Moreover, the researcher points out that the utilization of concept mapping in this study enabled ELL students to engage actively in the cognitive processes. As a consequence, the students in the individual concept mapping group did better on the overall ELL reading comprehension posttest than the control group (who used only the traditional way of thinking throughout the intervention) because the latter group did not develop the active cognitive engagement skills necessary for achieving overall ELL reading comprehension.

Importantly, individual concept mapping enabled students to develop a better understanding of the general ideas contained in the texts. Thus, the researcher believes that the students improved their ability to extract key concepts and classify them under general ideas.

In addition, by utilizing individual concept mapping, the students became more able to discover the interrelationships between concepts under several different general ideas. As a consequence, they developed the abilities necessary for mastering overall ELL reading comprehension later in the posttest.

Implications of hypothesis 4. One implication of the results, discussed above, of the hypothesis four, is the feasibility of using individual concept mapping to successfully develop overall ELL reading comprehension. This implication can be very beneficial because ELL students could benefit from the broad range of cognitive processes they encounter while constructing concept maps individually in preparation for overall ELL reading comprehension. This engagement in cognitive processes is an essential factor in successful overall ELL reading comprehension.

Moreover, individual concept mapping can help ELL students summarize paragraphs after they have read them. Concept mapping enables students to connect and analyze the concepts embedded in the text. Summarizing the paragraphs helps ELL students to develop a high level of text comprehension and produce creative ideas.

Discussion of Question 2

Question two represents another facet of this study. In seeking to answer it, four null hypotheses were tested. The aggregated data from the overall ELL reading comprehension pretest, which used a one-way ANOVA, indicate that the students in the collaborative and individual concept mapping groups were equivalent in the three reading comprehension sub-skills of reviewing, listing, and enforcing ($M = 4.03$, $SD = 1.89$; $M = 4.14$, $SD = 1.82$), $F(1, 66) = 0.06$, $p = 0.81$.

Discussion of hypothesis 5. Regarding the null hypothesis five, the analyzed data show that the mean scores for the reviewing sub-skill were slightly higher and not significant for the collaborative concept mapping group than the individual concept mapping (control) group, as shown in Figure 7 ($M = 7.79$, $SD = 0.81$; $M = 7.44$, $SD = 1.15$), $t(63) = 1.05$, $p = 0.15$. While this difference was not deemed significant by the researcher, some analysis was devoted to determining the cause of the non-significant difference. The researcher believes that, while both the collaborative and individual concept mapping enabled the students in the respective groups to recognize and elicit the general information at the same level, concept mapping in a social environment (i.e. in the collaborative group) enabled the students to share and revise their own understanding in light of the group's understanding and to explore and evaluate the concepts that the other students reviewed. Exchanging their ideas and understandings with fellow group members helped them to better recognize the concepts and the general ideas embedded in the written text, and to crystallize the general information in the learning context.

This interpretation aligns with Chularut & DeBacker's (2004) explanation of the roles and responsibilities of students practicing concept mapping. They indicate that concept mapping further develops the reviewing process by facilitating the identification and generation of general ideas following the reading of the text. The researcher believes that

engaging the ELL students in concept mapping, whether collaboratively or individually, enabled them to identify relevant vocabulary in order to grasp the general notions in the text. While the ELL students were creating concept maps, either collaboratively or individually, in order to review the texts, they also increased their ability to elicit concepts from sentences and extract general ideas from paragraphs.

Additionally, the researcher attributes the parallel reviewing performance of the two concept mapping groups to the high level of cognitive concentration in which the students engaged while reading the text and creating concept maps throughout the intervention. The students paid additional attention to the items and concepts in the reading material while they were identifying items in the text. This interpretation is supported by the work of Rosenberg (2010), who emphasizes the role of concept mapping in identifying and developing meaning and concentrating learners' attention while they are analyzing the text in a social environment.

In addition, the researcher points out that collaborative and individual concept mapping—equally—served to maximize the space students allotted in their minds for each general idea, because they automatically expected a sort of expansion, editing, or revision based on the students' comments within the group. Moreover, creating concept maps in both learning settings enabled students to maximize their reading flow and recognition of items in the texts, thus developing a better general understanding of the text.

Implications of hypothesis 5. The discussion of the results of the hypothesis five led to some important implications. Collaborative and individual concept mapping could be very beneficial for ELL students, but in two different ways.

Both collaborative or individual concept mapping greatly enhance the reviewing process by helping students' recognize details in the text. Collaborative concept mapping could be applied successfully for word pattern recognition within groups. However,

individual concept mapping is also highly likely to enable ELL students to engage in pattern recognition, identification, cognitive practicing, vocabulary recognition, and for eliciting the initial ideas and information of written texts.

A close look at the reviewing scores of the collaborative and individual concept mapping groups in Figure 7 reveals three important phases. In the first phase, the groups started from the same point and performed very closely until the week five of the experiment. In the second phase, from the week five to the week nine, a very small (not statistically significant) difference emerged in their performance. In the third phase, which began at the 10^{th} week, the collaborative concept mapping group improved its reviewing performance, while the individual concept mapping group unexpectedly decreased its reviewing performance. The researcher has explanations for each of these three phases, which may have implications for similar situations.

In the first phase, reviewing is an inherently personal process, one that takes place individually regardless of whether the student is working within a group or individually. Hence, the two groups' performance is roughly parallel. The implication here is that giving mostly individual assignments and activities at the beginning of training in the reviewing sub-skill can be beneficial because at this point students are still building their own elementary skills.

In the second phase, the slightly better results of the collaborative group suggest that practicing newly-acquired elementary reviewing skills in a collaborative setting is beneficial. While, as state above, reviewing is inherently a personal task, practicing it in a social environment enables students to demonstrate their ability, and that demonstration strengthens their self-confidence.

In the third phase, the divergent curves imply again that ELL students benefit from practicing their reviewing skills in an active social environment—an environment that was

not available to the students in the individual concept mapping group in this study, which explains that group's lower performance. It should be noted, however, that any collaborative reviewing practice should come only after a considerable period of personal reviewing, so that students have had time to build their individual reviewing skills. By doing this scenario, the ELL students are expected to be more active, master the reviewing skills, be well-trained, and ready for more activities. Accordingly, this was the reason of decreasing the performance of individual concept mapping group at the end of the experiment.

Discussion of hypothesis 6. Regarding the null hypothesis six, the aggregated data show that the mean values from the listing section of the rubric for the collaborative and individual concept mapping groups were extremely close with no significant difference throughout the 10 weeks of the intervention ($M = 9.84$, $SD = 1.55$; $M = 9.35$, $SD = 2.23$), $t(63) = 1.06$, $p = 0.29$.

According to the trends in the scores for the listing sub-skill for both groups, shown in Figure 8, there was a cross point at the week three of the experiment. The individual concept mapping group fairly outperformed the collaborative group in the weeks one and two, because, in addition to the slight difference in the entry level scores, practicing listing individually was more preferred by the students at the beginning. Learning listing skills based on their own individual abilities enabled the students in the individual concept mapping group to perform slightly higher than the collaborative group during the weeks one and two. After that, however, the benefits of practicing cognitive engagement in a social environment helped the collaborative group to slightly outperform the individual concept mapping group. The training in the listing skill required students to rely on their own cognitive abilities before participating in social activities. This individual beginning established students' ability to classify concepts and master the required cognitive processes. Once this was accomplished, the students would be ready and able to engage in listing activities in a social setting.

From the week three on, the collaborative concept mapping group fairly outperformed the individual concept mapping group, though the difference in performance was not significant until the end of the experiment. The trends suggest that it might be more beneficial for the development of the listing skill for students to start with individual concept mapping first and then move to collaborative concept mapping activities.

Based on these results, the researcher looked for factors that may have caused the lack of significant difference between the collaborative and individual groups in terms of development of listing skills. The researcher interpreted this result as demonstrating the impact collaborative concept mapping has on cognitive development due to the huge amount of cognitive processing and effort required to practice listing using concept mapping in a social setting. Moreover, the researcher attributes the superior performance of the students in the collaborative group in the last week of the study to the high level of cognitive engagement in details and secondary concepts available to the students in the collaborative concept mapping group. This important feature very likely improved the listing skills of the students in this group. These students exchanged specific details and information among themselves as they created concept maps for the listing skill. This particular social cognitive activity increased students' ability to visualise details and collaboratively create visual maps to display them.

Additionally, the researcher cites the tremendous impact of the organizing aspect of collaborative concept mapping, which enabled the students to share their ideas and methods of organizing information and concepts while they constructed their concept maps during their listing skill development. This explanation is supported by the claim by Cassata-Widera (2008) that listing, as a skill of ELL reading comprehension practiced in group concept mapping, requires such processes as eliciting, organizing, and creating connections. The researcher attributes that case by emphasizing the role of collaborative concept mapping in

developing students' ability in terms of exchanging information and organizing the listed items and concepts, based on their similar schema and characteristics. Hence, the process of organizing and structuring concepts during the listing activities maximized ELL students' knowledge acquisition, as well as their connections-making.

Implications of hypothesis 6. An analysis of the various benefits of concept mapping in both collaborative and individual environments, and of the role concept mapping played in developing the listing sub-skill of ELL reading comprehension, leads to some useful implications.

One implication is that it is very beneficial to have students work individually at the beginning of their listing skill development. Allowing them to first develop their own entry-level listing skills enables them, later on, to efficiently perform listing tasks and concept mapping within a collaborative setting.

In practical terms this could mean that students begin by doing individual concept mapping activities, and then gradually move to a social environment, where they do tasks collaboratively with classmates. Collaborative concept mapping could be more beneficial after students have mastered the listing skill individually. This progression from individual concept mapping during the listing skill development phase, to collaborative concept mapping once the listing skill is mastered, might ensure a high level of reading comprehension.

Discussion of hypothesis 7. The null hypothesis seven was investigated. Supporting the results of the *t*-test, the mean values of the enforcing part of the rubric for both the collaborative and individual concept mapping groups grew closely and parallel without significant difference throughout all 10 weeks of the intervention ($M = 9.08$, $SD = 2.77$; $M = 8.79$, $SD = 3.09$), $t\ (66) = 0.41$, $p = 0.68$.

Based on the enforcing scores of the collaborative and individual concept mapping groups on Figure 9, the two groups' performance curves tracked very close to each other, with two cross points, until the week seven. From the week seven on, there was a slight difference in the groups' performance curves, with the collaborative concept mapping group the higher of the two. The trends of both charts were convergent and not clear before the week seven. This was interpreted as indicating that both concept mapping styles were suitable for early enforcing learning. The reason for that was that concept mapping, in both individual and collaborative settings, had a positive impact on cognitive engagement during the performance of enforcing tasks.

The development of the enforcing skill was clear in both collaborative and individual concept mapping groups after the week seven of the intervention. This can be interpreted as indicating that the students in both groups practiced enough tasks to enable efficient and productive cognitive engagement. The slight difference that occurred after the week seven was due to the opportunity for collaborative group members to practice enforcing in social settings, which enriched their understanding of the connections between concepts due to the knowledge exchange between group members.

The researcher emphasizes that the use of concept maps was very beneficial in helping students discover connections between concepts, and to build knowledge structures. There are many possible explanations for the statistically close enforcing scores of the collaborative and individual concept mapping groups. The researcher interpreted the results as indicating that collaborative concept mapping and individual concept mapping helped students in two different ways to achieve a deep understanding of the text and create new knowledge structures.

The individual concept mapping strategy enabled students to focus on improving their cognitive skills and thus develop their enforcing skill. Individual concept mapping also

forced students to rely heavily on their own understanding and analysis of the concept in order to infer new information from the text. During individual concept mapping, the students connected their prior knowledge with the new knowledge. This aspect of individual concept mapping makes learning more sustainable and meaningful because the ELL student has built it himself or herself.

To put it another way: while the students in the collaborative group exchanged their analysis with other group members, they were also developing their own enforcing skills by combining their own understanding with others' ideas. The collaborative nature of the concept mapping forced them to assess others' ideas and prove their own. They had to review all the text analysis and incorporate their own analysis. This way of learning the enforcing skill helped them to develop both their own enforcing skills and their reading comprehension.

Additionally, while using concept mapping in collaborative situations, students used their prior knowledge and other group members' ideas as information sources to develop their enforcing skills. Based on this interpretation, the ELL student unconsciously employed other group members' prior knowledge in developing their own enforcing skills.

Implications of hypothesis 7. The results from the hypothesis seven led to an important implication in a different situation, one in which individual or collaborative concept mapping is used to developing the enforcing skill.

Practicing enforcing with the help of individual concept mapping might enable ELL students to discover and create connections between all the items and variables in a written text. Accordingly, by taking all the variables into consideration while building new knowledge students can build the most suitable text analysis, one that fits their own understanding. Each student has a unique way of discovering the connections between

concepts. Thus, individual concept mapping can encourage students to produce knowledge that will be more sustainable and meaningful, because they built it themselves.

On the other hand, collaborative concept mapping can be used in developing the enforcing skill when students are required to comprehend a complex text that is idea-intense. In this case, collaborative concept mapping could be a very useful technique for elaborating the ideas in the text and grasping more of them in less time, because more internal processes would be occurring at the same time between more students.

Another direct implication of this hypothesis that training in the enforcing skill should begin with a combination of social and individual concept mapping activities. However, this combination should not continue indefinitely, because the ELL students tended towards the social environment in learning the enforcing skill. This tendency came from the benefits of sharing ideas and creating connections between the facts in the text, which helped students to concentrate their attention on creating more relationships among the items in the text.

Discussion of hypothesis 8. The null hypothesis eight was examined. Based on the charts in Figure 10 and the results of the one-way ANOVA of collaborative and individual concept mapping groups' overall ELL reading comprehension ($M = 7.69$, $SD = 1.57$; $M = 7.03$, $SD = 1.61$), $F(1, 66) = 2.90$, $p = 0.09$, the researcher revealed some specific causal factors. These factors might be considered as reasons for the similar and not significant different achievement levels of the students in the collaborative and individual concept mapping groups.

Two very close trends of totals from the collaborative and individual concept mapping groups' rubrics are shown in Figure 10. Despite equivalent performance totals in the rubrics, a slight difference emerged after the week five of the intervention, and the trends continued to diverge slightly until the end of the experiment. This pattern was interpreted as indicating that concept mapping is a cognitive tool and thus requires the student to do most of the learning

process cognitively and through internal processes. Hence, the trends tracked close to each other until the week five. The researcher attributed the non-significant difference that emerged at the week five to the fact that the two kinds of concept mapping had impacts on their respective groups that, while equivalent in magnitude, were different in kind.

More specifically, as students started creating concept maps to develop better recognition of the text during the intervention, internal, individual cognitive processes were launched, involving a considerable amount of important feedback and other factors, such as student's prior knowledge, teachers' recommendations, text materials, etc. Individual concept mapping is better suited to this phase, when students are beginning to elicit and classify concepts under specific categories. During this process, the amount of cognitive processes increased and became more internal than external. Later on, students started engaging deeply in more external cognitive processes, creating connections between concepts in order to understand the meaning of the written text in a social environment. These two phases are distinct phenomena that occurred during the intervention and impacted reading comprehension.

The students spent about half of their time in the reading comprehension process discovering potential relationships, creating connections, and constructing new knowledge. On the individual concept mapping side, the majority of the early ELL reading comprehension processes tended to occur internally with few external interaction and little attention paid to social stimuli unless someone had queries or comments.

During the overall ELL reading comprehension posttest, students were alone, with no interaction with each other. The results of this situation align with the earlier characterization of ELL reading comprehension as an internal cognitive process. On the other hand, using collaborative concept mapping to train students in a social setting helped them to extend their cognitive processes to include more external cognitive processes than the students in

the individual group. This way of practicing overall reading comprehension had a positive impact on their achievement in the overall reading comprehension posttest.

Implications of hypothesis 8. One of the important implications of the results extracted for the hypothesis eight was related to the creation of complex structures after processing several passages on similar or different subjects. Creating such structures requires students to be aware of the comprehensive meanings of the texts, to see the connections between passages, and to understand the relationships among the embedded general ideas. Individual and collaborative concept mapping strategies can help in achieving a high level of overall ELL reading comprehension by encouraging students to exert more cognitive effort in identifying and characterizing interrelationships among concepts and ideas.

Utilizing an individual concept mapping strategy for a specific period of time can prevent many misunderstandings of the points of a new reading text, and produce an accurate representation of the original text. Individual concept mapping can play an important role as a training strategy for overall reading comprehension. It can provide ELL students with individual tasks that increase the students' independence and develop their own viewpoints. Using individual concept mapping to train ELL students helps them to grasp the text in a manner that reflects their own way of thinking.

At the same time, using collaborative concept mapping for a considerable period of time to generate discussion could help students develop their overall ELL reading comprehension by enabling them to draw accurate and reflective meaningful conclusions after reading several texts on a given topic. Furthermore, this social strategy can be used to enable ELL students to create new topics after reading different texts and topics. Comprehending a text in a social setting can increase students' ability to merge several notions and produce a new one. This implication has great potential for helping ELL students

comprehend a reading text in new ways and, as a result, increase their overall reading comprehension.

Limitations

The researcher encountered some limitation in conducting this study. For example, it was not possible to arrange a bigger research sample or include other schools in different cities, though these would have been desirable. The study consisted of 106 ELL students, which was a somewhat small sample. Furthermore, the students in all three groups were at the high school level, which meant they were under extra pressure because their achievement in this grade would determine their college major and future career. This situation put the students in a very high-stress environment because they needed to exert extra effort in other subjects besides the English language, and thus their attention was drawn to other important subjects because they wanted to maintain or increase their end-of-semester GPA.

In addition, this study was limited to 10 weeks during the second academic semester of school year 2013-2014. Achieving high reading comprehension requires a longer period of time than what was available. Furthermore, the English proficiency of all three groups was low, which meant more time was consumed to achieve any improvement in reading comprehension. This high consumption of time and effort led to a higher cognitive load and greater learning distribution. Furthermore, there were only two highly qualified raters who assessed the students using the rubric. Furthermore, the second rater assessed the students only three times. These two limitations impacted the accuracy of the aggregated data and the level of the interrater reliability. In addition, this is a quantitative study which did not pay attention to the qualitative aspects and elements that could reveal different findings.

Recommendations

Naturally, the researcher has some recommendations and suggestions for future research. The researcher suggests choosing a wider, larger, and more representative research

sample. Specifically, engaging other schools, from different areas, districts, and cities, as well as different grades and levels, including elementary school, middle school, high school, and college levels. Having ELL students from different levels would most likely make the elicited data more representative and reliable.

Additionally, the researcher recommends extending the length of the intervention to include several academic semesters, and avoiding critical times during the semester, such as the final weeks, in order to help students develop the targeted ELL reading comprehension skills without extra pressure or any additional cognitive load.

Importantly, the researcher recommends increasing the number of highly qualified English raters who assess the students using the rubric. Furthermore, increasing the numbers of dual or triple raters would increase interrater reliability and generate more accurate data. Especially important, the researcher suggests engaging ELL students from different language backgrounds. This recommendation is important because the data may show differences in performance on the reviewing, listing, enforcing skills, and the overall ELL reading comprehension pre- and posttest of students from different cultures. In addition, it is highly recommended adding a qualitative part because it is expected to have a different data based on different measuring instruments. The qualitative part is expected to reveal different types of findings that could help in getting in-depth understanding of the elements of the study.

APPENDICES

Appendix A
Rubric of Reviewing, Listing, and Enforcing

Instructions

1. Write the ELL student's number.
2. Read the sub-skills statements and Likert scale levels before filling the rubric form.
3. Observe the ELL student precisely and objectively.
4. Put √ in the column that accurately represents ELL student's performance quality.
5. Respond to all the sub-skills items' statements.

- ELL student's number: ……
- Grade level: 12th grade.
- Gender: Male

Rubric of Reviewing, Listing, and Enforcing

No.	Sub-skills' Statements	ELL Student's Performance on Likert Scale				
		Excellent	Above Average	Average	Below Average	Extremely Poor
		(5)	(4)	(3)	(2)	(1)
Reviewing as a Sub-Skill of ELL Reading Comprehension						
1	Identify the meanings and vocabularies.	The student accurately infers the meanings of the targeted vocabularies 100% of the times.	The student accurately infers the meanings of the targeted vocabularies 80% of the times.	The student accurately infers the meanings of the targeted vocabularies 75% of the times.	The student accurately infers the meanings of the targeted vocabularies 60% of the times.	The student accurately infers the meanings of the targeted vocabularies less than 60% of the times.
2	State the main ideas that are embedded in the text and learning context.	The student correctly states the main idea of the text at the first attempt (reading the text once).	The student correctly states the main idea of the text at the second attempt.	The student partially states the main idea of the text at the second attempt.	The student partially states the main idea of the text at the third attempt.	The student misunderstands entirely the main idea of the text after reading the text three times.
Reviewing Total (out of 10)						
Listing as a Sub-Skill of ELL Reading Comprehension						
3	List more meanings and secondary concepts that are relevant to the general notions and ideas.	The student correctly lists the secondary ideas of the text at the first attempt (reading the text once).	The student correctly lists the secondary ideas of the text at the second attempt.	The student partially lists the secondary ideas of the text at the second attempt.	The student partially lists the secondary ideas of the text at the third attempt.	The student entirely cannot list the secondary ideas of the text after reading the text three times.
4	Elaborate concepts and describe items that are embedded in the paragraphs.	The student clearly, completely, and accurately explains every concept or point listed.	The student accurately explains every concept or point listed however, a few of them are accurate but not complete.	The student accurately and completely explains 50% of the concepts or points listed.	The student accurately and completely explains less than 50% of the concepts or points listed.	The student is not able to explain any of the concepts/points listed in accurate or meaningful way.
5	Classify concepts and items under the right and	The student correctly	The student correctly	The student correctly	The student correctly	The student

	proper general ideas.	classifies 100% of the concepts under their relevant general idea.	classifies 85% of the concepts under the relevant general idea.	classifies 70% of the concepts under the relevant general idea.	classifies 50% of the concepts under the relevant general idea.	correctly classifies less than 50% of the concepts under the relevant general idea.
Listing Total (out of 15)						
Enforcing as a Sub-Skill of ELL Reading Comprehension						
6	Discover the connections between the listed concepts under one general idea.	The student correctly discovers all the relationships among the related concepts in each category.	The student correctly discovers most the relationships among the related concepts in each category with one or two missing or incorrect.	The student correctly discovers 50% of the relationships among the related concepts in each category.	The student correctly discovers less than 50% of the relationships among the related concepts in each category.	The student correctly discovers very few or none of the relationships among the related concepts in each category.
7	Identify the interactions between the listed concepts within different general ideas.	The student correctly explains all the interactions of the concepts between different categories.	The student correctly explains most of the interactions of the concepts between different categories with one or two missing or incorrect.	The student correctly explains 50% of the interactions of the concepts between different categories.	The student correctly explains less than 50% of the interactions of the concepts between different categories.	The student correctly explains very few or none of the interactions of the concepts between different categories.
8	Summarize the knowledge structure.	The student can accurately summarize the text by answering correctly to all the inference questions (i.e. the answer is inferred from the text).	The student can fairly accurately summarize the text by answering correctly to 75% of the inference questions (i.e. the answer is inferred from the text).	The student can somewhat accurately summarize the text by answering correctly to 50% of the inference questions (i.e. the answer is inferred from the text).	The student shows a marginal ability to accurately summarize the text by answering correctly to less than 50% of the inference questions (i.e. the answer is inferred from the text).	The student shows a very low ability to summarize the text by answering correctly to very few or none of the inference questions (i.e. the answer is inferred from the text).

9	State the author's purpose.	The student is clearly able to state the author's purpose.	The student is approximately able to state the author's purpose.	The student is partially able to state the author's purpose.	The student is not certain about the author's purpose.	The student is totally not able to state the author's purpose.
Enforcing Total (out of 20)						
Rubric Total (out of 55)						

Appendix B
Pretest of Overall ELL Reading Comprehension

Dear participant,

Thank you for considering taking this pretest of overall ELL reading comprehension. This pretest is for a study entitled, "Use of C-map as a Cognitive Tool in Collaborative and Individual Concept Mapping for Enhancing ELL Students' Reading Comprehension." The main purpose of this pretest is to measure your overall ELL reading comprehension before having the following tasks and activities. It consists of 10 questions that total 100 points.

Please, read carefully the following paragraphs and questions and choose the most accurate alternate for each question. If you do not feel comfortable with responding to any of the following questions, please feel free to skip it. This overall pretest takes approximately 30 minutes to be completed. If you have any queries or need further assistance, please ask the cooperative teacher. Thank you very much for your participation.

Best regards,

Enaz Yousef Rasheed Mahmoud

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Pretest of Overall ELL Reading Comprehension

ELL student's number: ……

Grade level: 12th grade.

Gender: Male

Read carefully the following passage and choose the most accurate alternate for the following questions.

Jordan has several interesting places that tourists come to visit. Petra is one of the most famous places in Jordan, where tourists come from all over the world to visit every year. It is a historical city that was built in the **heart** of a big mountain. It is an archaeological city which is located in southern region of Ma'an, which is rich with historical places. **It** lies between three main mountains in Jordan, including: Almadhbah, Hore, and Arabah. Moreover, it is located between two seas, the Dead Sea and Gulf of Aqaba. It is frequently called the Roe City because it was carved in a pink mountain. It was established around 300 BCE and it was the capital city of Nabataeans. It is a symbol of Jordanian government and well-known for all citizens.

In 1985, Petra has been one of the UNISCO World Heritage Sites. Interestingly, it was unknown for the Western world until a Swiss explorer introduced it and talked about it in 1918. Moreover, Smithsonian Magazine chose it and described it as one of the most interesting 28 places in the world that the tourist should see. When people visit Petra and see the high quality of cravings, they are surprised because it seems like not a product of human artifact.

Q 1: What is the thing that the word "It" in line four refers to?

(A) Ma'an city.

(B) Jordan.

(C) Petra.

(D) Southern region.

Q 2: What would be the best title of this passage?

(A) Nabataeans' cities.

(B) UNISCO World Heritage Sites.

(C) Tourism in Jordan.

(D) Rose City.

Q 3: What is the meaning that the word "heart" in line 3 refers to?

(A) Middle.

(B) Human organ.

(C) Group of rocks and stones.

(D) Significant important.

Q 4: Which one of the following general ideas is NOT relevant to the passage?

(A) Petra has a strategic geographical position in Jordan.

(B) Petra is well-known and recognized locally and globally.

(C) Petra has many historical and archaeological advantages.

(D) Petra was craved by high-qualified builders and advanced technical equipments.

Pretest of Overall ELL Reading Comprehension

Q 5: What is the reason beyond calling Petra by the Rose City?

(A) It has roses craves.

(B) The rocks and stones have pink color.

(C) It was built as a rose shape.

(D) There are many roses and flowers grow inside it.

Q 6: What is the main reason that makes Smithsonian Magazine interested in Petra?

(A) Its high-quality and professional proficiency of craving.

(B) Its strategic geographical location.

(C) Its political role in the Nabataeans' civilization.

(D) UNISCO listed Petra in its World Heritage Sites.

Q 7: What are the three main mountains that increased Petra's geographic importance?

(A) Almadhbah, Hore, and Arabah.

(B) Ma'an, Almadhbah, and Petra.

(C) Nabataeans, Arabah, and Hore.

(D) Dead, Ma'an, and Aqaba.

Q 8: What is the factor that does NOT impact the geographical importance of Petra?

(A) It lies between three famous mountains.

(B) It is between two seas.

(C) It is in the heart of a big mountain.

(D) It is in the southern region.

Pretest of Overall ELL Reading Comprehension

Q 9: What is the consequence of Petra being the capital of Nabataeans' civilization around 300 BCE?

(A) It is a symbol of Jordanian government.

(B) A Swiss explorer introduced it to the western world.

(C) It is well-known for all Jordanians.

(D) All answers are correct alternates.

Q 10: What is the reason of delaying of Petra recognition to the Western world?

(A) It is too old city which was built around 300 BCE.

(B) It is hidden between rigged terrains and mountains.

(C) It needs a huge amount of financial investment to be renovated.

(D) It is important to the Jordanians more than other nations.

Appendix C
Key Answers of Overall ELL Reading Comprehension Pretest Questions

Question No	Correct Answer
Q1	C
Q2	D
Q3	A
Q4	D
Q5	B
Q6	A
Q7	A
Q8	C
Q9	D
Q10	B

Appendix D
Posttest of Overall ELL Reading Comprehension

Dear participant,

Thank you for considering taking this posttest of overall ELL reading comprehension. This posttest is for a study entitled, "Use of C-map as a Cognitive Tool in Collaborative and Individual Concept Mapping for Enhancing ELL Students' Reading Comprehension." The main purpose of this posttest is to measure your overall ELL reading comprehension after experiencing the tasks and activities. It consists of 10 questions total 100 points.

Please, read carefully the following paragraphs and questions and choose the most accurate alternate for each question. If you do not feel comfortable with responding to any of the following questions, please feel free to skip it. This overall posttest takes approximately 30 minutes to be completed. If you have any queries or need further assistance, please ask the cooperative teacher. Thank you very much for your participation.

Best regards,

Enaz Yousef Rasheed Mahmoud

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Posttest of Overall ELL Reading Comprehension

ELL student's number: ……

Grade level: 12th grade.

Gender: Male

Read carefully the following passage and choose the most accurate alternate for the following questions.

Energy has been used increasingly day after day. It can be generated via several sources of power, such as: waterfalls, coal, sea waves, fuel, solar, rivers, biomass, hydro-power, as well as nuclear power plants. Nuclear power is considered as the most important power source due to its huge amount of power production with less cost. **They** generate electricity and heat by long life reactivating nuclear materials, such as: uranium. It can be found naturally in the ground but there are some manufacturing operations to elicit the pure uranium element. Namely, there are more than 437 operational nuclear power plants are distributed over 31 countries. Basically, they provide more than 19% of the world's daily need of energy.

Governments and nuclear power corporations establish and construct nuclear power reactors for many purposes, including: electricity, medical, warfare, laboratory, and industry. There are many international agreements that organize the work between governments, nuclear corporations, and social organizations. They **maintain** the nuclear security and safety standards of operating nuclear reactors by developing secure nuclear systems. Besides that, they exchange professional training, experience, and technical support for the technicians and specialists in the nuclear field. Nuclear radiation may cause serious hazards and health problems, such as: a wide range of cancers, natural sources pollutions, food

poisoning, death of organisms, etc. Hence, it is extremely important to commit to the nuclear safety standards and radiation monitoring systems. Nuclear power industry is a growing field and it may become the dominant power producer in the future.

Q 1: What are the things that the word "They" in line four refers to?

(A) Nuclear materials.

(B) Nuclear power plants.

(C) Power sources.

(D) Manufacturing operations.

Q 2: What is the main topic that this passage is focusing on?

(A) Energy sources.

(B) Power generating.

(C) Nuclear power.

(D) Uranium reactivating.

Q 3: What is the meaning of the word "maintain" in line 12?

(A) Develop.

(B) Provide.

(C) Improve.

(D) Preserve.

Q 4: Which one of the following general ideas is NOT relevant to the passage?

Posttest of Overall ELL Reading Comprehension

(A) There are many energy sources in the world.

(B) Reactivating uranium is the main process in nuclear power producing.

(C) Governments and societies collaborate together to maintain the security nuclear systems.

(D) It is significantly important to secure the nuclear power plants.

Q 5: Why is nuclear power considered one of the most important power sources?

(A) It produces more energy, less cost, and includes long life reactivating nuclear materials.

(B) It consumes less cost, clean energy, and renewable sources.

(C) It includes long life reactivating nuclear materials, less radiation, and less water consuming.

(D) It is natural source of energy, less pollution, and more power production.

Q 6: Who are the three main partners responsible for nuclear power plants security?

(A) Social organizations, governments, and experts.

(B) Nuclear power plants, nuclear corporations, and governments.

(C) Citizens, social organizations, and governments.

(D) Nuclear corporations, social organizations, and governments.

Q 7: What is the component that the nuclear partners do NOT exchange between them?

(A) Professional training.

(B) Experiences.

(C) Technical support.

(D) Reactivated uranium.

Posttest of Overall ELL Reading Comprehension

Q 8: What is the reason of having more than 437 operational nuclear power plants that produce more than 19% of energy in 31 countries?

(A) Nuclear power is globally distributed.

(B) Countries tend to reduce the numbers of their nuclear power reactors.

(C) A and B are correct answers.

(D) Nuclear power consumes a huge amount of natural uranium.

Q 9: Which one of the following is NOT a consequence of nuclear security failing?

(A) Nuclear radiation.

(B) Less cooperation and coordination between nuclear partners.

(C) Producing less or no nuclear power.

(D) Switching to a more safety, secure, and clean energy source.

Q 10: What are the obstacles of fully depending on the nuclear power reactors to produce 100% of daily energy in the world?

(A) High likelihood of radiation leak and its serious damages.

(B) High cost of nuclear reactors' building and the high professional experience to run them.

(C) Agreements commitment between nuclear and nonnuclear countries.

(D) High global price of uranium and particularly after the purifying and reactivating processes

Appendix E
Key Answers of Overall ELL Reading Comprehension Posttest Questions

Question No	Correct Answer
Q1	B
Q2	C
Q3	A
Q4	C
Q5	A
Q6	D
Q7	D
Q8	C
Q9	B
Q10	B

Appendix F
Pretest One-Way ANOVA Group Descriptives of Individual Concept Mapping Group vs. Control Group

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PretestItem1	Individual	36	0.56	0.50	0.08	0.39	0.73	0.00	1.00
	Control	38	0.55	0.50	0.08	0.39	0.72	0.00	1.00
	Total	74	0.55	0.50	0.06	0.44	0.67	0.00	1.00
PretestItem2	Individual	36	0.53	0.51	0.08	0.36	0.70	0.00	1.00
	Control	38	0.50	0.51	0.08	0.33	0.67	0.00	1.00
	Total	74	0.51	0.50	0.06	0.40	0.63	0.00	1.00
PretestItem3	Individual	36	0.44	0.50	0.08	0.27	0.62	0.00	1.00
	Control	38	0.45	0.50	0.08	0.28	0.61	0.00	1.00
	Total	74	0.45	0.50	0.06	0.33	0.56	0.00	1.00
PretestItem4	Individual	36	0.36	0.49	0.08	0.20	0.53	0.00	1.00
	Control	38	0.47	0.51	0.08	0.31	0.64	0.00	1.00
	Total	74	0.42	0.50	0.06	0.30	0.53	0.00	1.00
PretestItem5	Individual	36	0.42	0.50	0.08	0.25	0.59	0.00	1.00
	Control	38	0.42	0.50	0.08	0.26	0.59	0.00	1.00
	Total	74	0.42	0.50	0.06	0.30	0.53	0.00	1.00
PretestItem6	Individual	36	0.42	0.50	0.08	0.25	0.59	0.00	1.00
	Control	38	0.45	0.50	0.08	0.28	0.61	0.00	1.00
	Total	74	0.43	0.50	0.06	0.32	0.55	0.00	1.00
PretestItem7	Individual	36	0.36	0.49	0.08	0.20	0.53	0.00	1.00
	Control	38	0.34	0.48	0.08	0.18	0.50	0.00	1.00
	Total	74	0.35	0.48	0.06	0.24	0.46	0.00	1.00
PretestItem8	Individual	36	0.36	0.49	0.08	0.20	0.53	0.00	1.00
	Control	38	0.32	0.47	0.08	0.16	0.47	0.00	1.00
	Total	74	0.34	0.48	0.06	0.23	0.45	0.00	1.00
PretestItem9	Individual	36	0.39	0.49	0.08	0.22	0.56	0.00	1.00
	Control	38	0.29	0.46	0.07	0.14	0.44	0.00	1.00
	Total	74	0.34	0.48	0.06	0.23	0.45	0.00	1.00
PretestItem10	Individual	36	0.31	0.47	0.08	0.15	0.46	0.00	1.00
	Control	38	0.26	0.45	0.07	0.12	0.41	0.00	1.00
	Total	74	0.28	0.45	0.05	0.18	0.39	0.00	1.00
PretestTotal	Individual	36	4.14	1.82	0.30	3.52	4.76	1.00	8.00
	Control	38	4.05	1.51	0.24	3.56	4.55	1.00	7.00
	Total	74	4.09	1.66	0.19	3.71	4.48	1.00	8.00

Appendix G
Pretest One-Way ANOVA of Individual Concept Mapping Group vs. Control Group

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
PretestItem1	Between Groups	0.00	1.00	0.00	0.00	0.98
	Within Groups	18.28	72.00	0.25		
	Total	18.28	73.00			
PretestItem2	Between Groups	0.01	1.00	0.01	0.06	0.81
	Within Groups	18.47	72.00	0.26		
	Total	18.49	73.00			
PretestItem3	Between Groups	0.00	1.00	0.00	0.00	0.98
	Within Groups	18.28	72.00	0.25		
	Total	18.28	73.00			
PretestItem4	Between Groups	0.23	1.00	0.23	0.95	0.33
	Within Groups	17.78	72.00	0.25		
	Total	18.01	73.00			
PretestItem5	Between Groups	0.00	1.00	0.00	0.00	0.97
	Within Groups	18.01	72.00	0.25		
	Total	18.01	73.00			
PretestItem6	Between Groups	0.02	1.00	0.02	0.07	0.79
	Within Groups	18.15	72.00	0.25		
	Total	18.16	73.00			
PretestItem7	Between Groups	0.01	1.00	0.01	0.03	0.87
	Within Groups	16.86	72.00	0.23		
	Total	16.87	73.00			
PretestItem8	Between Groups	0.04	1.00	0.04	0.17	0.69
	Within Groups	16.52	72.00	0.23		
	Total	16.55	73.00			
PretestItem9	Between Groups	0.18	1.00	0.18	0.80	0.37
	Within Groups	16.37	72.00	0.23		
	Total	16.55	73.00			
PretestItem10	Between Groups	0.03	1.00	0.03	0.16	0.69
	Within Groups	15.01	72.00	0.21		
	Total	15.04	73.00			
PretestTotal	Between Groups	0.14	1.00	0.14	0.05	0.83
	Within Groups	200.20	72.00	2.78		
	Total	200.34	73.00			

Appendix H
Reviewing Rubrics' Independent Samples T-Test of Individual Concept Mapping Group vs. Control Group

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ReviewingWeek1	Equal variances assumed	2.57	0.11	0.95	72	0.34	0.38	0.40	-0.42	1.19
	Equal variances not assumed			0.95	69	0.35	0.38	0.41	-0.42	1.19
ReviewingWeek2	Equal variances assumed	0.21	0.65	1.63	72	0.11	0.57	0.35	-0.13	1.27
	Equal variances not assumed			1.63	71	0.11	0.57	0.35	-0.13	1.27
ReviewingWeek3	Equal variances assumed	0.39	0.53	2.31	72	0.02	0.78	0.34	0.11	1.46
	Equal variances not assumed			2.31	72	0.02	0.78	0.34	0.11	1.46
ReviewingWeek4	Equal variances assumed	3.53	0.06	2.12	72	0.04	0.73	0.35	0.04	1.43
	Equal variances not assumed			2.13	70	0.04	0.73	0.35	0.05	1.42
ReviewingWeek5	Equal variances assumed	6.44	0.01	4.21	72	0.00	1.38	0.33	0.73	2.04
	Equal variances not assumed			4.25	65	0.00	1.38	0.33	0.73	2.03
ReviewingWeek6	Equal variances assumed	2.61	0.11	3.79	72	0.00	1.35	0.36	0.64	2.06
	Equal variances not assumed			3.82	69	0.00	1.35	0.35	0.64	2.05
ReviewingWeek7	Equal variances assumed	0.02	0.89	4.65	72	0.00	1.47	0.32	0.84	2.10
	Equal variances not assumed			4.67	71	0.00	1.47	0.31	0.84	2.10
ReviewingWeek8	Equal variances assumed	5.29	0.02	4.74	72	0.00	1.40	0.30	0.81	1.99

	Equal variances not assumed			4.79	62	0.00	1.40	0.29	0.81	1.98
ReviewingWeek9	Equal variances assumed	5.15	0.03	4.41	72	0.00	1.36	0.31	0.75	1.97
	Equal variances not assumed			4.45	66	0.00	1.36	0.31	0.75	1.97
ReviewingWeek10	Equal variances assumed	0.33	0.57	3.59	72	0.00	1.28	0.36	0.57	1.99
	Equal variances not assumed			3.60	72	0.00	1.28	0.36	0.57	1.99
TotalReviewingAll Weeks	Equal variances assumed	0.17	0.68	3.66	72	0.00	1.07	0.29	0.49	1.65
	Equal variances not assumed			3.67	71	0.00	1.07	0.29	0.49	1.65

Appendix I
Listing Rubrics' Independent Samples T-Test of Individual Concept Mapping Group vs. Control Group

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ListingWeek1	Equal variances assumed	0.92	0.34	0.50	72	0.62	0.27	0.54	-0.81	1.35
	Equal variances not assumed			0.50	71	0.62	0.27	0.54	-0.81	1.35
ListingWeek2	Equal variances assumed	0.14	0.71	1.30	72	0.20	0.73	0.56	-0.39	1.84
	Equal variances not assumed			1.30	71	0.20	0.73	0.56	-0.39	1.84
ListingWeek3	Equal variances assumed	0.69	0.41	1.46	72	0.15	0.82	0.56	-0.30	1.94
	Equal variances not assumed			1.47	72	0.15	0.82	0.56	-0.30	1.94
ListingWeek4	Equal variances assumed	0.67	0.42	2.23	72	0.03	1.29	0.58	0.14	2.45
	Equal variances not assumed			2.23	72	0.03	1.29	0.58	0.14	2.45
ListingWeek5	Equal variances assumed	0.17	0.68	2.87	72	0.01	1.66	0.58	0.51	2.82
	Equal variances not assumed			2.87	72	0.01	1.66	0.58	0.51	2.82
ListingWeek6	Equal variances assumed	0.09	0.77	3.93	72	0.00	2.08	0.53	1.03	3.13
	Equal variances not assumed			3.94	72	0.00	2.08	0.53	1.03	3.13
ListingWeek7	Equal variances assumed	0.05	0.83	4.37	72	0.00	2.33	0.53	1.26	3.39
	Equal variances not assumed			4.38	72	0.00	2.33	0.53	1.27	3.39
ListingWeek8	Equal variances assumed	0.00	0.95	3.98	72	0.00	2.27	0.57	1.13	3.40

	Equal variances not assumed			3.98	72	0.00	2.27	0.57	1.13	3.40
ListingWeek9	Equal variances assumed	0.35	0.56	3.79	72	0.00	2.19	0.58	1.04	3.34
	Equal variances not assumed			3.79	72	0.00	2.19	0.58	1.04	3.34
ListingWeek10	Equal variances assumed	0.00	0.95	3.67	72	0.00	2.18	0.59	0.99	3.36
	Equal variances not assumed			3.68	72	0.00	2.18	0.59	1.00	3.36
TotalListingAll Weeks	Equal variances assumed	0.00	1.00	2.99	72	0.00	1.58	0.53	0.53	2.64
	Equal variances not assumed			2.99	72	0.00	1.58	0.53	0.53	2.64

Appendix J
Enforcing Rubrics' Independent Samples T-Test of Individual Concept Mapping Group vs. Control Group

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
EnforcingWeek1	Equal variances assumed	0.37	0.55	0.85	72	0.40	0.48	0.56	-0.64	1.60
	Equal variances not assumed			0.85	71	0.40	0.48	0.56	-0.64	1.60
EnforcingWeek2	Equal variances assumed	3.40	0.07	1.01	72	0.32	0.64	0.64	-0.63	1.91
	Equal variances not assumed			1.00	69	0.32	0.64	0.64	-0.63	1.92
EnforcingWeek3	Equal variances assumed	9.44	0.00	1.60	72	0.11	1.02	0.64	-0.25	2.30
	Equal variances not assumed			1.59	65	0.12	1.02	0.64	-0.26	2.31
EnforcingWeek4	Equal variances assumed	8.70	0.00	2.25	72	0.03	1.41	0.63	0.16	2.66
	Equal variances not assumed			2.23	64	0.03	1.41	0.63	0.15	2.67
EnforcingWeek5	Equal variances assumed	6.80	0.01	1.84	72	0.07	1.19	0.65	-0.10	2.48
	Equal variances not assumed			1.83	64	0.07	1.19	0.65	-0.11	2.50
EnforcingWeek6	Equal variances assumed	4.78	0.03	2.00	72	0.05	1.29	0.64	0.00	2.57
	Equal variances not assumed			1.99	66	0.05	1.29	0.65	-0.01	2.58
EnforcingWeek7	Equal variances assumed	4.57	0.04	2.13	72	0.04	1.34	0.63	0.09	2.60
	Equal variances not assumed			2.12	67	0.04	1.34	0.63	0.08	2.61
EnforcingWeek8	Equal variances assumed	8.41	0.01	2.54	72	0.01	1.77	0.70	0.38	3.16

	Equal variances not assumed			2.52	64	0.01	1.77	0.70	0.36	3.17
EnforcingWeek9	Equal variances assumed	5.51	0.02	2.97	72	0.00	2.37	0.80	0.78	3.96
	Equal variances not assumed			2.95	66	0.00	2.37	0.80	0.76	3.98
EnforcingWeek10	Equal variances assumed	3.10	0.08	3.40	72	0.00	2.95	0.87	1.22	4.68
	Equal variances not assumed			3.38	67	0.00	2.95	0.87	1.21	4.70
TotalEnforcingAll Weeks	Equal variances assumed	15.07	0.00	3.90	72	0.00	2.69	0.69	1.32	4.07
	Equal variances not assumed			3.86	61	0.00	2.69	0.70	1.30	4.09

Appendix K
Overall Reading Comprehension Posttest One-Way ANOVA Group Descriptives of Individual Concept Mapping Group vs. Control Group

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PosttestItem1	Individual	32	0.88	0.34	0.06	0.75	1.00	0.00	1.00
	Control	36	0.81	0.40	0.07	0.67	0.94	0.00	1.00
	Total	68	0.84	0.37	0.04	0.75	0.93	0.00	1.00
PosttestItem2	Individual	32	0.78	0.42	0.07	0.63	0.93	0.00	1.00
	Control	36	0.72	0.45	0.08	0.57	0.88	0.00	1.00
	Total	68	0.75	0.44	0.05	0.64	0.86	0.00	1.00
PosttestItem3	Individual	32	0.84	0.37	0.07	0.71	0.98	0.00	1.00
	Control	36	0.61	0.49	0.08	0.44	0.78	0.00	1.00
	Total	68	0.72	0.45	0.05	0.61	0.83	0.00	1.00
PosttestItem4	Individual	32	0.81	0.40	0.07	0.67	0.96	0.00	1.00
	Control	36	0.61	0.49	0.08	0.44	0.78	0.00	1.00
	Total	68	0.71	0.46	0.06	0.59	0.82	0.00	1.00
PosttestItem5	Individual	32	0.72	0.46	0.08	0.55	0.88	0.00	1.00
	Control	36	0.58	0.50	0.08	0.41	0.75	0.00	1.00
	Total	68	0.65	0.48	0.06	0.53	0.76	0.00	1.00
PosttestItem6	Individual	32	0.66	0.48	0.09	0.48	0.83	0.00	1.00
	Control	36	0.56	0.50	0.08	0.39	0.73	0.00	1.00
	Total	68	0.60	0.49	0.06	0.48	0.72	0.00	1.00
PosttestItem7	Individual	32	0.69	0.47	0.08	0.52	0.86	0.00	1.00
	Control	36	0.50	0.51	0.08	0.33	0.67	0.00	1.00
	Total	68	0.59	0.50	0.06	0.47	0.71	0.00	1.00
PosttestItem8	Individual	32	0.59	0.50	0.09	0.41	0.77	0.00	1.00
	Control	36	0.44	0.50	0.08	0.27	0.62	0.00	1.00
	Total	68	0.51	0.50	0.06	0.39	0.64	0.00	1.00
PosttestItem9	Individual	32	0.59	0.50	0.09	0.41	0.77	0.00	1.00
	Control	36	0.33	0.48	0.08	0.17	0.50	0.00	1.00
	Total	68	0.46	0.50	0.06	0.33	0.58	0.00	1.00
PosttestItem10	Individual	32	0.53	0.51	0.09	0.35	0.71	0.00	1.00
	Control	36	0.31	0.47	0.08	0.15	0.46	0.00	1.00
	Total	68	0.41	0.50	0.06	0.29	0.53	0.00	1.00
TotalPosttest	Individual	32	7.09	1.61	0.29	6.51	7.68	4.00	10.00
	Control	36	5.47	1.63	0.27	4.92	6.02	2.00	9.00
	Total	68	6.24	1.80	0.22	5.80	6.67	2.00	10.00

Appendix L
Overall Reading Comprehension Posttest One-Way ANOVA of Individual Concept Mapping Group vs. Control Group

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
PosttestItem1	Between Groups	0.08	1.00	0.08	0.59	0.45
	Within Groups	9.14	66.00	0.14		
	Total	9.22	67.00			
PosttestItem2	Between Groups	0.06	1.00	0.06	0.31	0.58
	Within Groups	12.69	66.00	0.19		
	Total	12.75	67.00			
PosttestItem3	Between Groups	0.92	1.00	0.92	4.74	0.03
	Within Groups	12.77	66.00	0.19		
	Total	13.69	67.00			
PosttestItem4	Between Groups	0.69	1.00	0.69	3.38	0.07
	Within Groups	13.43	66.00	0.20		
	Total	14.12	67.00			
PosttestItem5	Between Groups	0.31	1.00	0.31	1.35	0.25
	Within Groups	15.22	66.00	0.23		
	Total	15.53	67.00			
PosttestItem6	Between Groups	0.17	1.00	0.17	0.70	0.41
	Within Groups	16.11	66.00	0.24		
	Total	16.28	67.00			
PosttestItem7	Between Groups	0.60	1.00	0.60	2.48	0.12
	Within Groups	15.88	66.00	0.24		
	Total	16.47	67.00			
PosttestItem8	Between Groups	0.38	1.00	0.38	1.50	0.23
	Within Groups	16.61	66.00	0.25		
	Total	16.99	67.00			
PosttestItem9	Between Groups	1.15	1.00	1.15	4.82	0.03
	Within Groups	15.72	66.00	0.24		
	Total	16.87	67.00			
PosttestItem10	Between Groups	0.86	1.00	0.86	3.65	0.06
	Within Groups	15.61	66.00	0.24		
	Total	16.47	67.00			
TotalPosttest	Between Groups	44.54	1.00	44.54	16.93	0.00
	Within Groups	173.69	66.00	2.63		
	Total	218.24	67.00			

Appendix M
Pretest One-Way ANOVA Group Descriptives of Collaborative vs. Individual Concept Mapping Group

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PretestItem1	Collaborative	32	0.56	0.50	0.09	0.38	0.74	0.00	1.00
	Individual	36	0.56	0.50	0.08	0.39	0.73	0.00	1.00
	Total	68	0.56	0.50	0.06	0.44	0.68	0.00	1.00
PrettestItem2	Collaborative	32	0.44	0.50	0.09	0.26	0.62	0.00	1.00
	Individual	36	0.53	0.51	0.08	0.36	0.70	0.00	1.00
	Total	68	0.49	0.50	0.06	0.36	0.61	0.00	1.00
PretestItem3	Collaborative	32	0.47	0.51	0.09	0.29	0.65	0.00	1.00
	Individual	36	0.44	0.50	0.08	0.27	0.62	0.00	1.00
	Total	68	0.46	0.50	0.06	0.33	0.58	0.00	1.00
PretestItem4	Collaborative	32	0.41	0.50	0.09	0.23	0.59	0.00	1.00
	Individual	36	0.36	0.49	0.08	0.20	0.53	0.00	1.00
	Total	68	0.38	0.49	0.06	0.26	0.50	0.00	1.00
PretestItem5	Collaborative	32	0.34	0.48	0.09	0.17	0.52	0.00	1.00
	Individual	36	0.42	0.50	0.08	0.25	0.59	0.00	1.00
	Total	68	0.38	0.49	0.06	0.26	0.50	0.00	1.00
PretestItem6	Collaborative	32	0.38	0.49	0.09	0.20	0.55	0.00	1.00
	Individual	36	0.42	0.50	0.08	0.25	0.59	0.00	1.00
	Total	68	0.40	0.49	0.06	0.28	0.52	0.00	1.00
PretestItem7	Collaborative	32	0.44	0.50	0.09	0.26	0.62	0.00	1.00
	Individual	36	0.36	0.49	0.08	0.20	0.53	0.00	1.00
	Total	68	0.40	0.49	0.06	0.28	0.52	0.00	1.00
PretestItem8	Collaborative	32	0.41	0.50	0.09	0.23	0.59	0.00	1.00
	Individual	36	0.36	0.49	0.08	0.20	0.53	0.00	1.00
	Total	68	0.38	0.49	0.06	0.26	0.50	0.00	1.00
PretestItem9	Collaborative	32	0.31	0.47	0.08	0.14	0.48	0.00	1.00
	Individual	36	0.39	0.49	0.08	0.22	0.56	0.00	1.00
	Total	68	0.35	0.48	0.06	0.24	0.47	0.00	1.00
PretestItem10	Collaborative	32	0.28	0.46	0.08	0.12	0.45	0.00	1.00
	Individual	36	0.31	0.47	0.08	0.15	0.46	0.00	1.00
	Total	68	0.29	0.46	0.06	0.18	0.41	0.00	1.00
TotalPretest	Collaborative	32	4.03	1.89	0.33	3.35	4.71	1.00	7.00
	Individual	36	4.14	1.82	0.30	3.52	4.76	1.00	8.00
	Total	68	4.09	1.84	0.22	3.64	4.53	1.00	8.00

Appendix N
Pretest One-Way ANOVA of Collaborative vs. Individual Concept Mapping Group

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
PretestItem1	Between Groups	0.00	1.00	0.00	0.00	0.96
	Within Groups	16.76	66.00	0.25		
	Total	16.77	67.00			
PrettestItem2	Between Groups	0.14	1.00	0.14	0.54	0.47
	Within Groups	16.85	66.00	0.26		
	Total	16.99	67.00			
PretestItem3	Between Groups	0.01	1.00	0.01	0.04	0.84
	Within Groups	16.86	66.00	0.26		
	Total	16.87	67.00			
PretestItem4	Between Groups	0.04	1.00	0.04	0.14	0.71
	Within Groups	16.02	66.00	0.24		
	Total	16.06	67.00			
PretestItem5	Between Groups	0.09	1.00	0.09	0.37	0.54
	Within Groups	15.97	66.00	0.24		
	Total	16.06	67.00			
PretestItem6	Between Groups	0.03	1.00	0.03	0.12	0.73
	Within Groups	16.25	66.00	0.25		
	Total	16.28	67.00			
PretestItem7	Between Groups	0.10	1.00	0.10	0.40	0.53
	Within Groups	16.18	66.00	0.25		
	Total	16.28	67.00			
PretestItem8	Between Groups	0.04	1.00	0.04	0.14	0.71
	Within Groups	16.02	66.00	0.24		
	Total	16.06	67.00			
PretestItem9	Between Groups	0.10	1.00	0.10	0.42	0.52
	Within Groups	15.43	66.00	0.23		
	Total	15.53	67.00			
PretestItem10	Between Groups	0.01	1.00	0.01	0.05	0.83
	Within Groups	14.11	66.00	0.21		
	Total	14.12	67.00			
TotalPretest	Between Groups	0.20	1.00	0.20	0.06	0.81
	Within Groups	227.27	66.00	3.44		
	Total	227.47	67.00			

Appendix O
Reviewing Rubrics' Independent Samples T-Test of Collaborative vs. Individual Concept Mapping Group

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ReviewingWeek1	Equal variances assumed	4.00	0.05	0.54	66	0.59	0.23	0.42	-0.61	1.06
	Equal variances not assumed			0.55	65	0.59	0.23	0.41	-0.60	1.05
ReviewingWeek2	Equal variances assumed	2.01	0.16	0.11	66	0.91	0.04	0.34	-0.64	0.72
	Equal variances not assumed			0.11	65	0.91	0.04	0.34	-0.63	0.71
ReviewingWeek3	Equal variances assumed	3.36	0.07	-0.05	66	0.96	-0.01	0.31	-0.62	0.60
	Equal variances not assumed			-0.05	65	0.96	-0.01	0.30	-0.61	0.59
ReviewingWeek4	Equal variances assumed	7.89	0.01	0.66	66	0.51	0.18	0.27	-0.36	0.73
	Equal variances not assumed			0.68	60	0.50	0.18	0.27	-0.35	0.71
ReviewingWeek5	Equal variances assumed	0.83	0.37	0.49	66	0.63	0.13	0.25	-0.38	0.63
	Equal variances not assumed			0.50	66	0.62	0.13	0.25	-0.38	0.63
ReviewingWeek6	Equal variances assumed	1.78	0.19	1.76	66	0.08	0.49	0.28	-0.07	1.04
	Equal variances not assumed			1.79	62	0.08	0.49	0.27	-0.06	1.03
ReviewingWeek7	Equal variances assumed	3.08	0.08	2.19	66	0.03	0.61	0.28	0.06	1.17
	Equal variances not assumed			2.22	66	0.03	0.61	0.28	0.06	1.17
ReviewingWeek8	Equal variances assumed	0.05	0.83	2.02	66	0.05	0.51	0.25	0.00	1.01

	Equal variances not assumed			1.99	60	0.05	0.51	0.25	0.00	1.02
ReviewingWeek9	Equal variances assumed	0.36	0.55	0.77	66	0.44	0.20	0.26	-0.32	0.71
	Equal variances not assumed			0.77	65	0.45	0.20	0.26	-0.32	0.71
ReviewingWeek10	Equal variances assumed	13.47	0.00	3.69	66	0.00	1.13	0.31	0.52	1.75
	Equal variances not assumed			3.80	57	0.00	1.13	0.30	0.54	1.73
TotalReviewingAll Weeks	Equal variances assumed	8.93	0.00	1.43	66	0.16	0.35	0.24	-0.14	0.84
	Equal variances not assumed			1.46	63	0.15	0.35	0.24	-0.13	0.83

Appendix P
Listing Rubrics' Independent Samples T-Test of Collaborative vs. Individual Concept Mapping Group

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ListingWeek1	Equal variances assumed	4.11	0.05	-1.66	66	0.10	-0.89	0.53	-1.95	0.18
	Equal variances not assumed			-1.68	66	0.10	-0.89	0.53	-1.94	0.17
ListingWeek2	Equal variances assumed	2.65	0.11	-0.56	66	0.58	-0.31	0.55	-1.40	0.79
	Equal variances not assumed			-0.57	65	0.57	-0.31	0.54	-1.38	0.77
ListingWeek3	Equal variances assumed	4.26	0.04	0.10	66	0.92	0.05	0.50	-0.95	1.05
	Equal variances not assumed			0.10	64	0.92	0.05	0.49	-0.94	1.03
ListingWeek4	Equal variances assumed	3.43	0.07	0.56	66	0.58	0.29	0.53	-0.76	1.34
	Equal variances not assumed			0.56	65	0.58	0.29	0.52	-0.74	1.32
ListingWeek5	Equal variances assumed	5.93	0.02	0.96	66	0.34	0.51	0.53	-0.55	1.57
	Equal variances not assumed			0.98	64	0.33	0.51	0.52	-0.53	1.55
ListingWeek6	Equal variances assumed	9.48	0.00	1.21	66	0.23	0.57	0.47	-0.37	1.50
	Equal variances not assumed			1.24	63	0.22	0.57	0.46	-0.35	1.48
ListingWeek7	Equal variances assumed	9.53	0.00	1.36	66	0.18	0.62	0.46	-0.29	1.53
	Equal variances not assumed			1.39	61	0.17	0.62	0.45	-0.27	1.51
ListingWeek8	Equal variances assumed	7.30	0.01	2.60	66	0.01	1.32	0.51	0.31	2.34

	Equal variances not assumed			2.66	62	0.01	1.32	0.50	0.33	2.32
ListingWeek9	Equal variances assumed	7.62	0.01	2.85	66	0.01	1.51	0.53	0.45	2.56
	Equal variances not assumed			2.91	63	0.01	1.51	0.52	0.47	2.54
ListingWeek10	Equal variances assumed	4.04	0.05	2.34	66	0.02	1.23	0.53	0.18	2.28
	Equal variances not assumed			2.37	65	0.02	1.23	0.52	0.19	2.26
TotalListingAll Weeks	Equal variances assumed	10.33	0.00	1.04	66	0.30	0.49	0.47	-0.45	1.43
	Equal variances not assumed			1.06	63	0.29	0.49	0.46	-0.43	1.41

Appendix Q
Enforcing Rubrics' Independent Samples T-Test of Collaborative vs. Individual Concept Mapping Group

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
EnforcingWeek1	Equal variances assumed	0.44	0.51	0.45	66	0.65	0.29	0.64	-0.99	1.57
	Equal variances not assumed			0.45	62	0.66	0.29	0.65	-1.00	1.58
EnforcingWeek2	Equal variances assumed	2.65	0.11	-0.01	66	0.99	-0.01	0.67	-1.35	1.33
	Equal variances not assumed			-0.01	66	0.99	-0.01	0.66	-1.33	1.32
EnforcingWeek3	Equal variances assumed	4.12	0.05	-0.28	66	0.78	-0.19	0.70	-1.60	1.21
	Equal variances not assumed			-0.28	66	0.78	-0.19	0.70	-1.58	1.19
EnforcingWeek4	Equal variances assumed	2.77	0.10	-0.85	66	0.40	-0.59	0.70	-1.99	0.80
	Equal variances not assumed			-0.86	66	0.40	-0.59	0.69	-1.98	0.79
EnforcingWeek5	Equal variances assumed	3.45	0.07	-0.19	66	0.85	-0.14	0.70	-1.54	1.26
	Equal variances not assumed			-0.20	65	0.85	-0.14	0.69	-1.52	1.25
EnforcingWeek6	Equal variances assumed	3.67	0.06	-0.28	66	0.78	-0.19	0.69	-1.56	1.18
	Equal variances not assumed			-0.28	65	0.78	-0.19	0.68	-1.55	1.16
EnforcingWeek7	Equal variances assumed	1.06	0.31	1.08	66	0.28	0.75	0.70	-0.64	2.14
	Equal variances not assumed			1.09	66	0.28	0.75	0.69	-0.63	2.13
EnforcingWeek8	Equal variances assumed	1.27	0.26	1.20	66	0.23	0.95	0.79	-0.63	2.53

	Equal variances not assumed			1.21	66	0.23	0.95	0.79	-0.62	2.52
EnforcingWeek9	Equal variances assumed	0.72	0.40	1.44	66	0.15	1.29	0.89	-0.50	3.07
	Equal variances not assumed			1.45	66	0.15	1.29	0.89	-0.49	3.06
EnforcingWeek10	Equal variances assumed	0.81	0.37	0.74	66	0.46	0.80	1.08	-1.35	2.94
	Equal variances not assumed			0.73	62	0.47	0.80	1.08	-1.37	2.96
TotalEnforcingAll Weeks	Equal variances assumed	1.74	0.19	0.41	66	0.68	0.30	0.72	-1.13	1.72
	Equal variances not assumed			0.42	66	0.68	0.30	0.71	-1.12	1.71

Appendix R
Overall Reading Comprehension Posttest One-Way ANOVA Group Descriptives of Collaborative vs. Individual Concept Mapping Group

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Posttesttem1	Collaborative	32	0.88	0.34	0.06	0.75	1.00	0.00	1.00
	Individual	36	0.83	0.38	0.06	0.71	0.96	0.00	1.00
	Total	68	0.85	0.36	0.04	0.77	0.94	0.00	1.00
PosttestItem2	Collaborative	32	0.88	0.34	0.06	0.75	1.00	0.00	1.00
	Individual	36	0.81	0.40	0.07	0.67	0.94	0.00	1.00
	Total	68	0.84	0.37	0.04	0.75	0.93	0.00	1.00
PosttestItem3	Collaborative	32	0.84	0.37	0.07	0.71	0.98	0.00	1.00
	Individual	36	0.81	0.40	0.07	0.67	0.94	0.00	1.00
	Total	68	0.82	0.38	0.05	0.73	0.92	0.00	1.00
PosttestItem4	Collaborative	32	0.81	0.40	0.07	0.67	0.96	0.00	1.00
	Individual	36	0.78	0.42	0.07	0.64	0.92	0.00	1.00
	Total	68	0.79	0.41	0.05	0.70	0.89	0.00	1.00
PosttestItem5	Collaborative	32	0.78	0.42	0.07	0.63	0.93	0.00	1.00
	Individual	36	0.72	0.45	0.08	0.57	0.88	0.00	1.00
	Total	68	0.75	0.44	0.05	0.64	0.86	0.00	1.00
PosttestItem6	Collaborative	32	0.75	0.44	0.08	0.59	0.91	0.00	1.00
	Individual	36	0.69	0.47	0.08	0.54	0.85	0.00	1.00
	Total	68	0.72	0.45	0.05	0.61	0.83	0.00	1.00
PosttestItem7	Collaborative	32	0.75	0.44	0.08	0.59	0.91	0.00	1.00
	Individual	36	0.67	0.48	0.08	0.50	0.83	0.00	1.00
	Total	68	0.71	0.46	0.06	0.59	0.82	0.00	1.00
PosttestItem8	Collaborative	32	0.72	0.46	0.08	0.55	0.88	0.00	1.00
	Individual	36	0.64	0.49	0.08	0.47	0.80	0.00	1.00
	Total	68	0.68	0.47	0.06	0.56	0.79	0.00	1.00
PosttestItem9	Collaborative	32	0.66	0.48	0.09	0.48	0.83	0.00	1.00
	Individual	36	0.56	0.50	0.08	0.39	0.73	0.00	1.00
	Total	68	0.60	0.49	0.06	0.48	0.72	0.00	1.00
PosttestItem10	Collaborative	32	0.63	0.49	0.09	0.45	0.80	0.00	1.00
	Individual	36	0.53	0.51	0.08	0.36	0.70	0.00	1.00
	Total	68	0.57	0.50	0.06	0.45	0.69	0.00	1.00
TotalPosttest	Collaborative	32	7.69	1.57	0.28	7.12	8.26	5.00	10.00
	Individual	36	7.03	1.61	0.27	6.48	7.57	4.00	10.00
	Total	68	7.34	1.62	0.20	6.95	7.73	4.00	10.00

Appendix S
Overall Reading Comprehension Posttest One-Way ANOVA of Collaborative vs. Individual Concept Mapping Group

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
PosttestItem1	Between Groups	0.03	1.00	0.03	0.23	0.63
	Within Groups	8.50	66.00	0.13		
	Total	8.53	67.00			
PosttestItem2	Between Groups	0.08	1.00	0.08	0.59	0.45
	Within Groups	9.14	66.00	0.14		
	Total	9.22	67.00			
PosttestItem3	Between Groups	0.03	1.00	0.03	0.17	0.69
	Within Groups	9.86	66.00	0.15		
	Total	9.88	67.00			
PosttestItem4	Between Groups	0.02	1.00	0.02	0.12	0.73
	Within Groups	11.10	66.00	0.17		
	Total	11.12	67.00			
PosttestItem5	Between Groups	0.06	1.00	0.06	0.31	0.58
	Within Groups	12.69	66.00	0.19		
	Total	12.75	67.00			
PosttestItem6	Between Groups	0.05	1.00	0.05	0.25	0.62
	Within Groups	13.64	66.00	0.21		
	Total	13.69	67.00			
PosttestItem7	Between Groups	0.12	1.00	0.12	0.56	0.46
	Within Groups	14.00	66.00	0.21		
	Total	14.12	67.00			
PosttestItem8	Between Groups	0.11	1.00	0.11	0.48	0.49
	Within Groups	14.77	66.00	0.22		
	Total	14.88	67.00			
PosttestItem9	Between Groups	0.17	1.00	0.17	0.70	0.41
	Within Groups	16.11	66.00	0.24		
	Total	16.28	67.00			
PosttestItem10	Between Groups	0.16	1.00	0.16	0.64	0.43
	Within Groups	16.47	66.00	0.25		
	Total	16.63	67.00			
TotalPosttest	Between Groups	7.37	1.00	7.37	2.90	0.09
	Within Groups	167.85	66.00	2.54		
	Total	175.22	67.00			

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