The Effect of Using Computer-Assisted Semantic Mapping on Nursing Students' Reading Comprehension of Medical Texts and Vocabulary Increase at King Saud University

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Abstract

Nursing students at KSU are considered to be low achieving readers. They face difficulties with understanding and recalling medical texts due to the fact that they lack some necessary medical vocabulary knowledge. Thus, the researcher used computer-assisted semantic mapping (CASM) with level-three (114 NAJM) nursing students to map medical terms and medical passages for the purpose of helping such students in vocabulary acquisition and text recall and comprehension. The present study, therefore, aimed at investigating the efficiency of CASM in improving ESP students' reading comprehension and vocabulary knowledge. It also explored the effectiveness of CASM in enhancing students' ability for information retrieval and documented students' attitudes towards the technique of semantic mapping (SM).

Participating subjects were of two groups: Group A (n = 32) and Group B (n = 26). The control group (n = 26) received traditional in-class instruction that depends on the textbook only and the experimental group (n = 32) received a combination of traditional in-class instruction and SM instruction using a software (FreeMind 0.8.1). A pre- and post-test were utilized to assess student reading and vocabulary skills before and after the intervention. Students' medical knowledge was also examined in the pre- and post-tests. The semantic-mapping treatment lasted 8 weeks.

Results showed that SM expanded student vocabulary and enhanced their recall ability, but it was ineffective in improving student reading comprehension. This lack of progress in reading is attributed to the program's incapability of reinforcing reading comprehension skills such as inferencing and understanding causal relationships in a text. Further, students lack some necessary background knowledge that might aid them in making inferences and in comprehension. Also, SM needs more of teacher modeling and student training. However, students reported positive attitude towards usefulness of the technique.
ملخص الدراسة

واجهة طالبات قسم التمريض في جامعة الملك سعود للعلوم الصحية باللغة الإنجليزية، وتذكر المعلومات الواردة فيها، وتُعَزى ذلك إلى ضعف محصصتهم اللغوية، لذلك استخدمت الباحثة برنامج حاسب لرسم خرائط المعرفة (و تُعرف أيضاً بالخريطة الذهنية أو الجهاز الجماعي) مع طالبات المستوى الثالث للمسائلات في مقرر ١١٤ نجم تمثل الأفكار الرئيسية والفرعية في النصوص المقررة، وتوضح العلاقات الدلالية بين المفردات في النص. من أجل ذلك هدفت هذه الدراسة إلى التحقق من مدى فعالية خرائط المعرفة في تنمية مهاراتهم في فهم المقررات، وفهم معاني المصطلحات الطبية لدى الطالبات. شملت الدراسة ثمانية وخمسين طالبة: مجموعة A (٣٢ طالبة)، ومجموعة B (٢٦ طالبة). درست المجموعة الضابطة (٢٦ طالبة) بطريقة تقليدية اعتماداً على الكتب المقرر فقط، بينما أعطت المجموعة التجريبية (٣٣ طالبة) نفس المقرر بالإضافة إلى استخدامهم لبرنامج (فري مايند إس-إس٨٠٠٢). أعطت الباحثة جميع طالبات اختبارين (قبل و بعدي) يقيسون مهاراتهم في فهم المقررات، وفهم معاني المصطلحات الطبية، وнестиج ملاحظات الطالبات الطبية بعد التجربة. استمرت التجربة لمدة ثمانية أسابيع. تضمنت الدراسة أيضاً تنمية تقييم اتجاهات الطالبات نحو خرائط المعرفة كوسيلة تعليمية. أظهرت نتائج الاختبار الفعلي عدم وجود فروق دالة إحصائياً بين متوسطي مجموع درجات الطالبات في المجموعتين، ولكن في المقابل أظهرت نتائج الاختبار البديهي وجود فروق ذات دالة إحصائية بين المجموعتين لصالح المجموعة التجريبية، حيث أصبحت خرائط المعرفة في تنمية حسية الطالبات من المصطلحات الطبية، وساعدته على تذكر قدر كبير من المعلومات الطبية المدرسة خلال الفصل الدراسي، ولكنها لم تسهم في مساعدة الطالبات على فهم النصوص الطبية، وذالك يرجع إلى أسباب عدة منها: عدم قدرة خرائط المعرفة على تنمية مهارة الاستنتاج عند الطالبات. إضافة إلى عدم تمكن الدراسة من استخدام البرنامج لتمثيل العلاقات البديلة الموجودة في النصوص الطبية، وافتراء الطالبات تقدر مهم من المعلومات الطبية السابقة التي تمكنهم من فهم المعلومات الجديدة، علاوة على ذلك، يحتاج استخدام خرائط المعرفة كوسيلة تعليمية إلى الكثير من التدريب، وقدر كبير من التدريب على كيفية رسمها من قبل الطالب، وبالرغم من ذلك كلما أظهرت نتائج الاستبانة اتجاهات إيجابية للطلاب نحو خرائط المعرفة كوسيلة تعليمية نافعة، وقدمت الدراسة بعض التوصيات بخصوص استخدام برامج خرائط المعرفة في التدريس حتى تكون أكثر فعالية.
Dedication

To the soul of my mother
To my great father
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Chapter 1

Introduction

1.1 Introduction

The process of reading goes beyond simply decoding words on a page. It involves understanding the meaning of individual words and combining their meanings to reach an understanding of a reading text. Thus, knowledge of vocabulary items can aid in reading comprehension. Researchers such as Mezynski (1983), Draper and Moeller (1971), Gauthier (1991), Jackson and Dizney (1963), and Sternberg and Powell (1983) state that there is a strong relationship between students' word knowledge and their reading comprehension. People with large vocabulary understand more of a text. As suggested by Davis (1942, 1944), reading, as a skill, is built on a number of sub-skills. He mentions that two of the components, word knowledge and reasoning in reading, account for 89% of students' achievement. Moreover, Johnson, Toms-Bronowski, and Buss (1983), Thorndike (1973, 1974), Laflamme (1997, p. 372), and Thurstone (1946) found out that word knowledge is the most critical underlying component for reading comprehension.

In an attempt to explain this high correlation between vocabulary knowledge and linguistic competency, Anderson and Freebody (1979) report that there are three hypotheses explaining such a relationship. The first is known as the instrumentalist hypothesis which claims that possession of word knowledge helps in text comprehension. The second hypothesis, the aptitude hypothesis, holds that people who are verbally fluent can better understand a reading text than those who lack verbal fluency. The third position, the knowledge hypothesis, claims that stored prior knowledge including individual word meanings is crucial for comprehending a text. The aforementioned views stress that vocabulary knowledge is one significant factor for reading comprehension. Similarly, Sternberg and Powell (1983) suggest reasons for verbal comprehension which is defined as
the person's ability to understand oral and written language. The suggested hypotheses are known as the bottom-up approach, the top-down approach, and the knowledge-based approach. Bottom-up processing in reading refers to readers' ability to decode letters and words to achieve some lexical information without recourse to higher-level knowledge. The top-down processing, however, is the reader's ability to combine their prior knowledge with the new information represented in the text to reach an overall understanding of the text. The knowledge-based approach, on the other hand, refers to the use of old knowledge in obtaining new one.

Educators also believe that word knowledge will be expanded when students read a lot. In a study by Carver (1994), third, fourth, fifth, and sixth graders were asked to underline words whose meanings were unknown to them. Students underlined less than 1% of the words in the texts that were specified by the researcher to be at an easy reading level. Carver concluded that students who read texts easy for them will not increase their vocabulary. However, Gauthier (1991) stated that reading a wide variety of materials may increase students' vocabulary knowledge. In addition, Pikulski (1989) noted that students' reading during free time may expose them to different labels of the same concept.

Another researcher, Elley (1989), examined what effect reading aloud may have on New Zealand school children. Reading to students was accompanied by explanation of new words for one group and no explanation for the other group. Results showed that students in the former group gained about 40% of the new words introduced to them, whereas the latter group showed an increase of 15% in their vocabulary knowledge. In a replication of Elley's study, Brett, Rothlein, and Hurley (1996) conducted a study with 175 fourth graders in the United States. Students who had new words explained for them showed some significant growth in their vocabulary as opposed to the other group who received no explanation of new words.
As mentioned above, if one wants to understand a text, one needs to understand first the unfamiliar words in it. Thus, many researchers such as Carver (1994), Cudd and Roberts (1993/1994), Heise, Papalewis, and Tanner (1991), Klemp (1994), Norton (1993), Shu, Anderson, and Zhang (1995), Smith (1988), and Stahl and Kapinus (1991) explored the effectiveness of different ways and techniques in teaching vocabulary for the purpose of improving students' ability in reading comprehension. One of the techniques that gained some popularity for its efficiency in improving students' reading comprehension level and their vocabulary is the technique of semantic mapping (SM). As defined by Pearson and Johnson (1978), SM is an organizational strategy that shows graphically and visually the relationships between ideas.

Al-Jarf (2009) highlights that a considerable body of research indicates the effectiveness of SM in science, nursing, psychology, social studies, computer science, research methods, and teacher education. It can be used in every language skill to benefit native speakers of English at all grade levels, EFL (English as a Foreign Language), and ESL (English as a Second Language) language learners. It has been implemented with success in content-area instruction (Antonacci, 1991; Schwab & Coble, 1982/1985; Wineman & Hammond, 1987; Jegede, Alaiyemola, & Okebukola, 1990), as an outlining strategy (Bonds, 1989; Jones, 1988; Schewel, 1989), as an organizational tool for writing (Sinatra, Stahl-Gemake, & Wyche-Morgan, 1986; Washington, 1988; Al-Jarf, 2009), in vocabulary (Pikula, 1987; Jones, 1984; Toms-Bronowski, 1982; Johnson, Pittelman, Toms-Bronowski, & Levin, 1984) and in reading (Bos & Anders, 1990; Berkowitz, 1986; Englert & Mariage, 1991; Margosein, Pascarella, & Pflaum, 1982; Pittelman, Levin, & Johnson, 1985; Reutzel & Fawson, 1991; Sinarta, Berg, & Dunn, 1985; Toms-Bronowski, 1982; El-Koumy, 1999; Siddiqi, 2007). The technique is also known for its efficiency in information retention and activating students' prior knowledge.
Nowadays, computer-related technologies have been successfully introduced as instructional tools in classrooms and their impact cannot be ignored. Thus, the researcher will use a computer program known as FreeMind 0.8.1 to generate semantic maps. Such a program uses lines, arrows, branches, pictures, and colors and thus it makes learning tasks more appealing and motivating. Anderson-Inman and Horney (1997) highlight that computer-assisted SM (CASM) is a rich tool that stimulates the visual thinking that underlies knowledge representation and makes it more accessible and attractive.

Due to the wide use of SM in different areas, the researcher will use CASM to investigate its effectiveness with nursing students who need sufficient knowledge of medical terms to understand medical passages and who need to increase their readings to improve their vocabulary. The researcher will explore the efficiency of SM in increasing students' medical vocabulary and improving their comprehension level in medical reading. Additionally, it will examine to what extent SM is effective in information recall. Students' attitudes and perceptions towards SM will also be documented.

1.2 Statement of the Problem

Nursing students at King Saud University (KSU) are considered to be struggling readers compared with medical students. Pre-medical and nursing students are required to take an ESP (English for Specific Purposes) course known as 134 NAJM for pre-medical students and 114 NAJM for nursing students that aims at improving students' English and medical knowledge at the same time. The objectives of the course are mainly increasing students' medical terms and improving their reading comprehension level. Nursing and pre-medical students need to understand the meanings of medical terms if they are to understand medical texts. Further, they need to read a lot to be exposed to more medical terms. After teaching the course to both groups, the researcher noticed that nursing students are facing difficulties with understanding and recalling medical texts due to the fact that they lack some
necessary medical vocabulary knowledge. Thus, the researcher will use CASM to map medical terms and medical passages for the purpose of helping nursing students in vocabulary acquisition and text recall and comprehension.

1.3 Significance of the Study

The significance of this study stems from the following points:

1. To the best knowledge of the researcher, no study examined the impact of CASM on ESP college students, particularly in Saudi Arabia.
2. Very few researchers investigated the efficiency of CASM in improving students' understanding of medical texts.
3. Few studies attempted to use CASM with students of different levels for text comprehension and recall and vocabulary improvement.
4. This study would hopefully provide useful information about the effect of CASM on ESP college students and will guide instructors in the implementation of SM in ESP classes.
5. The present study would hopefully promote the use of CASM in ESP classes.

1.4 Purpose of the Study

This study aims at investigating the efficiency of CASM in improving ESP students' reading comprehension level and vocabulary knowledge. It also explores the effectiveness of CASM in enhancing students' ability for information retrieval. Finally, it documents students' attitudes towards using the SM technique.

1.5 Research Questions

The researcher will attempt to answer the following questions:

1. Does CASM improve nursing students' comprehension of medical texts?
2. Is CASM an effective technique for increasing nursing students' knowledge of medical terms?
3. Does CASM help in promoting students' recall ability of medical texts?

4. Do nursing students show positive attitude towards the SM technique?

1.6 Hypotheses of the Study

This study will attempt to test the following hypotheses:

1. There will be no statistically significant difference in the mean scores of reading comprehension between students who will be exposed to the SM treatment (the experimental group) and those who will not (the control group).

2. There will be no statistically significant difference in the mean scores of vocabulary acquisition between students of the experimental group and those of the control group.

3. The difference between students' mean scores of both groups in the recall test will be equal to zero.

4. Participants who will complete the SM intervention will show no positive attitude towards it.

1.7 Limitations of the Study

The present study has certain limitations that need to be taken into account when considering its contribution. The study is limited to:

1. ESP Saudi university female students taking an ESP course offered by the College of Languages and Translation (COLT) and studying at the Nursing College, KSU, Riyadh, Saudi Arabia. The sample is of a small size and students will not be randomly assigned into groups. Such students possess some basic medical knowledge.

2. Detecting the effectiveness of CASM in improving students' comprehension of medical passages, their vocabulary knowledge, and their recall ability.
3. A treatment of short duration (eight weeks).

4. Using FreeMind 0.8.1 as a means that will help students in map formation. Thus, testing the efficiency of the program will not be the focus of the present study.

1.8 Definition of Terms

The following terms, which are frequently used throughout this study, are defined as follows:

**Computer-assisted language learning (CALL)**

CALL is defined by Biehler and Snowman (1993) as "the use of computers to present programs or otherwise facilitate or evaluate learning".

**English for Specific Purposes (ESP)**

Tony Dudley-Evans (1997), co-editor of the ESP Journal, defined ESP in terms of absolute and variable characteristics. Regarding absolute characteristics, ESP is established to suffice students' specific needs. It uses the underlying methodology and teaches the language peculiar to the specific discipline it serves. For ESP's variable characteristics, ESP is designed for specific disciplines and for adult learners, and it can be also used by advanced and intermediate students. The majority of ESP courses assume some basic knowledge of the language systems, and therefore they may make use of a teaching methodology different from that of General English.

**Prior knowledge**

Beck and McKeown (1986) stated that prior knowledge refers to…

The major view of how knowledge affects reading comprehension involving the theoretical notion of schemata—abstract knowledge structures that provide framework for related concepts…A schema brought to bear on a reading task can be thought of as a framework containing slots to be filled by incoming text
information…The knowledge one brings to a reading task helps to determine what one will get from reading. (p. 118).

**Reading**

Reading refers to "a process in which information from the text and the knowledge possessed by the reader act together to produce meaning" (National Institute of Education, 1985, p. 8).

**Semantic Mapping (SM)**

According to Pearson and Johnson (1978), SM is a metacognitive strategy (because it helps learners think of their thinking) used for creating visual representations of the relationships among ideas.
Chapter 2

Literature Review

2.1 Introduction

This chapter presents a review of studies relevant to this research. Such a review aims to contextualize the present study and identify its place in this field of research. This chapter is divided into two main parts. The first part defines what SM is, explains the relationship between prior knowledge and reading comprehension, elaborates on the historical development of SM, and reviews a number of studies conducted on SM. The second part focuses on the history of CALL, the advantages of using CALL, and some selected studies on the use of computer to generate semantic maps.

However, let me first present the usefulness of SM. The popularity of SM is widely acknowledged by several researchers in various studies. Goldberg (2004) states that one can use SM with students of different ability levels and in all subject matters to aid in increasing student involvement in learning. It is an extremely useful technique for visual learners (Stephens & Hermes, 2007) because it facilitates the presentation of interrelationships between ideas in a nonlinear and visual manner (Ruffini, 2008).

SM can be used, as noted by Buzan (2000), to take notes, improve memory, generate and develop ideas. Hague (1987) and Machalias (1991) note that classroom activities that foster the formation of associations between concepts may build up semantic networks necessary for long-term retention. Hence, it has been proven that SM enhances recall of information (Berkowitz, 1986), helps in problem solving and decision making (Shmaefsky, 2007), lowers student apprehension about a subject (Jegede, Alaiyemola, and Okebukola, 1990), aids in planning learning materials (MacArthur, 2009), helps pinpoint any misconceptions, and thus allows teachers to find any initial barriers to learning (Brown, 2002).
Hay and Kinchin (2008) argue that SM is an effective tool if one wants to measure students' prior knowledge and their knowledge-change concerning any part of the curriculum. In this way, SM makes the learning process visible. As suggested by Hay (2007), SM may detect any changes in the course of learning by identifying any sort of surface, deep, and non-learning of materials. Thus, teachers can easily figure out which part of the curriculum is understood or not.

In addition, SM exercises can integrate students' and teachers' understanding in a meaningful way (Hay & Kinchin, 2008). Hay, Kinchin, and Lygo-Baker (2008) gave four main uses of SM: (a) the identification of prior knowledge, (b) the introduction and the presentation of new teaching materials in a way that promotes meaningful learning, (c) the sharing of knowledge and experience among teachers and learners, and (d) the documentation of any change in students' knowledge.

Moreover, Plotnick (1997) wrote that SM can be used to brainstorm, communicate complex ideas, and facilitate learning by integrating old and new knowledge. Additionally, the visual representation of ideas found in SM has its own advantages: (a) visual symbols are easily recognized, (b) one can easily scan a word, phrase, or general idea because there is a minimum use of text, and (c) the visual representation of ideas conveys a holistic understanding of the subject matter that cannot be conveyed with words alone.

Using computer software to generate semantic maps is one way to foster student participation and increase their motivation to higher levels. Anderson-Inman and Horney (1997) state that CASM may activate the visual representation of any form of knowledge and make it more accessible. Also, Plotnick (1997) highlights that computer support for SM makes adaptation and manipulation easier, develops dynamic thinking, and enhances communication and storage. Due to the various uses of the technique, as noted by Ward (1988), SM has been widely used as a prereading or prewriting strategy, or as a post-reading
check of comprehension.

2.2 Semantic Mapping

Antonacci (1991) describes SM as one that "creates a picture of knowledge and thoughts" (p. 174). Hence, semantic maps are of two aspects: visual and conceptual. Visually, a semantic map is an arrangement of shapes such as boxes, triangles, circles, or rectangles connected through lines and arrows. Conceptually, a semantic map contains verbal information within such shapes (Fisher, 1995, p. 68). Novak (1998, p. 3) noted that since semantic maps are "knowledge representation tools;" they should be read from top to bottom; from general concepts to more specific ones at the bottom.

Different labels have been coined to refer to such a strategy besides SM (Pearson & Johnson, 1978): (a) semantic webbing (Widomski, 1983), (b) story maps (Beck & McKeon, 1981), (c) webbing (Norton, 1991), (d) cognitive mapping (Peresich, Meadows, & Sinatra, 1990), (e) semantic organizer (Pehrsson, 1983), (f) concept maps (Moreira, 1979), (g) idea mapping, (h) patterned note taking, (i) construct procedure, (j) graphic overview, (k) flowcharting, (l) networking (Micciniati, 1988), (m) concept trees (Hirumi & Bowers, 1991), and (n) bubbling (Heimlich & Pittelman, 1986). Also, the terms "knowledge mapping", "mind-maps", "think-links", "idea branches", "structured overviews", and "graphic organizers" (Buzan, 1974; Clarke, 1991; Fisher, 1995; Heimlich & Pittelman, 1986; Novak, 1998; Novak & Gowin, 1984) have been used to refer to the same technique. It is worth mentioning that some researchers such as Fisher (1995, p. 63) distinguished between concept maps and thinking maps. In thinking maps, ideas are listed as in brainstorming, but in concept maps the relationships among ideas are listed.

Fisher (1995) provides a rationale for using SM. He argues that in learning a concept, one builds up a series of approximations and with too much exposure to the target body of knowledge, finer and finer distinctions are established. In this way, the learner will widen a
network of related ideas as he gains some understanding of a specific form of knowledge. Also stated by Lim, Cheng, Lam, and Ngan (2003), SM helps in creating meaningful patterns of our knowledge, and it increases our understanding of key concepts. In addition, it aids in the planning process through categorizing, linking, and organizing ideas. It activates active thinking, the cognitive skills of analysis, categorization, synthesis, and reflection.

Novak and Cañas (2006) specify some important parts of a concept map such as linking words or phrases, concept, propositions, cross-links, and illustrative examples. Linking words show the relationship between two concepts. A concept is defined as "a perceived regularity in events or objects, or records of events or objects, designated by a label" (Novak & Cañas, 2006, p. 1). The label for concepts is a word or two and it can be a symbol. Propositions are statements about universal objects that can be either naturally occurring or constructed. Propositions can be of two or more concepts that are connected through linking words to form a meaningful statement. Such meaningful units are called semantic units. Cross-links are relationships between concepts in a concept map which show how creatively a student connects concepts together. Illustrative examples of events and objects are included to clarify the meaning of a given concept. Examples are not included in boxes since they do not represent concepts. According to Novak and Cañas (2006), a semantic map is constructed around a focus question that a learner seeks to answer.

According to Lindsey and Norman (1972), a semantic map is mainly of two components, nodes (geometric shapes) and links (arrows). The most rudimentary form of semantic maps is concept mapping (CMING) or word mapping. Concepts can be mapped utilizing three relationships: (a) class, a category to which a word belongs; (b) property, a quality that makes the concept well distinguished; and (c) example, which is an instance of the concept. Relationships may exist at the node only level or among nodes at different levels (see Figure 2-1).
As shown above, example relationships can be reverse relationships. Yet, property relationships are enclosed in rectangles and they are node only relationships as opposed to class and example relationships which can be both among node relationships at different levels and node only level relationships.

SM was then developed to be of relationships between events. Lindsey and Norman (1972) developed SM using Fillmore's case grammar. Case grammar analysis focused on the verb as the central component (see Figure 2-3).

Pearson and Johnson (1978) further developed SM to represent units of longer discourse. The diagram developed by Pearson and Johnson was of main idea-detail semantic relationships (see Figure 2-4).
Hanf (1971) specified the following three components as primary ones: (a) main idea, topic, or title, (b) secondary categories, and (c) supporting details. Each title is enclosed in a circle and secondary categories are identified as main headings of a specific topic. Supporting details radiate from headings through links to represent various relationships.

As shown above, semantic maps vary from simple ones that are representatives of simple ideas to "hierarchical concept mapping" (Fisher, 1995, p. 68). Information in a semantic map can be either linearly or geometrically arranged. It can also take the form of a "free flowing organic structure" (Fisher, 1995, p. 68). When semantic maps take the form of a web, they have various advantages. The central idea and the supporting ideas are clearly defined. Importance of ideas and how they are connected are also highlighted. A semantic map is marked by its open-ended nature which helps in making further connections, adjustments, and elaboration (Lim, et al., 2003). Therefore, one can fully cover different topics through SM.

According to Johnson (1980), semantic maps can be classified in a different way regarding student and teacher involvement. Thus, they are of different types: general semantic maps (student-generated) and re-focused semantic maps (teacher-directed emphasis).
Educators such as Antonacci (1991, pp. 174-175), Heimlich and Pittelman (1986, pp. 5 & 12) and Hanf (1971, pp. 226-227) agreed on some instructional sequence that can be followed when one wants to apply SM in reading lessons:

1. Explain to your students that after reading a story, they will create a map about it.
2. Write the story title on the board and draw a circle around it.
3. Read the title and ask students to think of ideas related to the title.
4. Students can read the story silently or the teacher reads the story to class.
5. Students are then encouraged to generate topic headings and ideas related to each heading.
6. Each heading will be discussed and mapped.

As for word-mapping activities, Harmon (1998, as cited in Rosenbaum, 2001, p. 45) suggested eight techniques that can be used when mapping words: (a) synonyms, (b) brief descriptions, (c) examples and nonexamples, (d) rephrasing, (e) repetition, (f) associations, and (g) unique expression. Rosenbaum (2001, p. 45) prescribed the following instructional sequence:

1. Write the new word and page number in the central bubble.
2. Copy the sentence in which the new word appears in another bubble to provide context for the new word.
3. Use a dictionary to include the word's definition in another bubble.
4. Using the dictionary, find synonyms or antonyms for a word.
5. Record derivatives of the word in one of the bubbles. Word's morphology and structural analysis are equally important because they help in activating prior knowledge and extending new body of knowledge.
6. Record an example, a unique expression, or an association pertinent to the word in one of the bubbles. Students should create their original sentences.
7. Discussion of student-created semantic maps with the teacher or with other students may help in refining such maps.

Following the above advanced sequence, students integrate prior knowledge, new learning, and their personal experience. Johnson and Pearson (1984) suggested another instructional sequence related to word mapping activities:

1. Write a topic or a keyword on the blackboard.
2. Ask students to think of other words related to the one on the blackboard.
3. Ask students to list the generated words by categories.
4. Discuss with students the relationships between these words.

Furthermore, Al-Jarf (2010) recommended an instructional strategy for teaching vocabulary that can be followed by teachers interested in implementing a SM computer program in class. The procedure is of six stages: (a) orientation, (b) presentation and modeling, (c) guided practice, (d) independent practice, (e) extension activities, and (f) assessment. In the first stage, students are exposed to the SM software and its components. Then, the instructor can train their students in using the program by creating different kinds of maps: (a) morphological maps for words sharing the same root, prefix, or suffix, (b) phonics or sound-symbol association maps for words with silent letters, words with hidden sounds, homonyms, and homophones, (c) syntactic maps which focus on the plural and singular form of words, collocations, idioms, and phrasal verbs, (d) semantic maps for antonyms and synonyms, and (e) phonological maps that focus on pronunciations and stress patterns. In the guided practice stage, students connect words they already know with those studied in class through using the SM program. Students will be guided by their teacher to add any new word covered in class to the previously created maps according to specific categories. For the independent practice stage, students will continue using the program at home and will be asked to add new words to their maps and to create more maps. On tests, the instructor can
give their students a semantic map of specific category and with blank nodes to be filled with appropriate items. In this way, student knowledge of vocabulary items is evaluated and hence SM can be used also for evaluation purposes.

To conclude, a semantic map is a graphic representation of relationships that exist between concepts, events, and ideas in a longer discourse. This progression of SM from word level to reading comprehension level makes it a very common technique implemented in vocabulary and reading courses. In this study, SM will be used to map medical terms and medical reading passages.

2.3 Prior Knowledge and Reading Comprehension

Prior knowledge or schema is a term used to refer to a body of research that explains how thinking influences the reading process (Coleman, 1995, p. 12). Rumelhart and Ortony (1977) noted that knowledge is located in units called schemata and within these units there will be information on how to employ knowledge. Schema also contains other units that will be filled with information. Bartlett (1932) coined the term schema and defined it as "an active organization of past reactions, or past experience" (p. 201). Many researchers explored the effects of prior knowledge on thinking and reading process. Coleman (1995, p. 13) stated that the activation of prior knowledge helps in making links between students' prior knowledge and the new body of knowledge. Thereby, the resultant framework of information can be easily recalled. Pearson, Roehler, Dole, and Duffy (1992, p. 155) mentioned the following effects of prior knowledge on reading comprehension:

1. Successful readers, comparing them to poor ones, use their background knowledge to make sense of what is read.
2. Low achieving readers can be taught how to activate their prior knowledge and consequently their reading comprehension level will be improved.
3. High achieving readers use their background knowledge to make inferences during
and after reading.

4. Through the activation of prior knowledge, good readers acknowledge the importance of the information represented in a reading selection.

5. Having prior knowledge related to a certain topic is not enough and thus the activation of such knowledge is equally important.

2.4 Historical Development of SM

SM has its own origins in linguistics and psychology. According to Reutzel (1982), generative semantic theories and case grammar analysis explore how language functions in the human brain. Generative semantic theories are concerned with how one formulates a sentence that truly expresses their intended meaning. They explain also how a reader interacts semantically with a written text. Case grammar analysis (Fillmore, 1968, as cited in Reutzel, 1982, p. 13), on the other hand, has its foundation in Latin Case Grammar which used a small number of terms to describe the relationships that exist between nouns and verbs in a proposition. Hence, both theories aim at representing the underlying meaning of a sentence (deep structure) and the relationships between ideas in a sentence. Consider, for example, the following sentence: “A stranger unlocked the bathroom door with his key this morning.” This sentence will be analyzed using case grammar as follows:

![Case grammar diagram](Reutzel, 1982, p. 14).

*Figure 2-5. Case grammar diagram (Reutzel, 1982, p. 14).*
The field of psychology also contributes to the development of SM. It adds to the researchers' understanding of how the human brain processes, stores, and retrieves information. In 1956, Miller (as cited in Reutzel, 1982, p. 17) wrote an article, "The Magical Number Seven Plus or Minus Two", in which he coined the term "chunking" to refer to the fact that the degree of one's processing of information depends entirely on the relatedness or unrelatedness of the materials represented and that the person processes the largest chunk of meaningful information. Miller also noted that information is transformed into some understandable form before processing. Further, the visual presentation of ideas found in SM is originated in Piaget and Inhelder's (1971) work that manifests the fact that memory is improved when one constructs visual pictures of abstract information. The yielded framework illustrates ideas in an organized manner and aids in information retrieval. Moreover, it promotes visual connections between what is already known and what is newly represented.

Additionally, many educators argued that SM is mainly based on David Ausubel's theory of meaningful learning. Ausubel (1968, as cited in Safayeni, Derbentseva, & Cañas, 2003, p. 3) differentiated between meaningful learning and rote learning. He claimed that in meaningful learning the materials represented to learners should be clear and related to their prior knowledge. In meaningful learning, the learner must possess some knowledge related to the concept presented, and they must learn things in a meaningful way through incorporating new meanings into their prior knowledge instead of memorizing definitions. The rote-meaningful distinction is considered to be a continuum. Creativity is the highest level of meaningful learning. Meaningful learning builds one's knowledge structure (known as the individual's cognitive structure) by adjusting new concepts to learner's existing conceptual framework. Novak (1998, as cited in Safayeni, Derbentseva, & Cañas, 2003, p. 3) states that CMING is a "major methodological tool of Ausubel's Assimilation Theory of meaningful
learning". Novak developed CMING in 1972 in attempt to understand changes in children's knowledge of science that cannot be detected by interviews (Novak & Musonda, 1991). However, other researchers such as Macnamara (1982) attributes the origin of concept maps to children's attempt to recognize regularities in the world around them and find labels for such regularities.

Hanf (1971) was the first to introduce a mapping model that "translates reading into thought" (p. 225), but the first notable work conducted in the area of SM was by Pittelman and Johnson (1985). It was a longitudinal study of five years that explored the effects of SM as a vocabulary instruction on fourth, fifth, and sixth graders' word knowledge. The researchers mapped vocabulary items at the pre-reading stage to activate students' background knowledge. Their study showed that semantic mapping was an effective technique that improved students' vocabulary and reading comprehension level. Their study was then extended to investigate its effects on reading comprehension passages and it yielded similar results.

2.5 Applications of Semantic Mapping

2.5.1 Applications of SM in Different Content-Area Instruction

Researchers have used SM in different content-area instruction such as teacher education, social studies, chemistry, statistics, physiology, accounting, psychology, science, nursing, etc.

For teacher education, Loughran (1996) wrote that concept maps are preferred to essays when assessing student-teachers' understanding. White and Gunstone (1992) argued that SM is an efficient tool for checking student-teachers' understanding of a limited aspect of a certain topic. Semantic maps may assist one in discovering a change in relations between concepts. They foster discussion and help in checking whether students understand reasons for a lesson or not.
Lim et al. (2003) investigated how SM is used by teacher-educators mainly kindergarten teachers/principles to develop students' reflective and thinking skills regarding subject matter content (Art, Language, Mathematics/Science, and Social Studies) and teaching curriculum. Interviews of participants and the analysis of their semantic maps showed that there was a change of attitudes towards subject matter content and teaching curriculum. Further, CMING has been used to support university academics in course content analysis in the process of course design.

The effect of SM among university academics has been explored by Amundsen, Weston, and McAlpine (2008) in their article, "Concept Mapping to support University Academics' Analysis of Course Content". University academics reported that they gained a lot from their use of SM and that SM helped them in understanding the different relationships between concepts.

Further, Martin (1994) showed how SM is used by students in general and in science-oriented curriculum courses as a means for developing lesson plans. The technique was introduced by the researcher through a "fast-track" approach. Martin reported that the produced lesson plans were high in quality.

Also, Dana (1993) examined how pre-service teachers make sense of their teaching of social studies through CMING. Angell (1991) wrote that SM is crucial for identifying the kinds of experiences, beliefs, and expectations that pre-service teachers bring to a methods course. Thus, Dana asked teachers of social studies to create maps at the beginning and at the end of a course on teaching methods. She explored prospective teachers' attitudes towards the technique and participants reported that SM helped them think critically about what it means to teach and learn social studies in the elementary school. The researcher added that teachers' maps showed feelings of confidence and advocacy towards teaching social studies.

SM has been used to yield positive results in the field of chemistry. Schreiber and
Abegg (1991) wrote that concept maps measure the amount of chemical information students have, improve students' reasoning ability, and discover any misconceptions students hold about chemical concepts. Özmen, Demircioğlu, and Coll (2009) conducted a study to explore the impact of mind maps and laboratory activities on tenth graders' understanding of acid-base chemistry in a Turkish high school. It also investigated how SM changed students' attitudes towards chemistry. The researchers compared the performance of the intervention group with that of the control group who was taught in a traditional manner. Students of both groups were pre- and post- tested. Results showed that laboratory activities in conjunction with CMING were more enjoyable and aided students in connecting concepts together.

CMING has been also used in statistics courses. In a study by Chiou (2009), mind mapping was employed to increase students' achievement in a business and economics statistics course. Participants were divided into three groups: (a) collaborative concept mapping (CCMING), (a) individual concept mapping (ICMING), and (c) traditional textbook exercises (TTE). Results showed that CMING proved to be effective in raising students' level in statistics courses. Further, CCMING turned to be better than ICMING in increasing students' achievement and most students showed positive attitudes towards the use of CMING to learn statistics.

Educators claimed that students of physiology are taught through rote learning and thus they cannot extend what is taught beyond classroom constraints in the clinical setting. Hence, Gonzalez, Palencia, Umana, Galindo, and Villafrade (2008) examined the effect of using SM besides the mediated learning experience on students during the cardiovascular module of a medical physiology course at Universidad Autonoma de Bucaramanga. The study was based on Ausubel's theory of meaningful learning, Novak's concept maps, and Reuven Feuerstein's mediated learning experience. The participating subjects were divided into two groups. The first group was the intervention group who was taught through SM and
mediated learning experience and the second group was taught in a traditional manner. The treatment group was taught how to construct mind maps to solve problems related to cardiovascular physiology, whereas the second group was given discussion and problem-solving sessions. Students' performance was evaluated using problem-solving and multiple-choice questions. The experimental group excelled the control group on the problem-solving exams, but no difference was detected between the two groups in the multiple-choice exam. The researchers concluded that SM fostered meaningful learning and allowed such students to transfer their knowledge to solve problems.

SM was also effective in accounting classes. Chiou (2008) examined how SM can be used to increase students' achievement and improve their interests. The participants were 124 advanced accounting university students at the School of Management in Taiwan. The resultant data revealed that SM increased students' achievement. In addition, students reported that the technique of SM can aid in achieving a full understanding of accounting concepts and thus can be used in any other curriculum areas.

In psychology, SM has been employed to yield positive results. Berry and Chew (2008) used mind maps to improve students' performance in general psychology. The researchers conducted two studies to explore the impact of two learning strategies. In Study 1, students generated questions over course material, but in Study 2 students constructed maps related to course material. Results showed that generating concept maps improved student exam performance in general psychology.

Additionally, SM has been used in science classes. Asan (2007) explored the effects of CMING on the achievement of fifth graders in science classes. The participating subjects were 23 students at Ata Elementary School, Trabzon, Turkey. Students were divided into two groups and were pre- and post-tested using 20 multiple-choice questions. The researcher taught both groups a lesson on heat and temperature in a traditional way, but in the review
session of the lesson, the experimental group was exposed to the review by the use of Inspiration, which is a computer-based SM program. Post-test results showed that the program had its positive effects on students' achievement.

In another study by Guvenc and Acikgoz (2007), the researchers explored the effects of cooperative, individual CMING, and traditional instruction on fifth graders' learning strategy use in an elementary school in Aegean district, Turkey. The subjects (52 females and 70 males) were divided into three groups: (a) the first was taught the lesson of "Sound and Light" through traditional instruction, (b) the first experimental group was taught the same lesson by cooperative CMING, and (c) the second intervention group was taught the lesson by individual CMING. Researchers used the Learning Strategy Inventory and in-depth interview protocols with the subjects to derive their data. Findings showed that using cooperative and individual CMING promoted the use of effective learning strategies.

In a similar study, Seaman (1990) explored the effect of cooperative SM on students' achievement in a science class. Students were divided into three groups: (a) a cooperative SM group, (b) a standard SM group, and (c) a control group. Students studied a science text and then they were given vocabulary tests and a final unit test. Students in the SM groups scored higher marks comparing them to those in the control group.

Moreover, Kwon and Cifuentes (2009) explored the comparative effects of individually-generated and collaboratively-constructed computer-aided CMING on seventh-grade middle school students in a science class. 161 students participated in the study and were assigned to three groups: (a) a self-selected study strategy group, (b) an individual SM group, and (c) a collaborative pairs-SM group. Students were given a comprehension test and results showed that both individually and collaboratively-constructed computer-generated semantic maps had positive effects on students' performance. Students who collaboratively produced concept maps generated higher quality semantic maps that showed deeper
conceptual understanding.

Further, Sila and Olgun (2008) conducted a study to investigate the effects of SM on fifth graders' understanding and retention of heat and temperature concepts. The participants were 75 students and were randomly assigned into two groups. The treatment group was taught with the SM instruction, whereas the control group was taught in a traditional way. Results revealed that the treatment group performed better than the control group on heat and temperature concepts, but retention tests showed no difference between the two groups.

In another study, Tastan, Dikmenli, and Cardak (2008) examined the effect of CMING accompanied by conceptual change texts (CCTs) on the performance of eleventh graders in a science class. CCTs are supplementary texts used in class that make students aware of their inaccurate preconceptions. The participants were divided into two groups and taught a lesson on molecules. The semi-structured individual interviews were conducted with the students to find any misconceptions related to the topic. A success test was constructed depending on the information driven from both literature and interviews. The intact group (25 students) was taught in a traditional way, whereas the sample group (25 students) was given classes using concept maps and conceptual change texts. Results showed that using concept maps in conjunction with conceptual change texts enhanced students' understanding of concepts related to molecules. The average percent of correct responses of the treatment group was 61.6% and of the comparison group was 53.6% after intervention.

One more study by Roberts and Joiner (2007) investigated the impact of SM on students of autistic spectrum disorder (ASD) in science classes. ASD students are considered to be visual learners who cognitively cannot see the relationship between ideas. The subjects were ten pupils aged between 11 and 14 years. The same students were taught science lessons conventionally and through SM. Results indicated that pupil performance was four times greater in the CMING condition than after a conventional way of instruction.
CMING has also been used as an evaluation tool of student understanding of environmental concepts. In 2008, Andrews, Tressler, and Mintzes conducted their study on 325 middle school-aged students to examine the efficiency of SM as an assessment tool. They concluded that SM is an effective alternative evaluation tool better than the traditional pencil and paper tests because it provides a qualitative and quantitative measure of conceptual understanding.

Additionally, Hay, Kehoe, Miquel, Hatzipanagos, Kinchin, Keevil, and Lygo-Baker (2008) used SM to measure the quality of e-learning. The participants were third-year medical students who enrolled in an online course on the principles of magnetic resonance imaging (MRI). Students' understanding of MRI was measured before and after the intervention by using CMING. Any change in students' maps was evaluated using criteria developed to distinguish between rote and meaningful learning. Students' maps were scored for any richness in understanding. Further, each map was compared with the proposed content of teaching material. Results showed that students' misconceptions were eradicated and that some concepts were either ignored or learnt by rote. The researchers concluded that students' prior knowledge is an important factor leading to meaningful learning.

In a course for teaching research methods, Hay (2007) used SM with 12 postgraduate students to reveal patterns of deep, surface, and non-learning. Results showed that SM made the learning process tangible and thus it can be easily checked and observed. It also helped in detecting any changes in the course of learning and in distinguishing between meaningful changes and those that were not.

2.5.1.1 Semantic Mapping in Nursing Education

To be professional in a clinical setting, nurses must be able to relate concepts, solve problems, combine theory with practice, and draw on past experience in a way meaningful to them (Daley, 1996). Traditionally, clinical nursing educators encouraged nursing students to
develop linear care plans in tables or columns using the nursing process to identify patients' health problems. Such plans of linear nature have been utilized for many years, but their use showed that they have their own problems. Mueller, Johnston, and Bligh (2001) argued that the linear format of such plans does not foster critical thinking and directs thinking to occur in the same sequence, and hence nurses will not be able to view a patient's health problems holistically. Further, Hicks-Moore (2005) wrote that the linear structure of care plans used by nurses does not allow connections to be displayed, restricts one's creativity, and does not permit the addition of further viewpoints and connections. Hence, Baugh and Mellott (1998) and Schuster (2000) demonstrate the fact that beginning nursing students struggle endlessly when they use the traditional format of care plans. According to Hicks-Moore (2005), nursing knowledge is constantly increasing and nursing education is trying to foster optimal learning, critical thinking, and problem solving. Thus, concept maps can replace traditional care plans and can better represent nurses' thinking patterns (Baugh & Mellott, 1998).

Daley, Shaw, Balistrieri, Glasenapp, and Piacentine (1999) and Schuster (2000) argued that when reviewing nursing students' concept maps, nursing educators can easily discuss conceptual relationships, share information, correct misconceptions, and fill in missing concepts. Additionally, Kathol, Geiger, and Hartig (1998) wrote that concepts maps are efficient tools since they link theory with practice. Further, King and Shell (2002) added that through concept maps one can include important data such as diagnoses, symptoms, health needs, nursing interventions, and medical assessments. In this way, all the relevant components related to the client's health status are viewed simultaneously, and hence a deeper understanding of one's health problems is achieved. The structure of concept maps helps students act upon their previous knowledge, link it with new knowledge to extend it and apply it. It can help nurses to achieve a full picture of the situation instead of relying on rote memorization. When reviewing concept maps with students, instructors will be able to
evaluate their students' thinking to provide them with feedback when necessary (King & Shell, 2002).

Schuster (2000) described in detail how one can use concept maps to replace traditional care plans of linear structure:

1. Nurses should first write the patient's medical diagnosis in the middle. Then, nursing diagnosis will be added to the map.
2. Data that support the diagnoses should be included in the map.
3. Relationships between diagnoses should be shown.
4. Nurses should also add nursing interventions and evaluation to the map.

SM proved to be an effective tool in nursing education and many researchers such as Koehler (2001), Mueller, Johnston, and Bligh (2002), and Schuster (2000) recommend that concept maps should be used instead of traditional care plans. Also, Rooda (1994) found that SM was effective in increasing the academic performance of sophomore-level BSN (the Bachelor of Science in Nursing) nursing students in an introductory nursing course. The participants were divided into two groups: control and experimental. The participants were given three exams and their average exam grades were compared on each of the three exams administered. Students of the experimental group reported that the course was exceptionally informative and that SM was extremely helpful.

In another study, Daley, Shaw, Balistrieri, Glasenapp, and Piacentine (1999) used SM as a way for teaching and evaluating critical thinking skills in BSN students during the final semester of the senior year. The participating subjects were only three students who were asked to create maps at the beginning and at the end of the semester. Students' maps showed a significant improvement in their way of conceptualizing concepts. Students commented that SM can be more beneficial if introduced earlier in the course. Instructors reported that CMING can show which students are good practitioners. Also, students who found difficulty
expressing their medical knowledge verbally could easily show it through SM. On the other hand, concept maps of students who were considered to be outspoken showed some knowledge gaps. Similarly, Wheeler and Collins (2003) explored to what extent CMING will be effective in helping junior-level BSN students improve their critical thinking skills. The California Critical Thinking Test (CCTT) was administered after the completion of the intervention that took one semester and students' scores indicated a significant increase in their performance.

A study by Wilkes, Cooper, Lewin, and Batts (1999) implemented SM to teach science to registered nurses (RNs) in a BSN program in Australia. Participants reported that SM helped them in achieving a full understanding of concepts of homeostasis, cellular needs, acute inflammation, and blood pressure control. The maps produced were high in quality and showed students' motivation towards the technique. The authors added that SM helped students link nursing practice with science.

One more study by Jitlakoat (2005) examined the effectiveness of SM in nursing competencies of primary medical care among fourth year university nursing students. Data were collected using interviews and questionnaires. Results revealed that the participants improved their competencies regarding primary medical care. Further, findings of the study may contribute to nursing education and may improve nursing competencies in various contexts.

Because of the importance of SM in nursing education, the researcher has chosen nursing students to be the participants of the present study.

2.5.2 Semantic Mapping in Language Skills and Sub-skills

SM has been applied in classrooms for three main purposes: (a) for general vocabulary development, (b) as a pre- and post- reading technique, and (c) as a study skill strategy (Melendez, 1991). Many instructional studies examined the impact of SM on
improving students' vocabulary (Pittelman, Levin, & Johnson, 1985; Toms-Bronowski, 1982; Dyer, 1985). Also, since the 1980s, researchers were interested in implementing SM in classrooms to improve students' reading comprehension levels (Sinatra, Stahl-Gemake, & Berg, 1984; Sinatra, Berg, & Dunn, 1985; Berkowitz, 1986; Reutzel & Fawson, 1991; McCarty-Tucker, 1992). Most of the studies conducted targeted elementary school students. Only few were with college students. The following sections review some of the studies on SM and reading comprehension and vocabulary.

2.5.2.1 Selected Studies on Semantic Mapping and Reading Comprehension

A close examination of the studies conducted in the area of SM and reading comprehension revealed differences among instructional settings and research tools. Also, some of the following studies investigated the impact of SM on students' recall ability besides their reading comprehension level. One of the earliest studies was by Sinatra, Stahl-Gemake, and Berg (1984) and was conducted with special education students from a clinical setting. The purpose of the study was to determine whether SM or a traditional directed lesson was more effective in improving student comprehension level than a traditional textbook approach. The study was for four months and lessons were taught by clinical personnel. Each lesson began with a review followed by a general discussion of the lesson and, then, students were asked to read the passages silently. Comprehension questions were constructed to assess students' performance. The researchers found that SM was an effective strategy for reading comprehension, but no differences were found for main idea, inference, and details.

In a similar study, Sinatra, Berg, and Dunn (1985) conducted their study with special education students in a clinical setting to explore the efficiency of SM in reading comprehension. The assessment tools as well as the silent reading procedures were similar to the 1984 study. The treatment was of five weeks and results showed a significant increase in
students' reading comprehension level when SM was used.

A notable work by Berkowitz (1986) documented the effects of SM on students' ability of organizing expository texts. Sixth-grade students comprised the sample. Over a six-week intervention, students were taught to reread and to use map-story procedures and question-answer procedures. Teachers were trained on how to implement SM effectively in classrooms and were given a lesson plan checklist of a specified instructional sequence. Teachers made their tests as assessment tools and results indicated that student-generated maps were effective on free-recall of main ideas.

Working with 22 below-average first grade readers, Reutzel and Fawson (1991) investigated the effect of using a literature webbing strategy lesson (maps showing the plot, theme, setting, and characters in a literary work) and predictable books on students' oral reading and reading comprehension. Standardized tests and comprehension questions were used as assessment measures besides audio tapes of each student's reading passages. Teachers received no training but they were asked to read all the passages and to activate students' previous knowledge. The length of the study was not specified. Assessment measures indicated that the literature webbing strategy lesson was significantly more effective in improving below-average readers' comprehension than was a directed listening/reading thinking approach.

Further, McCarthy-Tucker (1992) worked with 68 in three fourth-grade classrooms to compare the effectiveness of SM to semantic-pictorial mapping and basal reader instruction (using textbooks to teach reading to schoolchildren) on students' reading comprehension level and memory. The researcher served as the teacher of the three groups. Comprehension questions from the teacher's text edition were used to assess students' performance. Prior to each lesson, students' prior knowledge was activated. Results showed that SM improved students' comprehension of reading passages and their information recall ability. Low
achievers showed improvement when SM was combined with basal reader instruction; however, basal reader instruction alone could not improve students' comprehension level.

Brady's study (1990) examined the comparative effects of two strategies, SM and reciprocal teaching (RT), on students' reading comprehension. Brady worked with fifth- through eighth-grade students. The RT group learnt the four reciprocal teaching strategies of questioning, summarizing, clarifying, and predicting developed by Palincsar. Another group, (the SMART group) received reading comprehension instruction through SM combined with RT. The control group was taught in a traditional way. The participants were bilingual Alaska Natives from a rural village in southwest Alaska who were considered of low reading ability as measured by a standardized achievement test. The intervention was of 25 days. Daily comprehension tests, Gates-MacGinitie reading tests, and generalization probes in both science and social studies were used as tests to measure students' performance. Brady's study was of important findings. First, there was no significant difference between instructional groups in their performance, but the combined experimental group outperformed the control one.

A study by Coleman (1995) investigated the effectiveness of SM in third graders' reading comprehension. The control sample received instruction through the basal reader, whereas the intervention group received instruction through SM. The District Skills Test, a criterion-referenced test developed by the school district, was used as a pre- and post-test. The treatment was of six consecutive weeks with both groups receiving comprehension lessons three times a week for 40 minutes. Tests yielded positive results in favor of the SM technique. The researcher recommends the use of a performance-based test as an assessment measure instead of using a skill-oriented test. Also, she recommends that the implementation period as well as the practice sessions should be extended. Additionally, she suggested that
having small groups that encourage peer collaboration in constructing maps is extremely effective for reading comprehension.

One more study by Armbruster and Anderson (1980) examined the impact of SM on eighth graders who were taught to map short expository prose passages during 12 hours of instruction. The SM group remembered a great deal of the ideas represented in the passages they mapped comparing them to the control group who used a different reading strategy. Students of the treatment group mapped two passages and the probability of recalling mapped ideas outweighed that of recalling unmapped ideas. The researcher concluded that SM is an efficient tool for information recall.

Nevertheless, there are other studies that reported no effect of SM on student reading comprehension. For example, Alvermann and Boothby (1986) worked with fourth graders to investigate the effect of graphic organizers on improving student comprehension and retention ability, but the study yielded no positive results in favor of the implemented treatment. Also, Clements-Davis & Ley (1991) study examined the effect of thematic preorganizers on secondary students’ comprehension of prose fiction. Researchers found that thematic preorganizers did not improve student comprehension ability. In addition, Dunston and Ridgeway (1990) conducted their study with college students to explore the effect of teacher-constructed and student-created graphic organizers on student comprehension and retention ability. Students were assigned into either of two treatment groups (one used teacher-created graphic organizers and another used student-constructed graphic organizers) or one control group. Results revealed that graphic organizers made no improvement in students' reading comprehension and their ability to recall information. Further, De Fina (1999) reported no effect of SM on college student comprehension of psychological texts. Students were randomly distributed into two treatment groups (one used SM and another
used SM combined with subsequent discussion) and one control group. The retelling procedure was used as an assessment measure. Results showed no difference in performance between the two treatment groups and between the control group and the one using SM only. Analysis of data also revealed that the control group outperformed those using SM combined with follow-up discussion. However, students of the experimental group viewed the technique as a valuable one.

Hall and Strangman (2002) argued for the effectiveness of SM in reading comprehension and claimed that some of the studies mentioned above suffered from deficiencies in their experimental designs. Alvermann and Boothby (1986) study, for example, showed no improvement because of a ceiling effect which means that students' scores were quite high before the execution of the treatment. As for Clements-Davis & Ley (1991) study, lack of improvement was due to the fact that students were not trained on using thematic preorganizers. The discrepancy in findings in De Fina's was due to the complexity and the length of the psychological passages, using the retelling procedure as a measure, and the limited time provided for the experiment. Other reasons include students focusing on the creation of the maps and not on the information represented within the map and the limited time allotted for students to display and discuss their maps after map creation.

Most of the aforementioned studies targeted elementary school students. This study, however, explored the effect of SM on college students' reading comprehension level and their recall ability.

2.5.2.2 Selected Studies on Semantic Mapping and Vocabulary

Most of the studies conducted on the use of SM for vocabulary development advocate the use of SM as a pre- and post-reading strategy. Such studies were with elementary school students and few of them explored the impact of SM on students' recall ability. As noted by
Moore and Readence (1984), a considerable body of research exists documenting the effect of SM on student vocabulary. For example, Johnson, Pittelman, Toms-Bronowski, and Levin (1984) examined the impact of three strategies (teacher-directed SM, semantic feature analysis, and a modified basal approach) on fourth graders' vocabulary. The aforementioned strategies were taught as examples of pre-reading vocabulary instruction. Results showed that the two groups receiving instruction in SM and semantic feature analysis outperformed the one of the modified basal approach.

In a similar study, Toms-Bronowski (1982) compared the effect of SM and semantic feature analysis with that of traditional contextual approach on students' vocabulary acquisition. 36 fourth-, fifth-, and sixth-grade students comprised the participating sample. For three weeks, students in each group were taught 15 target words each week and they were tested on all the 45 vocabulary items at the end of the fourth week. They were also given a comprehensive test of words and their definitions. Results showed that both SM and semantic feature analysis were more effective than the traditional contextual method for general vocabulary development. Such findings demonstrated the fact that strategies that activate students' prior knowledge improve students' vocabulary acquisition.

Similarly, Johnson et al. (1984) conducted a study to investigate the effect of SM and semantic feature analysis on students' vocabulary acquisition and reading comprehension. Such strategies were compared with a modified basal approach. The researchers worked with fourth graders and were placed in a full, partial, or control treatment group. The first treatment group received pre-reading vocabulary instruction and read a basal passage prior to taking vocabulary and comprehension tests, whereas students of the partial group either received vocabulary instruction or read the passage prior to testing. Results showed that all the three treatments were powerful in teaching vocabulary items. Further, students of full and partial treatment groups were even more privileged. Johnson's study showed that students of
higher levels of prior knowledge did well on reading comprehension tests which confirmed the strong relationship between reading comprehension and prior knowledge.

Pittelman, Levin, and Johnson (1985) conducted a study with 39 poor fourth-grade readers who received SM vocabulary instruction in two of their three daily lessons, once in a small group (poor readers only) and once in a large group of mixed abilities (whole class). The aim of the study was to compare the effect of SM on students in both cases. Eight target words related to one of three specific topics (water, stores, or Olympics) were introduced everyday. Participants received no instruction on the third day, but were tested on the vocabulary related to the third topic. Students were pre- and post-tested and results showed that there were no significant differences between poor readers' performance after small group instruction and their performance after large group instruction. However, the SM group scored higher gains than those in control classes. Furthermore, teachers reported that they felt comfortable when they implemented SM with poor readers of different groups. Also, this study yielded findings that support the effectiveness of SM as an instructional strategy for vocabulary development.

In a series of studies on the use of SM and semantic feature analysis, Pittelman and Johnson (1985) recommend the use of SM as a powerful pre-reading strategy because it helps introduce key vocabulary words and activate students' prior knowledge about a certain topic. They also suggested the use of SM as a post-reading strategy to review newly acquired information and link it with student previous relevant knowledge.

Working with eighth-grade students, Dyer (1985) examined the performance of two groups using different pre-reading SM strategies to improve their story comprehension level. Both implemented strategies differed in content but the procedures followed for each strategy were similar. Students were asked to brainstorm a certain concept to be represented as a semantic map on the board. Then, they copied the brainstormed semantic maps in their
notebooks. One group of students brainstormed a concept related to the story they read, whereas the other group brainstormed an unrelated concept. The control group was simply told what the story would be about. The resultant data revealed that the two intervention groups outperformed the control one. Further, the related concept group outperformed the other two groups on a transfer task.

One more study was by Pikula (1987) who explored the effectiveness of SM as a technique for increasing vocabulary. 38 fourth graders were chosen as subjects and were divided into experimental and control groups. Words from the Scott, Foresman Reading Program, Grade Four, were selected for a pretest of both groups. The control group was taught vocabulary through the traditional vocabulary technique, whereas the experimental group was taught vocabulary through SM. The treatment was of six weeks and students were given a post-test after the completion of the intervention. Post-test results showed no significant difference between the two groups. Yet, the experimental group showed an increase in their vocabulary. Thus, the researcher recommended a replication of the study over a longer period of time.

In 1983, Vogt's study was with fourth-, fifth-, and sixth-grade students to explore the efficiency of SM as a technique of word recall. SM was compared to the traditional method of teaching vocabulary. First, students' knowledge was tested using vocabulary subtests of the Gates-McGinitie reading tests to identify the unknown words. Then, students were presented words using the traditional method and other words using SM. A month later, students were post-tested. Using the Wilcoxon Two Sample Test, the two methods of instruction were compared to each other. In the free recall setting, students recalled word meanings that are taught through SM more than those taught through the traditional method.

2.5.2.3 Semantic Mapping in EFL/ESL Settings

To the researcher's best knowledge, the present study is the first study which will be
conducted with ESP college students, but there are few studies conducted with EFL/ESL students. This section will review some of the important studies conducted with EFL/ESL students.

El-Koumy (1999) examined the impact of three classroom methods for teaching SM on EFL college students' reading comprehension. The researcher worked with 187 freshman students at an Egyptian university who were divided into three groups: (a) teacher-initiated SM group; (b) student-mediated SM group; and (c) teacher-student interactive SM group. The treatment was in one session per week and lasted for 5 months. Students were pre- and post-tested and post-test results showed that students of the teacher-student interactive SM group outperformed students of the other two groups.

Ojima (2006) explored the effectiveness of CMING as a pre-task planning in the writing performance of three Japanese ESL learners. The researcher analyzed four compositions from each learner, written with and without SM, using measures of accuracy, complexity, fluency, etc. Through a questionnaire and retrospective interviews, students' application of the strategy was explored. Data revealed that students made unique applications of the strategy, suggesting that the technique of SM can immeasurably improve students' writing in ways unique to individual experience and motivation.

SM was compared to the traditional instruction method to explore ninth graders' achievement in an English course. Tumen and Taspinar (2007) worked with 23 participants at Balakgazi High School. Concept maps were developed by the experimental group who took a questionnaire but both groups were given an achievement test. Results indicated that although the CMING group had problems with constructing concept maps, the technique had a positive impact on students' English level. The researchers recommend that to make SM more effective teacher-made concept maps should be used first. Then, students should be encouraged to develop their own maps.
One more study examined the effects of SM on ESL students' writing. Schultz (1991) worked with students in a second-year French university programme in California. The treatment was of one year. In the first semester, instructors implemented SM as a pre-writing activity and it was combined with classroom discussion. Students showed improvement in their writing, their satisfaction with their progress on the course, and their willingness to participate in classroom discussions. Schultz argued that this combination of SM with oral activities could foster students' "higher-level thinking" (p. 986).

2.5.2.3.1 An Overview of Studies on Semantic Mapping in Saudi Arabia

There are only two important studies conducted by Al-Jarf (2009) and Siddiqi (2007) on SM in Saudi Arabia. Both were with EFL students and examined the effects of SM on two different skills. This section will review such studies and will highlight some differences between these two studies and the present study.

Al-Jarf (2009) worked with 86 EFL female college students in their first writing course to investigate the effectiveness of SM in students' writing. Participants were divided into two groups and they were in their first semester of the translation program at COLT, KSU, Riyadh, Saudi Arabia. Before any instruction, both groups were pretested and test results showed that there was no difference between the two groups. As reported by the researcher, level-one students were having problems with generating ideas in English and developing paragraphs with topic sentences and supporting details. Thus, a computer program (known as FreeMind 0.8.1) was used to help experimental students improve their writing level. The control group, on the other hand, was taught in a traditional way. Students of the SM group used the software every week to write their essays. Post-test results showed that the treatment group made higher gains than those in the control group.

Siddiqi (2007) conducted one important study that meant to explore the impact of CASM on EFL secondary school students in Makkah. Siddiqi's study aimed at: (a) exploring
the effectiveness of a SM software on EFL students' performance in reading comprehension, as compared to traditional methods; (b) examining the efficiency of a teaching method that incorporated computers in students' reading comprehension; and (c) providing recommendations for educators interested in implementing SM in different fields. The study was of a quasi-experimental design and participants were divided into two groups. The experimental group was taught their lessons using CASM, whereas the control group was taught in a traditional way. Two units (The Food Which We Eat) and (Saudi Arabia: Yesterday and Today) were mapped by the researcher and the experiment took 6 weeks. After the completion of the experiment, a test was administered to measure students' comprehension. Results indicated that students' level in reading comprehension has been increased after using CASM. The researcher recommended that SM training should be offered to teachers, supervisors, and to those who are interested in improving their teaching. Siddiqi also suggested that strategic reading as well as technology should be introduced to EFL classrooms to improve students' performance.

Unlike Al-Jarf (2009) and Siddiqi (2007) that conducted studies on EFL students testing the effect of CASM on reading and writing, this study aims at investigating its impact on ESP students' vocabulary, reading comprehension and recall ability.

2.6 Computer-Assisted Language Learning

In the last few years, the number of teachers using CALL has increased markedly and countless articles have been written about the role of technology in education in the 21st century. This section will elaborate on the history of CALL, advantages of implementing CALL in classrooms, and some selected studies that compare hand-drawn maps with computer-generated maps.
2.6.1 The History of CALL

The use of computers in education went through stages over the last 30 years. According to Warschauer (1996), the development of CALL can be described in terms of stages. The introduction of a new phase does not mean discarding the previous one. Nevertheless, the new phase has some characteristics of the old one. The first phase, *behavioristic CALL*, was introduced in the 1950s and implemented in the 1960s and '70s. It was based on the behavioristic theories of language learning, and hence programs of this phase are of repetitive nature. A computer is considered to be a tutor, which delivers instructional materials to students. The rationale behind drill and practice programs is the following:

1. Repeated exposure to the same material is essential.
2. A computer is an ideal tool for presenting drills since it does not get bored and provides immediate feedback.
3. Through computers, instruction can be individualized and each student can proceed on their pace.

As mentioned by Warschauer (1996), the PLATO system is an example of a tutoring system used at that time that offered vocabulary drills, grammar explanations, and translation tests. In the late 1970s and early 1980s, behavioristic CALL was attacked for two reasons. First, behavioristic approaches to language teaching and learning were attacked on theoretical and pedagogical levels. Secondly, the invention of the microcomputer offered a number of possibilities. Also, Vance Stevens (1989) noted that behavioristic CALL did not motivate students intrinsically and did not foster interactivity among learners and between computers and learners. Hence, a new phase of CALL was set and became known as *communicative CALL* (Warschauer, 1996).

Communicative CALL was based on the communicative approach to language
teaching which was prominent in the 1970s and 80s. Advocates of the communicative approach argued that drill and practice programs of behavioristic CALL did not allow authentic communication to occur among students (Warschauer, 1996). John Underwood, a proponent of communicative CALL, wrote an article entitled "Premises for Communicative CALL" in which he specifies some characteristics of communicative CALL. According to Underwood (1984), communicative CALL:

1. teaches students how to use forms instead of focusing on forms only;
2. teaches grammar implicitly;
3. encourages students to produce original sentences;
4. does not judge or reward students in terms of their responses;
5. is open and flexible to a wide variety of students' responses;
6. encourages students to use the target language exclusively and creates an environment in which the foreign language is produced naturally; and
7. serves more functions than what a book can just do.

Types of computer programs developed during the phase of communicative CALL "provide skill practice, but in a non-drill format" (Warschauer, 1996, p. 2). Examples of such programs include paced reading, text reconstruction, and language games. As with drill and practice programs, programs of communicative CALL treated the computer as the knower of the correct answer. In this case, a computer is still a tutor. Yet, communicative activities involve students' participation and stimulate students' discussion. Thus, computers are not only tutors, but also stimuli. Examples of communicative programs in which computers are stimuli include SimCity, Sleuth, and Where in the World is San Diego? Further, there are other communicative programs that treat computers as tools. Such programs do not provide any language material, but encourage the learner to use and understand language. Word processors, spelling and grammar checkers, and concordancers are examples.
To distinguish between behavioristic and communicative CALL, one should consider how the software is used by the teacher and students. By the end of the 1980s, educators criticized communicative CALL believing that it did not contribute to central elements of the language teaching process. Due to advances in computer technology, educators became more interested in integrating the various aspects of the language learning process. This introduced a new phase of CALL known as integrative CALL.

Warschauer (1996) wrote that integrative CALL is based on either multimedia computers or the Internet. CD-ROMs are examples of multimedia technology that allow students to access text, graphics, sound, animation, and video on a single machine. Using hypermedia in education has its own advantages. First, authentic material is provided to students since listening is combined with seeing. Secondly, skills can be easily integrated through hypermedia. Third, while students are focusing on the main lesson in the foreground, they can easily access different resources that offer grammar explanations and pronunciation guidelines through background links. Finally, students can control the pace of their learning and instruction can be easily individualized. Dustin, developed by the Institute for Learning Sciences at Northwestern University, is an example of a program in which hypermedia is used to aid language learning. Yet, programs like Dustin failed to be truly interactive and intelligent because it could not analyze one's speech for correctness as well as appropriateness. Further, Warschauer (1996) noted that multimedia technology could not integrate "meaningful and authentic communication into all aspects of the language learning curriculum" (p. 4).

As mentioned by Warschauer (1996), computer-mediated communication (CMC) and the Internet represent another use of CALL in an integrative way. CMC was first introduced in the 1960s, but it became wide-spread in the 1990s. Through CMC, language learners can communicate with native speakers 24 hours a day and their communication can be
asynchronous (not simultaneous) via electronic mails or synchronous (simultaneous) using programs such as Multiuse Object Oriented systems (MOOs). Further, the World Wide Web (WWW) allows users to browse various websites to download authentic materials and to publish their documents. In this way, integrative CALL aims at integrating the various skills of language learning and integrating technology more fully into language teaching (Warschauer & Healey, 1998).

In this study, a computer program known as FreeMind 0.8.1 will be used to generate semantic maps of medical terms and medical texts. Using the program, vocabulary (as a sub-skill) will be integrated with reading (as a skill) and CALL, thus, will be used integratively.

2.6.2 The Advantages of Using CALL

Teachers all around the world are inspired by the rapid development of technology from the 1980s. Thus, computer has become an important component of second and foreign language learning pedagogy. To teachers and students, explaining the advantages of CALL seems to be necessary (Lai & Kritsonis, 2006). Only then, students and teachers will realize the benefits of computer technology and will be more motivated to utilize computer appropriately. Many researchers cited advantages of using CALL. Kung (2002), for example, wrote that CALL programs can create highly independent and collaborative environments and provide students with essential language experiences needed for any language learner. Also, educators such as Jonassen (1996), Salaberry (1999), and Rost (2002) argued that computer technology allows students to work on language materials at any time. Hence, more independence from school will be created with CALL programs.

Lee (2000) further stated other advantages of utilizing computer technology in classrooms. He noted that computers (a) expose students to a huge amount of human experience, (b) increase students' motivation and achievement, (c) provide students with authentic materials 24 hours a day, (d) foster greater interaction between teachers and their
students and students with their peers, (e) individualize instruction, (f) help students discover thousands of information resources, and (g) increase students' global understanding.

Additionally, Taylor (1980) wrote that computer technology provide students with lots of fun games, communicative activities, and repeated lessons that lower students' anxiety and promote their motivation. Further, CALL communicative programs may strengthen students' linguistic skills and build their self-esteem. Also, Taylor and Gitsaki (2003) stated that computers can provide teachers with important data on students' performance. Thereby, students' progress can be easily tackled. Further, Kozma (1991) wrote that computers help students understand abstract concepts because of the visual media that computers provide. Lee (2000) also wrote that the combination of computer technology with the Internet breaks the linear form of instruction found in classrooms, develop students' thinking skills, help students extend their personal experience, and prepare them to real-life situations. In this way, students are creators of knowledge and not merely receivers of it.

For the above stated advantages, the researcher implemented a computer program that uses colors, images, and arrows to generate concept maps. This use of computer software will make the intended learning environment appealing and will foster student motivation and involvement.

2.6.3 Studies on the Use of Computer to Generate Semantic Maps

Researchers compared maps produced by computer programs with hand-drawn maps in a number of studies. They also examined the effect of computer programs on students' attitudes and achievement. For example, the Royers (2004) compared computer-generated semantic maps with hand-drawn maps. 52 students in two combined 9th/10th grade biology classes took part in the study. There were two treatment groups: a computer-mapping group and a paper/pencil group. The computer group constructed their maps using Inspiration, whereas the paper/pencil group generated their maps without the use of computer programs.
The $t$ statistic was used to evaluate the mean difference between the two interventions. The computer-support group created more complex maps than the paper/pencil group.

In another study, Sturm and Rankin-Erickson (2002) examined the effect of CASM on students' achievement in a writing class. 12 eighth-grade disabled students produced descriptive essays under three conditions: no-map treatment, hand-drawn SM, and CASM. The essays produced were compared on four measures: number of words, syntactic maturity, number of T-units, and holistic writing scores. Results indicated that student descriptive essays produced by the mapping groups (hand-drawn or computer-based maps) showed a significant increase in students' writing level with respect to number of words produced, number of T-units, and holistic writing scores. Students' attitudes were also explored by researchers. Results revealed that students in the computer-mapping group showed positive attitudes towards writing comparing them to the two other groups.

2.7 Conclusion

SM is a graphic organizer used to represent ideas visually. It has been proven that SM is effective in improving memory, generating and organizing ideas, solving problems, and making decisions. Thus, researchers used SM in different areas such as social studies, chemistry, teacher education, accounting, physiology, nursing, etc. Also, many educators implemented SM in language skills such as reading and writing and language sub-skills such as vocabulary. As advanced above, studies conducted on SM target different participants such as elementary school students (Berkowitz, 1986; Reutzel & Fawson, 1991; McCarthy-Tucker, 1992; Coleman, 1995; Johnson, Pittelman, Toms-Bronowski, & Levin, 1984; Toms-Bronowski, 1982; Pittelman, Levin, & Johnson, 1985; Pikula, 1987, Vogt, 1983), college students (El-Koumy, 1999; Schultz, 1991; Al-Jarf, 2009), EFL/ESL students (El-Koumy, 1999; Ojima, 2006; Schultz, 1991), and Saudi students (Al-Jarf, 2009; Siddiqi, 2007). As noted above, most of the research studies were with elementary students. Very few were with
EFL/ESL college students, especially those with ESP students. There are only two documented studies on SM in Saudi Arabia. Both studies by Al-Jarf (2009) and Siddiqi (2007) chose EFL female Saudi students as their participants. Al-Jarf (2009) investigated the effectiveness of SM in students' writing, whereas Siddiqi (2007) explored the impact of SM on students' reading comprehension. The present study, however, will be the first one conducted with ESP Saudi college students to examine the effect of SM on students' vocabulary and reading comprehension. In addition, this study aims at investigating the effect of SM on students' ability of information recall and will document students' attitudes towards the technique.
Chapter 3
Research Methodology and Procedure

3.1 Introduction

This chapter will present information related to the selection of participants, the research design chosen for this study, the procedures followed during the study, research instruments, and the statistics used to analyze the obtained data.

3.2 Population of the Study

The participants of this study were ESP Saudi university female students studying at the Nursing College, KSU, Riyadh, Saudi Arabia. This study took place during the first semester of the academic year 1430/31 A.H. (2009/10). Students were in their third semester taking an ESP course (114 NAJM) offered by COLT. The subjects were all native speakers of Arabic and they were the researcher's students. Their median age was 19, and they all had no less than seven years of EFL instruction in grades 6-12 prior to their admission to the Nursing College. Students enrolled at the College of Nursing are provided with the essential knowledge and skills that help them become qualified nurses. They are encouraged to act promptly and to think critically in order to face career challenges in any setting. Thus, students are not only offered specialized courses in nursing, but they are given other courses in chemistry, physics, nutrition, pharmacology, anatomy, physiology, biostatistics, the English language (112 NAJM and 113 NAJM), the Arabic language, the Islamic culture, etc.

114 NAJM is the only ESP course offered by COLT to nursing students. The course is taught to students of level three for three hours per week. It aims at improving students' reading comprehension level and vocabulary. Additionally, students are required to memorize the medical information contained in the medical passages of their textbook. Hence, the textbook assigned for the course (The Language of Medicine in English by Ethel and Martin Tiersky) is primarily of medical passages followed by sections focusing on some
medical terms and exercises. Exercises are reading comprehension exercises (T/F statements, WH-Questions, identifying causes and their effects, inferencing, etc.) and vocabulary exercises, including analyzing words and word parts, matching words with their meanings or synonyms, matching meronyms (parts such as organs) with holonyms (wholes exemplified by systems), etc. The researcher covered only five required chapters from the book, namely, "Highlights from the History of Medicine", "Human Anatomy", "Disease: Its Symptoms and Treatments", "Physicians and Medical Specialties", and "First Aid in Medical Emergencies".

3.3 Sample of the Study

Participants were of two intact groups and they were the only two groups taking 114 NAJM for the first time during the first semester of the academic year 1430/31 A.H. (2009/10). This study began with 76 participants, but the total number of subjects became 58 because of students' irregular attendance and withdrawal, which affected the process of obtaining data. As mentioned above, participating subjects were of two groups: Group A (n = 32) and Group B (n = 26). The control group (n = 26) received traditional in-class instruction that depends on the textbook only (The Language of Medicine in English by Ethel and Martin Tiersky) and the experimental group (n = 32) received a combination of traditional in-class instruction and SM instruction using a software (FreeMind 0.8.1).

3.4 Research Design

This study is of a quasi-experimental design known as the nonequivalent-control-group design (hereafter NEGD) represented as follows:

\[
\begin{array}{cccc}
O_1 & X & O_2 & O_1 \quad O_3 = \text{pretests} \\
\cdots & \cdots & \cdots & \cdots \\
O_3 & C & O_4 & O_2 \quad O_4 = \text{posttests} \\
\end{array}
\]

\[X = \text{SM treatment}\]

*Figure 3-1.* The pretest-posttest nonequivalent-groups design (Best & Kahn, 1986, p. 129).
In quasi-experimental designs, the equivalence of the two groups is not assured because students will not be randomly assigned to experimental and control groups. Best and Kahn (1986) described NEGD as one "used frequently in classroom experiments when experimental and control groups are naturally assembled groups as intact classes, which may be similar" (p. 129). Yet, Campbell and Stanley (1963) stated that quasi-experimental designs are constructed from real-life situations, and therefore they are true representatives of educational contexts.

Following the above illustrated design, Group A (n = 32) was the experimental group that received the intervention (SM instruction) whereas Group B (n = 26) was the one instructed traditionally using the textbook only. This study was of 12 weeks from the 14th of October to the 13th of January. SM treatment lasted 8 weeks. Both groups were pretested during Week 1 to ensure that they were comparable to each other and to attribute any resultant change in student behavior to the treatment itself and not to any other factor. During the second week, students of the intervention group only received a training session on the procedure of SM. A week later, the experimental group started using SM to map medical passages and terms in their textbook. The control group, on the other hand, was taught in a traditional way, as is usually the case in traditional teacher-fronted classrooms. The post-test was administered to students of both groups during Week 11 to measure the extent to which the treatment benefited students of the experimental group. One week later, the experimental group received a questionnaire to document their attitudes towards SM. The following is an illustrative timetable of the study:
Table 3-1

Timetable of the Study

<table>
<thead>
<tr>
<th>Week</th>
<th>Treatment</th>
<th>Intake assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>(No treatment)</td>
<td>Pretest</td>
</tr>
<tr>
<td>Week 2</td>
<td>SM training session</td>
<td>-</td>
</tr>
<tr>
<td>Week 3 to Week 10</td>
<td>SM treatment</td>
<td>-</td>
</tr>
<tr>
<td>Week 11</td>
<td>(No treatment)</td>
<td>Post-test</td>
</tr>
<tr>
<td>Week 12</td>
<td>(No treatment)</td>
<td>Students' attitude questionnaire</td>
</tr>
</tbody>
</table>

3.5 Instruments of the Study

Quasi-experimental research design, one form of quantitative research design, was used in this study. Another kind of quantitative research designs known as descriptive study (exemplified by the survey research implemented in this study) was also used. The survey research aimed at investigating students' attitudes towards SM. Based on the aforementioned research designs, the instruments of the present study are the following:

1. A pre- and post-test.
2. A 5 point Likert-type scale questionnaire.

114 NAJM is a course that aims at improving students' reading comprehension level and vocabulary. Additionally, students are required to memorize the medical information contained in the medical passages of their textbook. Hence, the textbook (*The Language of Medicine in English* by Ethel and Martin Tiersky) is primarily of medical passages followed by sections focusing on some medical terms and exercises. Exercises are reading comprehension exercises and vocabulary exercises. The pre- and post-test was developed by the researcher and it reflects the textbook exercises. It is made of three parts: (a) reading, (b) vocabulary, and (c) recall test. The following sections will elaborate on the instruments used in the present study.
3.5.1 Pre- and Post-test

The pre-test was administered to the treatment group and the control group to assess student reading and vocabulary skills and to evaluate their knowledge regarding the information represented in the test. Additionally, the pre-test was used in this study to ensure that both groups are equivalent and to attribute any resultant differences in student performance after the intervention to the treatment itself and not to any preexisting differences. The purpose of the post-test, on the other hand, is to measure any change in student performance after the treatment through comparing pre- and post-test results. Any detected progress may help one draw conclusions about the technique utilized in this study.

3.5.1.1 Reading Test

The reading test (see Appendix A) is of five passages (adopted from *Health Topics* offered by the University of Iowa) and of 30 items (True-False and multiple-choice questions) designed by the researcher to meet the content and objective of the course. Each item was assigned one point and the whole reading test was out of 30 points. It examines students' ability in identifying causal relationship between ideas, inferencing, and understanding the texts. Such reading skills are emphasized in student textbook. Text readability statistics of the five passages (Hernia Problems, Food Poisoning, Appendicitis, Migraine, Glaucoma) chosen for the test are shown in the following table, respectively.
Table 3-2

**Text Readability Statistics**

<table>
<thead>
<tr>
<th>Text readability statistics</th>
<th>Passage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Word count</td>
<td>324</td>
</tr>
<tr>
<td>Passive sentences</td>
<td>6%</td>
</tr>
<tr>
<td>Flesch Reading Ease</td>
<td>40.4</td>
</tr>
<tr>
<td>Flesch-Kincaid Grade Level</td>
<td>12.4</td>
</tr>
</tbody>
</table>

Flesch–Kincaid readability tests have been used in the present study to indicate comprehension difficulty of the aforementioned reading passages. As mentioned by Rudolf Flesch (1948), higher scores on the Reading Ease test indicate that such passages are easier to read than those with lower scores. Scores on the Reading Ease test can be converted to grade levels on the Grade Level test. As shown above, a text having a high score on the Reading Ease test would indicate a lower one on the Grade Level test (Flesch, 1948). The five selected passages scored between 40.0 and 57.7 and thus they are suitable to students at grade 9 through 12. The researcher's students have spent at least 7 years of EFL instruction and studied specialized nursing courses for one year which made the selected passages suitable to student level.

Five reading passages of different topics have been included in the pre-and post-test to ensure reliability of the test. As noted by Hughes (1989), using more than one passage in a test may give examinees "a good number of fresh starts" in a test (Hughes, 1989, p. 119). Additionally, Madsen (1983) mentioned that it is advisable to include from three to five reading passages in a reading test since students usually differ in their interests and level of training.
Each reading text is followed by True-False and multiple-choice questions. True-False tests are widely used as measurements of reading comprehension. Heaton (1975) stated that such questions are very reliable indicators of student comprehension of reading passages. However, True-False items may encourage guessing among students. To reduce any chance of student guessing of the correct answer, the researcher included a third distractor (IK) besides the True-False options. In this way, any statement could be marked True, False, or IK (short for impossible to know) for statements with information not mentioned in the passage. Multiple-choice questions can also yield objective, reliable results since such items require no interpretation on the part of the teacher, and any grading will depend entirely on student selection (DePalma, 1990). Further, Bontis, Hardie, and Serenko (2009) argued that multiple-choice tests are the best assessment tool of student knowledge because other factors such as handwriting are not taken into account in such tests. They can successfully diagnose problem areas in student understanding (Jones, 1994).

3.5.1.2 Vocabulary Test

The vocabulary test is of 30 items (matching questions). It was set to explore students' ability in identifying meanings of words using their knowledge of medical roots, matching words with their definitions, and matching meronyms with holonyms. Such vocabulary skills are emphasized in student textbook and textbook exercises. Student textbook, *The Language of Medicine in English*, is not merely of medical passages, but each passage is followed by a group of words and their definitions. Students were asked to map medical passages and medical terms. They had to find ways of dividing medical terms into categories to create maps of medical words and their definitions (see Appendix C, p. 145). Hence, the focus of Question III (see Appendix A, p. 133) is on matching words with their definitions. Students were also required to generate maps of body systems (holonyms) and their organs (meronyms). Identifying the organs of each body system is the focus of Chapter 2 and thus
Question II (see Appendix A, p. 133) is about matching body systems with their organs.

Textbook exercises place a lot of importance on medical roots and hence students were urged to create maps of words sharing the same medical root. The focus of Question I (see Appendix A, p. 132) is on matching medical terms with their definitions and students had to depend on their knowledge of medical roots to answer this question.

The researcher chose to test student vocabulary through matching questions because such questions are used normally in testing meanings of words (Pavlû, 2009). In addition, educators argued that matching questions are the best when one wants to assess "content knowledge" (1994). Further, Jones stated that matching questions are more efficient than multiple-choice questions since one can read one list of distracters to answer a group of items. To avoid any arbitrary answers by students, the researcher included more options than premises in the test and hence the probability of guessing is low.

3.5.1.3 Recall Test

For the recall test, it is made up of 30 multiple-choice questions which were used to investigate the extent to which students recalled information taught through the use of SM. One of the objectives of the course is to help students memorize all the medical information contained in the passages. Thus, students were asked to map some of the medical passages and some of the medical terms in their textbook. The researcher selected six pieces of information from each chapter to be included in the test. Multiple-choice questions (see Appendix A) have been used to test student ability in information recall. Many studies (Sinatra, Stahl-Gemake, & Berg, 1984; McCarthy-Tucker, 1992; Sorrell, 1990; Rinehart & Welker, 1992; Sakta, 1992; Lipson, 1995; Boyle, 1996) used either cloze testing or multiple-choice questions in their studies on SM for the same purpose.
3.5.1.4 Test Validity

Three types of validity have been obtained for the pre- and post-test: content validity, face validity, and concurrent validity. According to Hughes (1989), a test is said to have content validity if its content truly reflects the purpose of the test. It can be safely said that the test (See Appendix A) sufficiently covers the entire body of the content that was intended to be measured. The reading test, for example, consists of items aimed at examining students' ability in identifying causal relationship between ideas, making inferences, and understanding the texts. Also, the vocabulary test contains items that were set to explore students' ability to identify meanings of words by using their knowledge of medical roots, matching words with their definitions, and matching meronyms with holonyms. For the recall test, test items investigate the extent to which students recall information taught through the use of SM. Heaton (1975) stated that one should develop a table of test specifications to achieve content validity. Thus, the following test blueprint was developed by the researcher to specify the content of the test.

Table 3-3

Pre- and Post-test Blueprint

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Test type</th>
<th>Skills to be tested</th>
<th>Total points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reading—Students will use their prior knowledge of medical texts and medical terms to understand long medical passages.</td>
<td>Multiple choice</td>
<td>Checking for text comprehension.</td>
<td>18 pts</td>
</tr>
<tr>
<td>1. Show understanding of texts by providing answers to information questions from the texts.</td>
<td>True / False</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Read between the lines to detect the unspoken hidden meanings that enrich overall understanding of a text or to draw one’s own personal conclusions about a text.</td>
<td>Matching Qs</td>
<td>Reading the passage to draw inferences.</td>
<td>4 pts</td>
</tr>
<tr>
<td>3. Students will identify words such as because, since, so,</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
consequently that signal a cause and effect relationship.

<table>
<thead>
<tr>
<th>II. Vocabulary—Students will expand their knowledge of medical terms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Words and their Definitions- Use knowledge of medical roots, suffixes, and prefixes to match words with their definitions.</td>
</tr>
<tr>
<td>2. Holonyms and Meronyms- Match meronyms with holonyms.</td>
</tr>
<tr>
<td>3. Words and their Definitions- Match words with their memorized definitions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>III. Recall—Students will improve their ability of information recall.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use information recall ability to choose the correct answer for each statement. 30 statements are pertinent to 5 different chapters covered in the textbook such as &quot;Highlights from the History of Medicine, Human Anatomy, Diseases: Its symptoms and Treatments, Physicians and Medical Specialties, and First Aid in Medical Emergencies.&quot;</td>
</tr>
</tbody>
</table>

**Total item types/ Total points** 39 items 21 items 30 items 90 pts

Face validity was also obtained for the same pre- and post-test. A test having face validity, as described by Heaton (1975), is a test that "looks right" when shown to other testers and testees (p. 159). It has been shown to three experienced teachers at COLT (two MA holders in English Literature and one MA holder in TESL) who taught the course more than once. All the reviewers confirmed the suitability of the test to student level and suggested some modifications that have been considered. One of the teachers, for example, suggested that the reading passages should be shorter and another reviewer suggested that the
third option in the True-False questions should be changed from DK (impossible to draw any conclusion) to IK (for impossible to know).

As for concurrent validity, the researcher compared results of the post-test with those of the final exam which has been previously validated. Both tests were administered during Week 11 and were intended to measure student performance in the skills of reading comprehension, vocabulary acquisition, and information recall. Scores obtained from both tests were correlated using the Pearson product-moment correlation coefficient. Results showed that there is a moderate degree of correlation between both test scores ($r = 0.403$) and in this way concurrent validity of the test used in this study has been obtained.

### 3.5.1.5 Test Reliability

Test reliability was calculated for the pre- and post-test. According to Heaton (1975), for a test to be valid, it should be reliable in the first place. As defined by Hughes (1989), a test is reliable if it gives the same results when scored by different people or administered on different occasions. To achieve test-re-test reliability, the pre- and post-test was piloted with a sample ($n = 24$) of 114 NAJM students who were not part of the present study. It was administered to the same group on two different occasions (two-week interval). Scores obtained from these two administrations were correlated using the Pearson product-moment correlation coefficient. Results revealed that the three tests showed a moderate to high degree of correlation which suggested that students performed similarly on both occasions. Hence, the vocabulary test ($r = 0.675$), the reading test ($r = 0.711$), and the recall test ($r = 0.513$) are considered to be reliable.

### 3.5.2 Questionnaire

Student attitudes towards the technique of CASM were explored through a 20-item questionnaire (see Appendix B) that was administered to the students at the end of the experiment. Through these items, students were asked about the belief that CASM was
helpful to their learning, the affective acceptance of CASM as a useful learning tool, and the difficulties students encountered during their map construction. Questionnaire items have been adopted from different studies. Items 10 and 11 were derived from Chiou's study (2008, p. 382), 5, 6, 13, 14, 17, 18, and 20 were from Chang, Sung, and Chen's research (2001, p. 29), and items 7, 8, 9, and 12, were taken from Santhanam, Leach, and Dawson's (1998, p. 323). When writing questionnaire items, the researcher avoided long complex sentences, jargon, abbreviations, culture-specific terms, leading and complex questions, double negatives, ambiguous words, and double-barreled items (Oppenheim, 1992).

The type of questionnaire implemented in this study is a five-point Likert scale in which students indicated their degree of agreement to each statement. In Likert scaling, respondents are asked to make a decision on their level of agreement with questionnaire statements by checking one of five response categories: *strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree*. Likert scaling is commonly used in survey research as a technique for measuring respondent attitudes (Corbetta, 2003). The researcher chose a five-point Likert scale for the present study because such questionnaires with fewer options may yield higher mean scores than those with ten options when one considers the highest obtained score (Dawes, 2008).

### 3.5.2.1 Questionnaire Validity

The questionnaire has been shown to two professors to obtain face validity. One of the reviewers suggested that some items should be rewritten in a clearer and easy way using unmitigated language and that any overlapping between items should be avoided. Further, it has been recommended that the letter included with the questionnaire should not explain the real purpose of it. A third professor suggested that the questionnaire should be translated into Arabic, the native language of the participants, to eliminate any variance in the subjects' English language proficiency levels as a variable. As recommended by the professor, the
researcher has changed the expressions "semantic map" and "semantic mapping" in each questionnaire item to "الرسوم التوضيحية". Item 7 has been changed from "summarizing lecture notes" to "تلخيص النصوص الطبية".

3.5.2.2 Questionnaire Reliability

To assess the internal consistency of the questionnaire, correlation between questionnaire items (intended to measure the same characteristic) was calculated using the Pearson product-moment correlation coefficient. Table 3-4 shows the correlation coefficients between each subscale item and the total of the items belonging to the same subscale.

Table 3-4

*Correlation Coefficients Between Each Scale Item and the Total of the Items Related to the Same Subscale*

<table>
<thead>
<tr>
<th>Statements</th>
<th>Pearson's correlation coefficient values (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subscale 1: The belief that CASM was helpful to student learning</td>
<td></td>
</tr>
<tr>
<td>Statement no. 1</td>
<td>0.718**</td>
</tr>
<tr>
<td>Statement no. 2</td>
<td>0.634**</td>
</tr>
<tr>
<td>Statement no. 3</td>
<td>0.733**</td>
</tr>
<tr>
<td>Statement no. 4</td>
<td>0.758**</td>
</tr>
<tr>
<td>Statement no. 5</td>
<td>0.609**</td>
</tr>
<tr>
<td>Statement no. 6</td>
<td>0.581**</td>
</tr>
<tr>
<td>Statement no. 7</td>
<td>0.702**</td>
</tr>
<tr>
<td>Statement no. 8</td>
<td>0.698**</td>
</tr>
<tr>
<td>Statement no. 9</td>
<td>0.780**</td>
</tr>
<tr>
<td>Statement no. 10</td>
<td>0.760**</td>
</tr>
<tr>
<td>Statement no. 11</td>
<td>0.674**</td>
</tr>
<tr>
<td>Statement no. 12</td>
<td>0.664**</td>
</tr>
</tbody>
</table>
Subscale 2: The affective acceptance of CASM as a useful learning tool

<table>
<thead>
<tr>
<th>Statement no.</th>
<th>Pearson's r</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>0.676**</td>
</tr>
<tr>
<td>14</td>
<td>0.840**</td>
</tr>
<tr>
<td>15</td>
<td>0.737**</td>
</tr>
<tr>
<td>16</td>
<td>0.834**</td>
</tr>
<tr>
<td>17</td>
<td>0.833**</td>
</tr>
</tbody>
</table>

Subscale 3: Difficulties students encountered during map construction

<table>
<thead>
<tr>
<th>Statement no.</th>
<th>Pearson's r</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>0.659**</td>
</tr>
<tr>
<td>19</td>
<td>0.722**</td>
</tr>
<tr>
<td>20</td>
<td>0.336*</td>
</tr>
</tbody>
</table>

Note. Pearson's $r$ is significant at $p<0.01$ and $p<0.05$.

Pearson's $r$ varies from -1 to +1, with 0 indicating no relationship. If Pearson's correlation coefficient value is +1, it indicates a perfect positive linear relationship, but if it is -1, so there is a perfect negative linear relationship between two variables (Dowdy & Wearden, 1983). As shown above, Pearson's $r$ ranges from 0.25 to 1 indicating a low to high degree of correlation between each subscale item and the total of items in each subscale.

Another measure of reliability known as Cronbach's alpha was used for the same questionnaire to examine how closely related a set of items are as a group. Alpha scores can be less than or equal to 1, but higher scores of alpha (those of 0.70 or higher) are desirable. The first subscale about the belief that CASM was helpful to student learning scored 0.90, whereas the one regarding the affective acceptance of CASM as a useful learning tool achieved 0.84. The alpha score for the third subscale about the difficulties students encountered during map construction was 0.84. In general, Cronbach's alpha for the whole questionnaire was computed to be 0.90 and this result indicates that the questionnaire is highly reliable.
3.6 Materials

The materials used for the experiment were mainly students' textbook *The Language of Medicine in English* by Ethel and Martin Tiersky, a SM program called FreeMind 0.8.1, and a classroom projector.

3.6.1 Student Textbook

114 NAJM is an ESP course offered to nursing students. The course aims at improving students' reading comprehension level and vocabulary. Additionally, students are required to memorize the medical information contained in the medical passages of their textbook. Hence, the textbook (*The Language of Medicine in English* by Ethel and Martin Tiersky) is primarily of medical passages followed by sections focusing on some medical terms and exercises. Exercises are reading comprehension exercises (T/F statements, WH-Questions, identifying causes and their effects, inferencing, etc.) and vocabulary exercises, including analyzing words and word parts, matching words with their meanings or synonyms, matching meronyms (parts such as organs) with holonyms (wholes exemplified by systems), etc. The researcher covered only five required chapters from the book, namely, "Highlights from the History of Medicine", "Human Anatomy", "Disease: Its Symptoms and Treatments", "Physicians and Medical Specialties", and "First Aid in Medical Emergencies". The reading passages in the textbook are considered to be lengthy passages and some studies such as those by Caverly, Mandeville, and Nicholson (1995) and Lipson (1995) employed texts of similar size.

3.6.2 FreeMind 0.8.1

FreeMind 0.8.1 (see Figure 3-2) is a free mind mapping program written in Java licensed under a free software license called the GNU General Public License. The program is used for creating mind maps. A mind map, as mentioned above, is a diagram of nodes representing ideas or words and arranged around a central concept (Tanaka, 2007, ¶4). The
program is notable for its ability in helping users in generating, classifying, and organizing ideas. It can also aid in problem solving and decision making (Tanaka, 2007, ¶ 5).

Figure 3-2. FreeMind 0.8.1 as it appears on a computer desktop.

FreeMind 0.8.1 has been chosen specifically among other mind mapping programs for different reasons. First, FreeMind 0.8.1 is a free downloadable program that can be easily installed on student computers. Second, the software has some features that makes it user friendly. For example, there is a navigation bar on the top of the workspace (see Figure 3-3) where a number of operations can be executed such as formatting text, adding, editing, removing, joining nodes and moving them around (Frey, 2006, ¶ 3). Also, there is a vertical toolbar on the left of the workspace with map icons for numbers and symbols (see Figure 3-3). In this way, nodes can be decorated using numbers, different fonts, colors, and arrows of various sizes. In addition, mind maps can be magnified and reduced in size using a drop-down box. Frey (2006, ¶ 5) mentioned that the ability of folding node branches is one of the program's most significant features. By clicking on parent nodes, all child nodes below them will disappear from view and hence any visual clutter (caused by the large number of child nodes) will be reduced (see Figure 3-4 & 3-5). Further, Freemind 0.8.1 makes rearranging topics much easier for users by dragging and dropping one node or multiple nodes. Smart drag and drop is not peculiar to nodes only, but also texts and lists of files. Besides smart drag and drop, smart copy and paste allows users to work on texts from Microsoft Office applications. Furthermore, users can create links to web pages and local folders and they can remove such links through a "remove link" command when one clicks on the selected map...
node. Also, created semantic maps can be exported to HTML, XHTML, PDF, SVG, PNG, and JPEG (Tanaka, 2007, ¶ 5). When a semantic map is exported to HTML or XHTML, an outline will be created out of this map (see Figure 3-6). The program is of three modes: (a) mindmap mode (for creating semantic maps), (b) browse mode for reviewing program operations and ways of executing them (see Figure 3-7), and (c) file mode (for browsing files on one's computer).

**Figure 3-3.** Freemind workspace.

**Figure 3-4.** A semantic map before folding node branches.
I. ANCIENT MEDICINE

1. Introduction

The practice of medicine is one of the oldest professions. Some of the methods used by ancient healers are amusing to modern people. Some of the old methods are still used today.

2. Causes of illness

1. Evil spirits
2. Angry gods

3. Cures of illness

1. Spells, charms, and prayers
2. Specific foods
3. Still used today...
   1. Aspirin
   2. Trephining

Def. a surgery in which a hole was cut in the skull to relieve pressure on the brain

4. Folk wisdom

Passed down through generations.

Ex.

1. Cold-dirty sock around the neck
2. Leg cramps-upside-down shoes under the bed
3. Earache-tobacco juice
4. Asthma-black pepper & lard
5. Pregnant women shouldn't hang clothes on a clothesline

Figure 3-5. The same semantic map after folding node branches.
5. Hippocrates

1. Born in Greece in 460 B.C.
2. Father of Medicine
   1. Separated medicine from religion
   2. Hippocratic oath
      1. Respect human life
      2. Respect doctor/patient confidentiality

6. Pre-Christian Egypt

Doctor's routine established
1. Symptoms
2. Examination
3. Therapy
4. Prognosis

7. Middle East-2040 B.C.

Babylonian Code of Hammurabi
1. Proper conduct of physicians
2. Punishments for malpractice

8. Far East-India

1. The relationship between malaria & mosquitoes was discovered
2. 700 medicinal plants discovered
3. 100 surgical instruments were invented
4. Susruta (5th century A.D.)
   1. Treated fractures
   2. Removed tumors
   3. Performed Caesarean deliveries

9. Far East-China

Use of acupuncture
1. To treat diseases
2. To control chronic pain
3. How and why it works not known
4. Some believe that it releases painkilling chemicals such as...
   1. Endorphins
   2. Enkephalins

10. Galen-2nd century A.D.

1. Insisted on the study of anatomy
2. But his anatomical research was on animals, not on humans

*Figure 3-6. An outline created from exporting a semantic map to XHTML.*
Figure 3-7. The browse mode of FreeMind 0.8.1.

3.7 Treatment

The present study was of 12 weeks from the 14th of October to the 13th of January. The control group (n = 26) received traditional in-class instruction, whereas the experimental group (n = 32) was exposed to a combination of traditional in-class instruction and SM treatment that lasted 8 weeks. Both groups were taught by the researcher. The following sections will elaborate on the stages that the treatment went through.

3.7.1 The Orientation Week & the Pre-test (Week 1)

The researcher met both groups on a weekly basis for three hours on Wednesdays. Three hours (from 8 to 11) were allocated for the experimental group (Group A) and other three (from 11 to 2) for the control group (Group B). When the researcher met the participants of this study for the first time, a number of issues were discussed regarding attendance, marks and homework. Students were urged to attend classes regularly and to do their homework. They have been told that they would be exposed to a technique that might
help them understand medical passages, acquiring new vocabulary items, and could aid in summarizing medical passages and revision for tests. Additionally, participating subjects were told that their performance on the SM tasks would not affect their original course score. During the first week, students of both groups were given the pre-test without any previous notice. Two hours have been allocated for the pre-test (one hour for the reading test, 30 minutes for the vocabulary test, and 30 minutes for the recall test). As mentioned above, the aim of the pre-test was to assess student reading and vocabulary skills and to evaluate their knowledge regarding the information represented in the test. Additionally, the pre-test was used in this study to ensure that both groups are comparable to each other and to attribute any resultant differences in student performance after the intervention to the treatment itself and not to any preexisting differences.

3.7.2 The SM Training Session (Week 2)

SM can be very effective only if students received instruction on using it or minimally were introduced to the purpose of the technique (Carnes, Lindbeck, & Griffin, 1987; Clements-Davis & Ley, 1991). Therefore, students of the experimental group were given a training session on the use of FreeMind 0.8.1 during Week 2. Before explaining how the program could be used to create semantic maps, the teacher elaborated on the effectiveness of SM in organizing notes and in developing care plans that illustrate the nursing process. Then, students were shown examples of tabular care plans and those developed through mind mapping. They were asked to follow two links necessary for downloading the program. The first link is http://java.com/en/download/index.jsp to install Java Runtime Environment for those who do not have the Java software. The second link is mainly for downloading FreeMind 0.8.1 http://sourceforge.net/projects/freemind/files/freemind/0.8.1/FreeMind-Windows-Installer-0.8.1-min.exe/download. As for the text used in the training session, the passage below was
taken from Stephen Korsman's article "Vaccines" and has been mapped using the mind mapping program. The text has been chosen specifically because it has a clear main idea and well-organized supporting details.

The concept of vaccination was practiced in ancient China, where pus from smallpox patients was inoculated onto healthy people in order to prevent naturally acquired smallpox. This concept was introduced into Europe in the early 18th century, and in 1796, Edward Jenner did his first human experiments using cowpox to vaccinate (vacca is Latin for cow) against smallpox. In 1931, viral growth in embryonated hens eggs was discovered, and in the 1940s, the US military developed the first approved inactivated vaccines for influenza, which were used in the Second World War (Baker 2002, Hilleman 2000). Greater advances were made in vaccinology and immunology, and vaccines became safer and mass-produced. Today, thanks to the advances of molecular technology, we are on the verge of making influenza vaccines through the genetic manipulation of influenza genes (Couch 1997, Hilleman 2002).

To help students use the program in creating mind maps, students were first asked to identify the main idea and the supporting details of the passage. With the help of the teacher, the supporting details were identified. Using the program and an LCD projector, a central node of the main idea (or the topic) of the paragraph with its child nodes representing the supporting details were created. A mind map is developed outward into branches and sub-branches. Thus, students were encouraged to use different colors for different branches and sub-branches. Arrows and lines are used to connect nodes together and hence students were required to make such lines thicker as they branch from the central node and thinner as they radiate from branches and sub-branches. In this way, students can proceed from general concepts in the centre to more specific ones on each side of the map (Al-Jarf, 2009). Besides colors and arrows of different sizes, students were urged to use numbers to show the
arrangement of ideas in a paragraph. They were also asked to include symbols as well as images because they make semantic maps more appealing for learners. A semantic map is known for its open-ended nature and hence students can add to their maps and make adjustments whenever possible.

In the training session, students were given instructions on how to insert parent, child, and sibling nodes; how to change the color of nodes and lines; and how to create arrows of different sizes and styles. Additionally, students were trained on the insertion of images, symbols, and numbers into maps; the printing out of maps; and the exporting of maps to HTML, PNG, and JPEG. Attention was also paid to editing, folding, and removing nodes; changing font and map size, and encouraging students to develop their mapping style. However, the instructor was not interested in explaining the details of the program as much as how students could create comprehensible maps. Students continued to use the program at home to explore it and to create maps and the instructor answered student questions and provided technical support whenever necessary. The resultant mind map based on the text on the history of vaccination is shown below (see Figure 3-8).

Figure 3-8. The semantic map created during the SM training session.
3.7.3 Description of the Treatment (Weeks 3-10)

Week 3 was marked as the first week of the experiment, which lasted eight weeks. The researcher met both groups on a weekly basis for three hours on Wednesdays. Three hours (from 8 to 11) were allocated for the experimental group (Group A) and other three (from 11 to 2) for the control group (Group B). Both groups were taught the same textbook (*The Language of Medicine in English* by Ethel and Martin Tiersky) assigned by COLT. The teacher taught only five chapters from the book with both groups. Students in each group were required to do textbook vocabulary and reading exercises. Each chapter was completed over two weeks (five hours or so), and the book was covered over eight weeks.

The control group (Group B) was taught in a traditional way, whereas the intervention group (Group A) was exposed to the technique of SM and was required to map medical passages and medical terms using FreeMind 0.8.1. With the control group, the instructor would start explaining the meanings of the key terms listed after each medical passage in each chapter. Then, the teacher would go back to the passage to explain each paragraph. After that, students of the control group were asked to do the exercises and their answers were shared and discussed among the group. On the other hand, participants of the treatment group received the following instruction:

1. As mentioned above, each medical passage is followed by a section on the important medical terms of the passage and their definitions. Thus, keywords (pertinent to the chapter) were introduced by the teacher to be mapped. First, the teacher introduced one important keyword mentioned in the chapter and asked students to think of other words related to it to activate their prior knowledge. Using the SM software, the projector, and a laptop, students' responses were documented and the teacher asked students to find ways of categorizing such words and connecting them to each other. Hence, students worked with the
teacher and individually to map some medical terms of the passage by identifying their synonyms, antonyms, definitions (see Figure 3-9), derivatives, etc., or by finding other medical terms that share with the key one its prefix, suffix, or its root (see Figure 3-10), or identifying meronyms and holonyms (see Figure 3-11).

**Figure 3-9.** A semantic map showing some words and their definitions.

**Figure 3-10.** A student-created semantic map showing words that share the same prefix.
Figure 3-11. A map of the respiratory system (as a holonym) and its organs (meronyms).

2. For mapping medical passages, the teacher first wrote the chapter title and encouraged students through questioning to think of other concepts related to the one in question.

3. Some of the generated concepts are considered to be subheadings related to the one suggested earlier by the teacher.

4. The first constructed map was of the chapter title and its subheadings (see Figure 3-12).
Figure 3.12. A semantic map showing one chapter title and its subheadings.

5. For each subheading, there is a paragraph or two explaining it in the book chapter.

6. Before reading paragraphs of subheadings, students' prior relevant knowledge was activated to generate ideas, facts, and details pertinent to such subtopics. Students' contributions were documented.

7. The teacher or a student (when called on) would then read the paragraphs of each subheading to find more ideas and supporting details that were later added to each subheading map (see Figure 3.13).

Figure 3.13. A map showing a subheading with its supporting details.
8. When SM was used as a post-reading strategy, students were encouraged to work individually and their contributions were discussed and shared.

9. The teacher with her students created one major semantic map that is representative of the chapter title and its subheadings and others that elaborated on the chapter subheadings.

10. After the completion of the map, the teacher read aloud the content of the map as a summary of the whole text.

11. The students were asked to do the textbook exercises and were encouraged to do them without going back to the text. In this way, students would try to remember what have been mapped earlier through SM.

12. The teacher assigned some paragraphs and terms as homework, so that students would use the software at home and their computer-generated maps would be discussed later on. When the instructor assigned some paragraphs to be mapped by students, the skeleton of mind maps representing such paragraphs (with some information filled in) was given to students during the first three weeks of the experiment (see Figure 3-14). Students were then required to create mind maps of paragraphs from scratch. Information represented on the maps should not differ greatly from one person to another. Maps demonstrating student input and involving students' interaction with the teacher or among themselves can be extremely effective (Darch, Carnine, & Kammeenui, 1986; Gallego, Duran, & Scanlon, 1989). As students reached the end of the intervention, they were able to map more paragraphs and more medical terms. Maps created by students ranged from re-focused semantic maps (teacher-directed emphasis) to general semantic maps (student-generated) made towards the end of the treatment.
13. When revising for exams, the experimental group used semantic maps to aid them in revision.

As shown above, SM has been used as a pre-learning activity (to activate student prior knowledge), as a during-reading activity (to enhance student understanding of the passages), and as a post-reading activity (to review and summarise the information presented in class). This last use of SM can be adopted by instructors if they want to assess student understanding of reading passages.

3.7.4 The Post-test and Questionnaire (Weeks 11-12)

The post-test was given to students of both groups during Week 11 and without any previous notice. As mentioned above, the purpose of the post-test was to measure any change in student performance after the treatment through comparing pre- and post-test results of both groups. Two hours have been allocated for the post-test (one hour for the reading test, 30 minutes for the vocabulary test, and 30 minutes for the recall test). Any detected progress may help one draw conclusions about the technique utilized in this study. One week later, students of the intervention group were given an attitude questionnaire to examine their
attitudes towards the technique of SM. Students were not asked to write their names on the questionnaire sheets since the purpose of such questionnaire was to obtain honest responses from participants. Thus, students were urged to give honest and objective responses with regard to the technique implemented.

3.7.5 Data Analysis

To analyze the obtained data, the researcher used descriptive statistics to describe the basic features of the collected data. Descriptive statistics are necessary to show the distribution, the central tendency (mean, median, and mode), and the dispersion (standard deviation) of data. Inferential statistics such as the independent samples t tests, the paired samples t tests, and the Pearson product-moment correlation coefficient were used to compare the mean scores of both groups, to measure student progress in each group, and to compare student performance on one post-test with that of another.

3.8 Summary

In brief, the present study targeted nursing students taking an ESP course offered by COLT. To achieve the purpose of the study, the nonequivalent-control-group design was followed, and students were divided into two groups: experimental (n = 32) and control (n = 26). The control group received traditional in-class instruction that depends on the textbook only (The Language of Medicine in English by Ethel and Martin Tiersky) and the experimental group received a combination of traditional in-class instruction and SM treatment using FreeMind 0.8.1. The semantic-mapping intervention lasted 8 weeks.

A pre- and post-test was set to assess student reading and vocabulary skills before and after the treatment, and it was also used to evaluate student knowledge of the information represented in the test. Additionally, an attitude questionnaire was administered at the end of the experiment to explore students' attitude towards the SM technique. To analyze the collected data, a series of t test statistics procedures and descriptive analyses have been used.
Chapter 4

Date Analysis and Discussion of Results

4.1 Introduction

This chapter presents and analyzes the data collected from the attitude questionnaire and the pre- and post-test. It also discusses the results obtained and compares them to those of previous research. The collected data were used to answer the following questions:

1. Does CASM improve nursing students' comprehension of medical texts?
2. Is CASM an effective technique for increasing nursing students' knowledge of medical terms?
3. Does CASM help in promoting students' recall ability of medical texts?
4. Do nursing students show any positive attitudes towards the technique of CASM?

To analyze the results of the pre- and post-test, the researcher used the independent samples $t$ test. The $t$ test was used to analyze pre-test results to ensure that the control and the intervention groups were equivalent. For the post-test, the same test was used to measure to what extent the treatment was effective. The analyses conducted to derive results from the obtained data are the following:

1. Results of the independent samples $t$ test of the two groups in the pre- and post-test designed to measure student reading performance.
2. Results of the independent samples $t$ test of both groups in the pre- and post-test set to examine any increase in student vocabulary.
3. Results of the independent samples $t$ test of both groups in the pre- and post-test intended to detect any improvement in student recall ability.
4. Results of a series of paired samples $t$ tests investigating whether student mean scores significantly increased on the posttest.
5. Results of the Pearson product-moment correlation coefficient investigating the
relationship between student performance (of the same group) on the post-tests.

6. Descriptive analyses and percentages of student responses to each questionnaire item set to investigate student attitudes towards CASM.

The results of the above mentioned tests along with reference to some research papers are discussed in detail in the following sections.

4.2 Testing Research Questions

The following section dwells on the findings related to the four questions raised in this study.

4.2.1 Testing Question One

The first research question poses: Does CASM improve nursing students' comprehension of medical texts?

To answer this question, one needs to compare the reading performance of students in both groups before and after the treatment. The pre-test was crucial in determining the initial equivalence between the experimental and the control groups. To ensure the equality of both groups, the researcher used the independent samples \( t \) test. Results of the reading pre-test (see Table 4-1) showed that there was no significant difference between the two groups. The mean score of the experimental group \((n = 32)\) was \((13.25)\) with a standard deviation (SD) of \((3.182)\), whereas the control group \((n = 26)\) scored \((14.88)\) with a SD of \((4.245)\). As shown in Table 4-1, the Sig. (2-tailed) was \((0.099)\) and it is greater than \((0.05)\) and hence one can conclude that there was no significant difference in the mean scores for each of the two groups before carrying out the experiment.
Table 4-1

*Reading Pre-test Results Using the Independent Samples t Test*

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case group</td>
<td>32</td>
<td>13.25</td>
<td>3.182</td>
<td>-1.675</td>
<td>.099</td>
</tr>
<tr>
<td>Control group</td>
<td>26</td>
<td>14.88</td>
<td>4.245</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The probability of error (*P*-value) is significant if it is equal or less than .05.

To figure out if CASM has improved the reading ability of the experimental group, the independent samples *t* test was used to analyze reading post-test results. Table 4-2 showed that the mean score of the experimental group was (16.18) with a SD of (2.693) and that the control group scored (16.11) with a SD of (3.141). Table 4-2 revealed that the Sig. (2-tailed) was (0.925) and it is greater than (0.05) indicating no significant difference between both groups after the intervention.

Table 4-2

*Reading Post-test Results Using the Independent Samples t Test*

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case group</td>
<td>32</td>
<td>16.18</td>
<td>2.693</td>
<td>.094</td>
<td>.925</td>
</tr>
<tr>
<td>Control group</td>
<td>26</td>
<td>16.11</td>
<td>3.141</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The probability of error (*P*-value) is significant if it is equal or less than .05.

Besides the analyses presented above, the researcher used the paired samples *t* test to measure any increase in student reading ability by comparing student mean scores (of the same group) in the pre-test with those of the post-test. As shown in Table 4-3, the pre-test mean score of the experimental group was (13.25) while their post-test mean score was (16.18). The Sig (2-tailed) was (.000) and it is less than (0.05) indicating a significant difference between student performance on both tests in favor of the post-test.
Table 4-3

Paired Samples t Test for the Difference in Reading Comprehension Between the Pre- and Post-test of the Case Group

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>13.25</td>
<td>32</td>
<td>3.182</td>
<td>-5.632</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>16.18</td>
<td>32</td>
<td>2.693</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The probability of error (P-value) is significant if it is equal or less than .05.

On the other hand, the pre-test mean score of the control group was (14.88) while their post-test mean score was (16.11). As shown in table 4-4, the Sig (2-tailed) was (0.136) and it is greater than (0.05) indicating no significant difference between student performance on both tests.

Table 4-4

Paired Samples t Test for the Difference in Reading Comprehension Between the Pre- and Post-test of the Control Group

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>14.88</td>
<td>26</td>
<td>4.245</td>
<td>-1.541</td>
<td>.136</td>
</tr>
<tr>
<td>Post-test</td>
<td>16.11</td>
<td>26</td>
<td>3.141</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The probability of error (P-value) is significant if it is equal or less than .05.

From the results cited above, it is clear that the control group's performance in reading comprehension did not progress during the period of the experiment as opposed to that of the experimental group whose reading comprehension level has improved but that improvement did not result in any significant difference between both groups. Thus, one can hardly attribute this improvement to the treatment. To answer the first question in this study, it could be concluded that CASM did not improve nursing students' comprehension of medical texts. Hence, the researcher would accept the null hypothesis that states that the
difference between both groups after the treatment is equal to zero.

4.2.2 Testing Question Two

The second research question asks: Is CASM an effective technique for increasing nursing students' knowledge of medical terms?

To answer this question, one needs to compare student performance in both groups before and after the treatment. The pre-test was used to ensure that both groups were equivalent before carrying out the experiment. To ensure the equality of both groups, the researcher used the independent samples t test. Results of the vocabulary pre-test (see Table 4-5) showed that there was no significant difference between the two groups. The mean score of the experimental group (n = 32) was (16.31) with a standard deviation (SD) of (4.496), whereas the control group (n = 26) scored (16.34) with a SD of (4.947). As shown in Table 4-5, the Sig. (2-tailed) was (0.978) and it is greater than (0.05) and hence one can conclude that there was no significant difference in the mean scores between the two groups before the commencement of the treatment.

Table 4-5

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case group</td>
<td>32</td>
<td>16.31</td>
<td>4.496</td>
<td>-.027</td>
<td>.978</td>
</tr>
<tr>
<td>Control group</td>
<td>26</td>
<td>16.34</td>
<td>4.947</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The probability of error (P-value) is significant if it is equal or less than .05.

To find out if CASM has increased the vocabulary range of students in the experimental group, the independent samples t test was used to analyze vocabulary post-test results. Table 4-6 showed that the mean score of the experimental group was (28.21) with a SD of (1.929) and that the control group scored (25.15) with a SD of (3.966). Table 4-6 showed that the Sig. (2-tailed) was (.000) and it is less than (0.05) indicating a significant
difference between both groups favoring the case group.

Table 4-6

**Vocabulary Post-test Results Using the Independent Samples t Test**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case group</td>
<td>32</td>
<td>28.21</td>
<td>1.929</td>
<td>3.608</td>
<td>.000</td>
</tr>
<tr>
<td>Control group</td>
<td>26</td>
<td>25.15</td>
<td>3.966</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The probability of error (P-value) is significant if it is equal or less than .05.

Besides the analyses presented above, the researcher used the paired samples t test to measure any increase in student vocabulary by comparing student mean scores (of the same group) in the pre-test with those of the post-test. As shown in Table 4-7, the pre-test mean score of the experimental group was (16.31) while their post-test mean score was (28.21). The Sig (2-tailed) was (.000) and it is less than (0.05) indicating a significant difference between student performance on both tests in favor of the post-test.

Table 4-7

**Paired Samples t Test for the Difference in Student Vocabulary Between the Pre- and Post-test of the Case Group**

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>16.31</td>
<td>32</td>
<td>4.496</td>
<td>-18.923</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>28.21</td>
<td>32</td>
<td>1.929</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The probability of error (P-value) is significant if it is equal or less than .05.

On the other hand, the pre-test mean score of the control group was (16.34) while their post-test mean score was (25.15). As shown in Table 4-8, the Sig (2-tailed) was (.000) and it is less than (0.05) indicating a significant difference between student performance on both tests favoring the post-test.
Table 4-8

Paired Samples t Test for the Difference in Student Vocabulary Between the Pre- and Post-test of the Control Group

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>16.34</td>
<td>26</td>
<td>4.947</td>
<td>-10.357</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>25.15</td>
<td>26</td>
<td>3.966</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The probability of error (P-value) is significant if it is equal or less than .05.

From the results advanced above, student vocabulary of both groups has increased significantly, but students of the treatment group outperformed those of the control group. One can conclude that this significant increase in the vocabulary of the experimental group was due to the use of CASM. As a result, the researcher would reject the null hypothesis and would state that CASM is an effective technique for increasing students' knowledge of medical terms.

4.2.3 Testing Question Three

Research question three poses: Does CASM help in promoting students' recall ability of medical texts?

To answer this question, one needs to compare student performance in both groups before and after the treatment. The pre-test was used to ensure that both groups were comparable to each other before executing the experiment. To ensure the equality of both groups, the researcher used the independent samples t test. Results of the recall pre-test (see Table 4-9) showed that there was no significant difference between the two groups. The mean score of the experimental group (n = 32) was (12.43) with a standard deviation (SD) of (3.340), whereas the control group (n = 26) scored (11.57) with a SD of (2.715). As shown in Table 4-9, the Sig. (2-tailed) was (0.294) and it is greater than (0.05) and hence one can conclude that there was no significant difference in the mean scores for each of the two
groups before the commencement of the treatment.

Table 4-9

Recall Pre-test Results Using the Independent Samples t Test

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case group</td>
<td>32</td>
<td>12.43</td>
<td>3.340</td>
<td>1.059</td>
<td>.294</td>
</tr>
<tr>
<td>Control group</td>
<td>26</td>
<td>11.57</td>
<td>2.715</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The probability of error (P-value) is significant if it is equal or less than .05.

To find out if CASM has improved student recall ability of those in the experimental group, the independent samples t test was used to analyze vocabulary post-test results. Table 4-10 showed that the mean score of the experimental group was (23.21) with a SD of (3.386) and that the control group scored (16.61) with a SD of (3.034). Table 4-10 showed that the Sig. (2-tailed) was (.000) and it is less than (0.05) indicating a significant difference between both groups favoring the case group.

Table 4-10

Recall Post-test Results Using the Independent Samples t Test

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case group</td>
<td>32</td>
<td>23.21</td>
<td>3.386</td>
<td>7.823</td>
<td>.000</td>
</tr>
<tr>
<td>Control group</td>
<td>26</td>
<td>16.61</td>
<td>3.034</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The probability of error (P-value) is significant if it is equal or less than .05.

Besides the analyses presented above, the researcher used the paired samples t test to measure any improvement in student recall ability by comparing student mean scores (of the same group) in the pre-test with those of the post-test. As shown in Table 4-11, the pre-test mean score of the experimental group was (12.43) while their post-test mean score was (23.21). The Sig (2-tailed) was (.000) and it is less than (0.05) indicating a significant difference between student performance on both tests in favor of the post-test.
Table 4-11

Pairied Samples t Test for the Difference in Student Recall ability Between the Pre- and Post-test of the Case Group

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>12.43</td>
<td>32</td>
<td>3.340</td>
<td>-20.168</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>23.21</td>
<td>32</td>
<td>3.386</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The probability of error (*P*-value) is significant if it is equal or less than .05.

On the other hand, the pre-test mean score of the control group was (11.57) while their post-test mean score was (16.61). As shown in Table 4-12, the Sig (2-tailed) was (.000) and it is less than (0.05) indicating a significant difference between student performance on both tests favoring the post-test.

Table 4-12

Pairied Samples t Test for the Difference in Student Recall Ability Between the Pre- and Post-test of the Control Group

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>SD</th>
<th>t-Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>11.57</td>
<td>26</td>
<td>2.715</td>
<td>-7.664</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>16.61</td>
<td>26</td>
<td>3.034</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The probability of error (*P*-value) is significant if it is equal or less than .05.

From the results advanced above, student recall ability of both groups has improved significantly, but students of the treatment group excelled those of the control group. One can conclude that this significant improvement in student recall ability of those in the experimental group was due to the use of the technique of CASM. As a result, the researcher would reject the null hypothesis and would state that CASM helped in promoting students' recall ability of medical texts.
4.2.4 The Correlation between Post-test Results

The researcher has administered three different tests (vocabulary, reading and recall tests) to students of both groups and thus one needs to examine the correlation between student performance (of the same group) on the three post-tests. The Pearson product-moment correlation coefficient was computed to assess the relationship between students' scores on the reading post-test and on the vocabulary post-test, students' performance on the reading post-test and on the recall post-test, and finally the relationship between students' recall post-test results and those of the vocabulary post-test. Table 4-13 showed the correlation of the three post-tests of the experimental group.

Table 4-13

<table>
<thead>
<tr>
<th></th>
<th>Reading</th>
<th>Vocabulary</th>
<th>Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Pearson correlation</td>
<td>1</td>
<td>.166</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.</td>
<td>.365</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Pearson correlation</td>
<td>.166</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.365</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Recall</td>
<td>Pearson correlation</td>
<td>-.171</td>
<td>.590**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.350</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>

*Note: **. Correlation is significant at the 0.01 level (2-tailed).*

For the experimental group, the correlation between vocabulary post-test results and their recall post-test results was (.590**). The result revealed a strong, positive, significant correlation between student vocabulary post-test results and their recall post-test results.
Increases in one measure were correlated with increases in another measure and decreases in one set of scores were associated with decreases in another. In addition, the correlation between student performance on reading and that on vocabulary was (.166) indicating a weak, positive relationship between both post-test scores. As for student scores on reading and recall post-tests, the correlation was (-.171) which showed a weak, negative relationship between both sets of scores. Any increase in student scores on one test was accompanied by a decrease on another test. One can conclude that students of the experimental group performed similarly on vocabulary and recall post-tests, but not on the reading post-test.

Regarding the control group, Table (4-14) showed the correlation between student performance on the three post-tests.

Table 4-14

The Correlation of the Three Post-tests of the Control Group

<table>
<thead>
<tr>
<th></th>
<th>Reading</th>
<th>Vocabulary</th>
<th>Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Pearson correlation</td>
<td>1</td>
<td>.679**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Pearson correlation</td>
<td>.679**</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.</td>
<td>.001</td>
</tr>
<tr>
<td>N</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Recall</td>
<td>Pearson correlation</td>
<td>.655**</td>
<td>.593**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.001</td>
<td>.</td>
</tr>
<tr>
<td>N</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
</tbody>
</table>

Note. **. Correlation is significant at the 0.01 level (2-tailed).

Table 4-14 indicated that there was a strong, positive, significant relationship between student scores on vocabulary and recall post-tests (.593**), between their scores on reading
and vocabulary post-tests (.679**), and their scores on reading and recall post-tests (.655**). Increases in one test were accompanied by increases in another test. Students of the control group performed similarly on the three post-tests.

### 4.2.5 Testing Question Four

The fourth research question asks: Do nursing students show any positive attitudes towards the technique of CASM?

To answer this question, the researcher used the five-point Likert questionnaire shown in Appendix B to gather data. The 20-item questionnaire was administered to the participants of the experimental group at the end of the semester to explore their attitudes towards the technique of SM. The questionnaire was divided into three subscales exploring the belief that CASM was helpful to student learning, the acceptance of CASM as a useful learning tool, and the difficulties students encountered during their map construction. Each questionnaire item consists of a five-point rating scale and coded as follows: 5 = Strongly agree, 4 = Agree, 3 = Neutral, 2 = Disagree and 1 = Strongly disagree.

Students' responses to each questionnaire item have been calculated and converted into percentages. Using the SPSS programme, data were calculated as arithmetic means (\(\bar{X}\)). To facilitate the analysis of mean scores, one would consider the five coded categories mentioned above and would subtract the lowest code number (1) from the highest one (5) in this way 5-1=4. Then, the resultant range (4) would be divided by the number of categories (5). The result would be 4/5= 0.80 which represented the length of each category in the scale. After that, the length of the category was added to the lowest code number in the scale (1). Hence, the first and the lowest category was (1+.80= 1.80) to indicate strong disagreement (Dörnyei, 2003, P 96). The same process was applied to the rest of the categories. The levels of the average mean scores and their interpretation are presented in Table 4-15.
Table 4-15

*Levels of the Average Mean Scores and Their Interpretation*

<table>
<thead>
<tr>
<th>Levels of the average mean scores</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.20 to 5.00</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>3.40 to 4.20</td>
<td>Agree</td>
</tr>
<tr>
<td>2.60 to 3.40</td>
<td>Neutral</td>
</tr>
<tr>
<td>1.80 to 2.60</td>
<td>Disagree</td>
</tr>
<tr>
<td>0-1.80</td>
<td>Strongly disagree</td>
</tr>
</tbody>
</table>

The first subscale of the questionnaire is of 12 items set to investigate the belief that CASM was helpful to student learning. The following table shows the number of responses for each item, the percentage and some descriptive statistics (the mean scores out of five and standard deviations).

Table 4-16

*Students' Attitudes Towards the Belief That CASM Was Helpful to Student Learning*

<table>
<thead>
<tr>
<th>Rank</th>
<th>Statements</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5. CASM was useful for organizing lesson contents.</td>
<td>16</td>
<td>14</td>
<td>7</td>
<td>1</td>
<td>-</td>
<td>4.18</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42.1</td>
<td>36.8</td>
<td>18.4</td>
<td>2.6</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7. CASM was useful in summarizing medical texts.</td>
<td>14</td>
<td>18</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>4.13</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12. CASM helped in understanding the relationships between concepts.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>16</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>3.74</td>
<td>1.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23.7</td>
<td>42.1</td>
<td>21.1</td>
<td>10.5</td>
<td>2.6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>6. It is much easier to catch the essential concepts after map construction.</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>9</td>
<td>14</td>
<td>11</td>
<td>3</td>
<td>1</td>
<td>3.71</td>
<td>1.01</td>
</tr>
<tr>
<td></td>
<td>23.7</td>
<td>36.8</td>
<td>28.9</td>
<td>7.9</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>3. CASM improved my reading comprehension level.</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>8</td>
<td>16</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td>3.66</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>21.1</td>
<td>42.1</td>
<td>21.1</td>
<td>13.2</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>11. CASM helped me clarify the interrelationships among curriculum contents.</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>3.63</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td>26.3</td>
<td>28.9</td>
<td>28.9</td>
<td>13.2</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>2. CASM increased my vocabulary range.</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>6</td>
<td>16</td>
<td>8</td>
<td>6</td>
<td>2</td>
<td>3.47</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>15.8</td>
<td>42.1</td>
<td>21.1</td>
<td>15.8</td>
<td>5.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>8. CASM helped in revision for examination.</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>9</td>
<td>11</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3.45</td>
<td>1.25</td>
</tr>
<tr>
<td></td>
<td>23.7</td>
<td>28.9</td>
<td>23.7</td>
<td>15.8</td>
<td>7.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>9. CASM encouraged thinking more deeply.</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>7</td>
<td>12</td>
<td>11</td>
<td>7</td>
<td>1</td>
<td>3.45</td>
<td>1.08</td>
</tr>
<tr>
<td></td>
<td>18.4</td>
<td>31.6</td>
<td>28.9</td>
<td>18.4</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>4. CASM helped me improve my medical</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>5</td>
<td>14</td>
<td>13</td>
<td>5</td>
<td>1</td>
<td>3.45</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>13.2</td>
<td>36.8</td>
<td>34.2</td>
<td>13.2</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
knowledge.

<table>
<thead>
<tr>
<th></th>
<th>10. CASM stimulated me to think and learn</th>
<th>8</th>
<th>8</th>
<th>2</th>
<th>3.45</th>
<th>1.22</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>23.7</td>
<td>28.9</td>
<td>21.1</td>
<td>21.1</td>
<td>5.3</td>
</tr>
</tbody>
</table>

11

As shown above, statement one, *CASM helped me improve my English*, scored (3.37) as its mean score and consequently ranked twelfth in the same subscale. Thus, students' attitudes towards this statement were neutral as indicated in Table (4-15).

The second statement in the same scale was set to explore students' belief if CASM really increased their vocabulary range. The mean score of the statement was (3.47) with an overall rank of 7 out of 12. The mean score revealed that the subjects were in agreement on this point.

Statement three ‘*CASM improved my reading comprehension level*’ scored the fifth highest mean (3.66) indicating that students agreed on this statement.

As for statement four, *CASM helped me improve my medical knowledge*, the mean score was (3.45) and thus it was ranked tenth in the same subscale. The score showed students' favorable attitude towards this statement.

Statement five, *CASM was useful for organizing lesson contents*, ranked first because it scored (4.18). According to table (4-15), this score indicated that there was an agreement on this statement.

Similarly, the mean score of statement six ' *It is much easier to catch the essential*
concepts after map construction' was (3.71) and ranked at 4/12 which showed that the subjects agreed with this statement.

Statement seven aimed at finding out if CASM was useful in summarizing medical texts. The statement ranked second with a mean score of (4.13). The score showed that there was agreement on this statement.

For the eighth statement 'CASM helped in revision for examination', the ninth 'SM encouraged thinking more deeply', and the tenth 'CASM stimulated me to think and learn independently', the mean score was (3.45) and thus the statements ranked eighth, ninth, eleventh, respectively in the subscale. The score of the statements revealed that the subjects responded in agreement as they did with other statements.

For the last two statements, statement 11, CASM helped me clarify the interrelationships among curriculum contents, scored the sixth highest mean (3.63) and statement 12, CASM helped in understanding the relationships between concepts, had the third highest mean (3.74). Students, in general, showed agreement on these two statements.

As shown in Table (4-16), the grand mean of the whole scale was (3.64) which indicated that the participants believed that CASM was helpful to their learning. The mean scores of the majority of the statements were greater than (3.40), and hence students’ attitudes and perceptions on such statements were positive.

One more calculation is needed to arrive at the percentage of respondents who agreed that CASM was helpful to their learning. First, the number of statements that showed general agreement were added together and divided by the number of statements the subscale had, multiplied by 100. The same thing was done to neutral statements. As a result, 91% of the subjects agreed that CASM was helpful to their learning since items 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 scored between 3.40 and 4.20. Only 8% of the participants were undecided because only one statement scored (3.37).
The second subscale of the questionnaire is of five items set to figure out if students affectively accepted the technique of CASM as a useful learning tool. The means and standard deviations of student responses are tabulated in Table (4-17).

Table 4-17

*The Affective Acceptance of CASM as a Useful Learning Tool*

<table>
<thead>
<tr>
<th>Rank</th>
<th>Statements</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>14. I like the teacher using CASM as an instructional aid.</td>
<td>9</td>
<td>15</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>3.63</td>
<td>1.17</td>
</tr>
<tr>
<td></td>
<td>23.7</td>
<td>39.5</td>
<td>21.1</td>
<td>7.9</td>
<td>7.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>13. Learning the skill of CASM was easy.</td>
<td>10</td>
<td>12</td>
<td>6</td>
<td>8</td>
<td>2</td>
<td>3.53</td>
<td>1.25</td>
</tr>
<tr>
<td></td>
<td>26.3</td>
<td>31.6</td>
<td>15.8</td>
<td>21.1</td>
<td>5.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>16. I wish more teachers would use CASM in other courses.</td>
<td>11</td>
<td>8</td>
<td>11</td>
<td>5</td>
<td>3</td>
<td>3.50</td>
<td>1.27</td>
</tr>
<tr>
<td></td>
<td>28.9</td>
<td>21.1</td>
<td>28.9</td>
<td>13.2</td>
<td>7.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>15. I feel that CASM was enjoyable in general.</td>
<td>6</td>
<td>12</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>3.18</td>
<td>1.29</td>
</tr>
<tr>
<td></td>
<td>15.8</td>
<td>31.6</td>
<td>21.1</td>
<td>18.4</td>
<td>13.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>17. I would like to use CASM in my future studies.</td>
<td>5</td>
<td>8</td>
<td>14</td>
<td>8</td>
<td>3</td>
<td>3.11</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>13.2</td>
<td>21.1</td>
<td>36.8</td>
<td>21.1</td>
<td>7.9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

General mean 3.39 0.96
Table (4-17) showed that statement 13, *Learning the skill of CASM was easy*, ranked second in the subscale because it scored (3.53) and thus one can conclude that the respondents agreed on this point.

Similarly, statement 14, *I like the teacher using CASM as an instructional aid*, scored the highest mean in the subscale (3.63) which means that students really liked the fact that their teacher used CASM as an instructional aid.

As for statement 15 *'I feel that CASM was enjoyable in general'* , students gave a neutral response (3.18) and the statement ranked at 4/5.

Statement 16, *I wish more teachers would use CASM in other courses*, had the third highest rank because of its mean score (3.50). Hence, one can say that students agreed on this statement.

Similar to statement 15, students were neutral on statement 17, *I would like to use CASM in my future studies*. It had the lowest mean (3.11) in the subscale.

For this subscale, the grand mean was (3.39) which revealed that students showed neutral attitudes towards the technique of CASM as a useful learning tool.

To figure out the percentage of those showing neutral attitudes, the same procedure of calculation used on the previous subscale was applied here. Results revealed that 40% of the subjects showed neutral attitudes towards the usefulness of CASM because statements 15 and 17 scored (3.18) and (3.11), respectively. Yet, 60% of the participants believed that CASM was useful since statements 13, 14, and 16 scored between 3.40 and 4.20. Therefore, it would be concluded that more than 50% of the participants exhibited positive attitudes towards the technique of CASM as a useful learning tool.
Table 4-18

*Students' Attitudes Towards the Process of Map-construction*

<table>
<thead>
<tr>
<th>Rank</th>
<th>Statements</th>
<th>Strongly agree No.</th>
<th>Strongly agree %</th>
<th>Agree No.</th>
<th>Agree %</th>
<th>Neutral No.</th>
<th>Neutral %</th>
<th>Disagree No.</th>
<th>Disagree %</th>
<th>Strongly disagree No.</th>
<th>Strongly disagree %</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19. Constructing a semantic map using a computer software was helpful.</td>
<td>7</td>
<td>18.4</td>
<td>16</td>
<td>42.1</td>
<td>8</td>
<td>21.1</td>
<td>5</td>
<td>13.2</td>
<td>2</td>
<td>5.3</td>
<td>3.55</td>
<td>1.11</td>
</tr>
<tr>
<td>2</td>
<td>18. Constructing a semantic map using a computer software was interesting.</td>
<td>8</td>
<td>21.1</td>
<td>10</td>
<td>26.3</td>
<td>9</td>
<td>23.7</td>
<td>4</td>
<td>10.5</td>
<td>7</td>
<td>18.4</td>
<td>3.21</td>
<td>1.40</td>
</tr>
<tr>
<td>3</td>
<td>20. The increasing number of concept nodes and relation links made map-construction difficult.</td>
<td>8</td>
<td>21.1</td>
<td>10</td>
<td>26.3</td>
<td>7</td>
<td>18.4</td>
<td>8</td>
<td>21.1</td>
<td>5</td>
<td>13.2</td>
<td>3.21</td>
<td>1.36</td>
</tr>
</tbody>
</table>

The last three statements comprise a subscale of their own concerned with students' attitudes towards the process of map-construction. As shown above, statement 18, *Constructing a semantic map using a computer software was interesting*, had the mean score 3.21 with a standard deviation of 1.40.
of (3.21) and ranked second in the subscale. As shown in Table (4-15), the mean score revealed that students were neutral on this point.

Statement 19 'Constructing a semantic map using a computer software was helpful' scored the highest mean (3.55) in the subscale which indicated that students agreed on this statement.

Similar to statement 18, statement 20, The increasing number of concept nodes and relation links made map-construction difficult, scored (3.21) and had the lowest rank in the subscale which revealed that students gave a neutral response as they did with statement 18. Students were unable to decide whether the increasing number of links and nodes in a map made its construction difficult.

In general, the whole subscale had a mean score of (3.32) and according to Table (4-15) students were unable to express any satisfaction towards the process they went through in map-construction.

As for the percentage of respondents who manifested positive, neutral, or negative attitudes, the same procedure of calculation applied on the previous subscales was applied on this subscale. Results showed that only 33% were satisfied with the implemented process of map construction because only one statement scored between 3.40 and 4.20, whereas 66% were undecided on the same process since two statements scored between 2.60 and 3.40.

To conclude, the majority of the respondents showed positive attitudes towards the technique of CASM as a helpful tool, but they gave neutral responses when asked about the use of computer for map construction.

4.3 Discussion of Results

The first finding in this study manifested that there was no difference between the control and the experimental groups in reading comprehension after the treatment and that the CASM intervention did not lead to any significant difference between the two groups.
However, enough research exists in support of the use of SM as a valuable tool for reading comprehension (Berkowitz, 1986; Englert & Marlage, 1991; Margosein, Pascarella, & Pflaum, 1982; Reutzel & Fawson, 1991; Sinarta, Berg, & Dunn, 1985; El-Koumy, 1999; Siddiqi, 2007; McCarthy-Tucker, 1992; Brady, 1990; Coleman, 1995; Armbruster & Anderson, 1980). However, only few studies reported no effects of SM on student reading comprehension (Clements-Davis & Ley, 1991; Alvermann and Boothby, 1986; Dunston & Ridgeway, 1990). As noted by Hall and Strangman (2002), having studies on SM and reading comprehension with no discernable effects is attributable in the first place to some defects in the experimental designs of such studies.

As mentioned above, the present study yielded no positive effects in favor of the SM treatment on students' reading comprehension. One reason behind such finding is the clash between what the program used to reinforce (identifying the topic, the main idea, and its supporting details) and what the book and the tests focused on (inferencing and identifying causal relationships in a text). FreeMind 0.8.1, as a mind-mapping program, could not exhibit causal relationships in a text because making connections between nodes of the same level or of different levels was not possible. Also, inferencing is a higher-order thinking skill in which students need to work on the information explicitly mentioned in a text to arrive at other pieces of information that are implicit. Students, however, were trained to work on what is explicit to locate the main idea and its supporting details. They spent much of their time organizing information rather than comprehending it. Further, students' failure in making inferences and comprehending the test passages is attributed to their poor background knowledge. As noted by Ehren (2005), students sometimes lack the background knowledge necessary for comprehension and making inferences. The researcher had difficulties activating students' prior knowledge because students either lack good background knowledge related to what is explained in classes or cannot express what they
know in English. In recalling the findings of previous studies, Sinatra, Stahl-Gemake, and Berg (1984) mentioned that SM was ineffective in improving students' inferencing ability.

The Pearson product-moment correlation coefficient showed that the correlation between student performance on reading and that on vocabulary was (.166) indicating a weak, positive relationship between both post-test scores. Students' knowledge of medical terms has been significantly improved but this improvement did not lead to higher gains in reading comprehension. As noted by Johnson, Toms-Bronowski, and Buss (1983), Thorndike (1973, 1974), Laflamme (1997, p. 372), and Thurstone (1946), word knowledge is the most critical underlying component for reading comprehension. In this study, however, students with increased vocabulary could not comprehend the test passages. One reason for this finding is that the vocabulary emphasized in the student textbook was different from that embedded in the test passages. This lack of correlation between student performance on the reading post-test and that on vocabulary indicates that word knowledge is not the only predictor for text comprehension, but prior knowledge is equally important.

There are other reasons that may account for such findings. One reason has to do with the strategy itself. SM, as a metacognitive strategy, needs more of teacher modeling and student training. Students did not receive longer periods of training focusing on creating maps of reading passages. Previous research (Ruddell & Boyle, 1989; Caverly, Mandeville, & Nicholson, 1995; Boyle, 1996; Lipson, 1995) suggested that intensive training in the use of SM can result in significant gains in reading comprehension. One more reason has to do with students who failed sometimes to decide which details are important (should be mapped) and which are minor (should be discarded). When examining students' maps, one may notice that students sometimes tend to include all the information mentioned in the paragraph in the map because they feel secure doing so. Figure 4-1 (a student's map) and Figure 4-2 (a teacher's map) showed students' tendency to include unimportant information in
their maps.

**Figure 4-1.** A student's map showing the presentation of unimportant information.

**Figure 4-2.** A teacher's map showing the presentation of important information only.

The teacher used to see her students once a week and hence offering intensive training on what to include in maps was not possible. Thus, it is highly recommended that students
should spend more time comparing their maps to those of the teacher to verify their understanding of medical texts. According to Antonacci (1990), a "post-analysis" (p. 194) of students' maps should be conducted after map construction to ensure that students "connect ideas and integrate information" accurately (p. 175).

Nonetheless, analysis of the attitude questionnaire showed that students believed that SM helped them think more deeply, improve their reading comprehension level, was useful in summarizing medical texts and organizing lesson contents and was beneficial in showing the relationships between concepts. This discrepancy between students' perceptions and their performance on the post-test can be justified on the grounds that students witnessed some improvement in their reading comprehension especially in the skill of locating main idea and its supporting details. Consequently, other relevant strategies such as summarization strategies have been improved. Prior studies such as that of De Fina (1999) found no significant improvement in student comprehension in spite of students' positive attitudes towards the efficiency of SM in improving their comprehension. This discrepancy in De Fina's was due to the complexity and the length of the psychological passages, using the retelling procedure as a measure, and the limited time provided for the experiment. Other reasons include students focusing on the creation of the maps and not on the information represented within the map and the limited time allotted for students to display and discuss their maps after map creation.

Regarding the second finding, students' vocabulary of both groups has increased significantly but students of the experimental group outperformed those in the control group in the vocabulary post-test. Similar findings have been emphasized by Toms-Bronowski (1982) who mentioned that SM was more effective than the traditional contextual method for general vocabulary development. Similarly, Pittelman and Johnson (1985) noted that SM was a powerful pre-reading strategy because it introduced key vocabulary words and activated
students' prior knowledge about a certain topic. According to Vogt (1983), students recalled word meanings that are taught through SM more than those taught through the traditional method. Moreover, Moore and Readence (1984) stated that studies documenting significant increase in student vocabulary are two times greater than those reporting significant improvement in reading comprehension which justified the findings of this study.

The third research question asks if CASM really helps in promoting students' recall ability of medical texts. Both groups showed significant improvement in their recall ability, but students of the treatment group excelled those of the control group. Other studies appear to support this finding. Berkowitz (1986), for example, noted that student-generated maps were effective on free-recall of main ideas. Also, McCarthy-Tucker (1992) compared the effectiveness of SM to semantic-pictorial mapping and basal reader instruction and results showed that SM improved students' comprehension of reading passages and their information recall ability. Similarly, Armbruster and Anderson (1980) argued that SM helped students remember a great deal of the ideas represented in the passages they mapped and that the probability of recalling mapped ideas outweighed that of recalling unmapped ideas.

Furthermore, Vogt (1983) stated that students recalled word meanings that are taught through SM more than those taught through the traditional method in the free recall setting. Additionally, Alvermann and Boothby (1986) found that SM had a positive effect on ninth grade students’ retention of text.

The fourth research question addresses whether students receiving SM report positive attitudes towards the technique. The analyses results demonstrated that 91% of the subjects agreed that CASM was helpful to their learning since items 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 scored between 3.40 and 4.20. Similarly, Chang et al. (2001) mentioned that the majority of biology students viewed the technique as a useful one. Chang's students agreed that SM helped them "acquire the essential points of their learning materials" (p. 30). De Fina (1999)
argued that students found SM a valuable strategy despite the study results that revealed no progress in student comprehension. De fina's participants noted that SM was very efficient in organizing and summarizing information. Further, Santhanam et al. (1998) wrote that students viewed the mapping procedure as a helpful one and that SM aided them in developing "a deeper approach to learning" (p. 324). Chiou (2008) pointed out that students argued for the usefulness of the technique and that it helped them clarify the interrelationships among curriculum contents and motivated them to learn independently. Gardill and Jitendra (1999) indicated that students were more positive about the usefulness of SM because it helped them understand and remember stories.

Additionally, 60% of the participants in the present study affectively accepted the technique and endorsed it as a useful learning tool. They liked their teacher to use SM as an instructional aid. In Chang's and Chiou's studies, most of the students expressed positive opinions on this aspect. Chiou's accounting students added that SM can be easily applied to other courses and that learning how to map accounting concepts was easy for them. In this study, students also believed that using the computer in map formation was helpful. Sturm and Rankin-Erickson (2002) reported that their participants had a more affirmative attitude for "using computer-mapping than when writing in other conditions" (p. 136). They noted that computer-mapping made their maps more legible and organized. They further claimed that CASM "relieved some of the cognitive load" that accompanied map formation (p. 136).

4.4 Conclusion

This study aimed at exploring the effect of CASM on students' reading, vocabulary, and retention of mapped texts. Results showed that the technique did not lead to any significant difference between the experimental and the control group in reading comprehension. Yet, students of the experimental group made significantly greater gains on the vocabulary and recall tests. Further, the overwhelmingly majority of the participating
students were of the opinion that SM was a useful instructional strategy. Such findings are consistent with those of previous research.
Chapter 5

Summary, Implications and Suggestions

5.1 Introduction

This concluding chapter gives an overview of the study and summarizes its findings. In addition, the theoretical and practical implications of the present study are provided. The last section proposes some suggestions for further research.

5.2 Overview of the Study and Summary of its Findings

Nursing students at KSU are considered to be poor readers. They face difficulties with understanding and recalling medical texts due to the fact that they lack some necessary medical vocabulary knowledge. Thus, the researcher used CASM with level-three nursing students to map medical terms and medical passages for the purpose of helping such students in vocabulary acquisition and text recall and comprehension. The present study, therefore, aimed at investigating the efficiency of CASM in improving ESP students' reading comprehension level and vocabulary knowledge. It also explored the effectiveness of CASM in enhancing students' ability for information retrieval and documented students' attitudes towards the technique of SM.

The researcher chose a quasi-experimental design known as the nonequivalent-control-group design to carry out the experiment. Participating subjects were of two groups: Group A (n = 32) and Group B (n = 26). The control group (n = 26) received traditional in-class instruction that depends on the textbook only (The Language of Medicine in English by Ethel and Martin Tiersky) and the experimental group (n = 32) received a combination of traditional in-class instruction and SM instruction using a software (FreeMind 0.8.1). The semantic-mapping treatment lasted 8 weeks.

To achieve the purpose of this study, quantitative tools have been used to collect data. These include a pre- and post-test set to assess student reading and vocabulary skills before
and after the treatment. The tests were also used to evaluate student knowledge of the information represented in the test. Additionally, an attitude questionnaire was administered at the end of the experiment to explore student attitudes towards the technique of CASM.

A series of $t$ test statistics procedures and descriptive analyses have been used to analyze the study results. Reading pre-test results showed that the two groups were comparable to each other prior to the treatment. Similarly, post-test results showed that there was no statistically significant difference between both groups after the intervention. One reason behind such finding is the emphasis paid to identifying main ideas and supporting details in a text and not to inferencing and understanding causal relationships in the same text. Further, students lack some necessary background knowledge that might aid them in making inferences and in comprehension. Also, SM, as metacognitive strategy, needs more of teacher modeling and student training. Students had difficulties with mapping reading passages because they did not know what to include in a map and what to ignore. Nevertheless, students believed that SM was effective in promoting their reading ability.

Regarding students' performance in the vocabulary and recall tests, pre-test results revealed that there was no difference between the two groups before carrying out the experiment. However, an analysis of students' scores on the post-tests indicated that the experimental group achieved significantly greater gains than the control group. Lack of correlation between student performance on the reading post-test and that on vocabulary indicates that word knowledge is not the only predictor for text comprehension, but prior knowledge is equally important.

Results based on frequency distribution of subjects’ responses to the attitude questionnaire showed that 91% of the subjects argued for the effectiveness of SM in student learning and 60% of the participants affectively accepted SM as a useful learning tool. However, 66% expressed uncertainty with some of the SM's procedures.
5.3 Implications of the Study

The present study suggests some theoretical and pedagogical implications that need to be highlighted in the following paragraphs.

Theoretically, this study reinforces the role of prior knowledge in helping students acquire new information. As suggested by this research, background knowledge and word knowledge are equally essential for reading comprehension. Certainly, the technique of SM aided learners in vocabulary acquisition and helped them relate new information to old one.

Pedagogically, the present study emphasizes the role of computer in classrooms. Computer programs can add easiness to task accomplishment and enjoyment to learning activities. Further, computers can make students' assignments more organized and reduce dependence on teachers as the only source of knowledge. They make students more motivated and more engaged in the learning process. Obviously, CASM helped students learn independently and think more deeply. It was extremely useful in summarizing and organizing medical passages and hence can be used as an effective revision tool. It would be also suggested from this study that metacognitive strategies can work very efficiently if used with small classes, so it would be easier for instructors to provide intensive training for students and detailed explanation of each student-created map. It has been expected that map creation during class hours would take up more time than scheduled, but CASM facilitated student comprehension of medical passages and saved class time.

5.4 Suggestions for Further Research

Based on the study findings, some suggestions and recommendations are offered for further research on this topic:

1. Some reading comprehension skills such as inferencing were assessed in this study. Other studies should be conducted to explore the effect of SM on promoting students' level in other higher-order thinking skills.
2. It would be insightful if the time of the treatment is extended in other replications of the study to evaluate long term effect of SM.

3. When investigating the effect of SM on students' reading comprehension, it would be prudent if small-group instruction and follow-up assessment (of student-constructed maps) are emphasized. Providing feedback on individually constructed maps should be also considered.

4. FreeMind 0.8.1 could not exhibit the relationship between nodes of the same level and of different levels. Therefore, other mind-mapping programs should be tried if one wants to examine the effect of SM on students' understanding of causal relationship in a text.

5. FreeMind 0.8.1 can profit students if the aim of replicated studies is to help students locate the main idea and its supporting details in a text. Thus, it would be useful if a similar study is conducted with 112 and 113 NAJM students.

6. It would be rewarding if the efficiency of SM is explored in other skills such as listening where students are required sometimes to create an outline of the listening passages within a short period of time.
References


Appendix A

The Pre- and Post-test

Name:…………………………………………… Group:……………… Score:……../30

Reading

Instructions: Read the following passages and answer the questions that follow. (1 point each)

Hernia Problems: How to Avoid the Problem Before It Starts

Three weeks after taking a part-time job hauling furniture, Rick noticed a small protrusion of tissue near his groin. He went to see his physician, who diagnosed the problem as an inguinal hernia.

"A hernia is a gap in the tissue layers that line the abdominal wall. When those tissues weaken through overexertion or repeated strain, a piece of intestine or other intra-abdominal tissue can begin to bulge out through the gap," says Kim Ephgrave, MD, professor of surgery at the University of Iowa.

"Straining, heavy lifting, and heavy labor are the most common causes, but any repetitive strain, including obesity, multiple pregnancies, or even a smoker's cough may contribute to development of a hernia," she says.

Men are five times more likely than women to develop inguinal hernias, which are hernias in the groin. An umbilical hernia, which occurs near a newborn's belly button, is the second most common. The other common type is an incisional hernia, which occurs after surgery. In most cases, surgery is indicated to repair the bulge and prevent intra-abdominal tissue from being trapped outside. When the protruding tissue contains a length of intestine, two secondary problems can result. One risk is that the hernia will cause an obstruction of the intestines, resulting in pain, nausea, and vomiting. A second risk is strangulation of the hernia, which occurs when the protruding tissue swells and cuts off the blood supply to the loop of intestine within it. The strangulated intestine can become gangrenous, which can be life-threatening. Obstructed and strangulated hernias require immediate medical attention, Ephgrave warns.

The rate of success for a first-time groin hernia surgery is more than 90 percent. "Follow your physician's advice about limits on your physical activity for the first few months after surgery, because activity that strains the muscles in that time period can cause the hernia to return," Ephgrave says.

(Kim Ephgrave, 2006)
I. According to the passage, are the following statements true (T) or false (F), or is it impossible to know (IK)?

1. Strenuous activities only can cause hernia problems. ............
2. Surgeries may treat or lead to hernias. ............
3. A part of the intestine may be involved in a hernia protrusion. ............
4. Inguinal hernia can be a reoccurring ailment. ............

II. For each of the following statements choose the word or phrase that best completes the statement according to the information contained in the passage.

1. ..................hernia is the most common type of hernias.
   a. Inguinal
   b. Umbilical
   c. Incisional
   d. Epigastric

2. The writer implies that hernia problems can be...
   a. avoided.
   b. treated successfully with surgeries.
   c. noticed by patients.
   d. All the above.

----------------------------------------

Food Poisoning: Protect Yourself

The warmth of the summer sun can do wonders for your spirits, but it can also promote the growth of dangerous bacteria in food. You can keep the good memories of summer picnics by preventing food poisoning and the symptoms that could upset your summer fun.

Food poisoning symptoms include diarrhea, vomiting, stomach ache, and possibly fever. Most cases of food poisoning are mild and don't require hospitalization. However, if symptoms last for more than two or three days, or if you have a number of the symptoms, see your doctor.

"The most important thing to do is to drink plenty of liquids so you don't become dehydrated. Using a sports drink that contains water, salt, and sugar can help keep liquid in the body," says Dr. Phyllis Stumbo, research nutritionist at the University of Iowa.
Common food poisoning bacteria include salmonella, most often found in meat and eggs that have not been thoroughly cooked; E. coli bacteria, found in meat and dairy products that have not been thoroughly cooked or pasteurized; and botulism, found in improperly canned vegetables.

Food poisoning can be prevented by following a few simple steps, Stumbo says, noting that bacteria need three things to grow: heat, water, and time. Heat is especially bad for eggs. "Carefully refrigerate foods that contain lightly cooked eggs, including cream pies. Even hard-boiled eggs and egg rich foods should not be left out of the refrigerator for more than two hours. Don't eat raw meat or eggs or drink unpasteurized milk."

You can prevent food poisoning in home-canned vegetables by pressure-cooking vegetables before canning. That kills the spores that can produce the deadly toxin that causes botulism. Boiling vegetables before eating them also kills the toxin. A swollen or bulging can is a signal that something dangerous may be growing inside, and should be discarded.

Even refrigerated foods can have bacterial growth, so examine bottles and packages carefully, especially those that have been in the refrigerator for several days or weeks. If bacteria are growing inside, you can tell by listening closely when you open the lid or package. If you hear gas escape, don't use the food.

"The best rule is: If in doubt, throw it out!" Stumbo says. "And before handling food, always wash your hands, wash your hands, wash your hands!"

(Phyllis Stumbo, 2006)

III. According to the passage, are the following statements true (T) or false (F), or is it impossible to know (IK)?

1. The writer implies that food poisoning cases increase in summer. 
   .......... 
2. Food poisoning cases can be mild or serious. 
   .......... 
3. One important sign of food poisoning is dehydration. 
   .......... 
4. Food poisoning is a digestive disease. 
   .......... 

IV. For each of the following statements choose the word or phrase that best completes the statement according to the information contained in the passage.

1. Which of the following is not a way of preventing food poisoning?
   a. Canning food 
   b. Cooking food 
   c. Pasteurization 
   d. Refrigerating food
2. One important piece of advice offered by Stumbo is ………………..if one has some doubts about it.
   a. washing food before eating
   b. looking for gas escape when opening the package
   c. throwing out food
   d. pressure-cooking food

-----------------------------------------

Appendicitis: Not as Bad as it Sounds

Many of us experience stomachaches that come and go but if you have pain in the lower right side of your abdomen, it may be appendicitis.

Appendicitis can sometimes be confused with other abdominal pains, but if you experience pain and tenderness in the abdomen and have fever or nausea, consult a physician immediately, says Dr. James Maher, professor of surgery at the University of Iowa. "Getting medical care before the appendix ruptures is important," says Maher, who adds that a ruptured appendix can be fatal.

The appendix is a small, finger- or worm-shaped projection attached to part of the large intestine on your right side. It is believed the appendix had a specific purpose at some point in evolution, but we don't know what it is, Maher says.

The appendix becomes inflamed when a piece of stool lodges in it or when its lymph tissue -- the tissue that produces a fluid containing white blood cells -- enlarges due to infections, especially viral ones. When this happens, the mucous that pours into the appendix becomes infected, causing the symptoms of appendicitis, he explains.

Pain around the navel is usually the earliest symptom. You'll probably have no appetite and may feel nauseated. As the infection progresses, the pain becomes more severe. You may feel feverish and the pain may move to the lower right part of the abdomen as inflammation spreads. Pain may subside briefly, and then become generalized and very severe. If you don't seek treatment, the appendix may burst, spreading infected fluid into the abdomen.

There is no way to prevent appendicitis once it develops and surgery is the only treatment, Maher says. If the appendix is removed in the early stages of pain, you can be discharged from the hospital after a few days with little chance of serious complications. The risk of complications is greater from a ruptured appendix because infected fluid spreads into the abdomen. Your physician probably will prescribe medication following surgery. Recovery can take two to six weeks.

Appendicitis can affect people of all ages but is more difficult to diagnose in children under age four and in adults over 70. In these individuals the appendix may burst without causing the usual symptoms and so in these age groups, a ruptured appendix is more
common, Maher says. The incidence of appendicitis is declining and now affects only six out of 100 people. Sometimes, if you request it, your surgeon can remove your appendix during another surgical procedure being conducted near the appendix, such as a hysterectomy. This is done only if it doesn't increase the risks associated with the original surgery, he adds.

(James Maher, 2006)

V. According to the passage, are the following statements true (T) or false (F), or is it impossible to know (IK)?

1. The appendix, as an organ, has no function. .......... 
2. Serious complications are associated with a ruptured appendix. .......... 
3. Diagnosing appendicitis in adults under age 70 is more difficult than in those over 70. .......... 
4. Though not infected, the appendix can be removed on one's request. .......... 
5. Some research suggests that appendicitis can get better without surgery. .......... 

VI. For each of the following statements choose the word or phrase that best completes the statement according to the information contained in the passage.

1. .................. are the earliest symptoms that mark appendicitis.
   a. A pain around the navel and loss of appetite
   b. Nausea and fever
   c. Fever and severe pain in the lower right part of the abdomen
   d. Both a & b

2. The inflamed appendix may burst if…
   a. the patient is over 70.
   b. a piece of stool lodges in it.
   c. the infected fluid spreads into the abdomen.
   d. None of the above.
Migraine: It's More Than a Headache

Everyone experiences a headache from time to time. While certainly not enjoyable, it does go away with a little rest and possibly a pain reliever. Migraines, on the other hand, are much more severe than common headaches.

"Migraines are typically distinguished by a severe throbbing headache that usually affects only one side of the head and is often accompanied by sensitivity to light and sound, as well as nausea," said Andrew Russo, PhD, professor in the UI Department of Physiology and Biophysics. Individuals who have migraines may experience dizziness, numbness, double vision, drowsiness, and even vomiting before and during an attack.

The cause of migraine headaches is not concretely known. However, according to Russo, most experts believe there are both genetic and environmental components. "The genetic component most likely makes some people more susceptible to the environmental and physiological changes that cause a migraine," Russo said. "It is safe to say that migraines tend to run in families."

Preconceived notions that men do not have migraine attacks are untrue. However, women seem to experience migraines more frequently, especially during menstrual cycles. "Women are three times more likely to get migraines than men," Russo said.

Medication is often the first treatment people seek, but the body's response may vary. Over-the-counter pain relievers such as aspirin, acetaminophen, and ibuprofen may provide some relief. If these medications do not help, the next step is to consult with a health care provider. Several medications may need to be tried before an effective one is found. While medications may provide relief, it is also important to be able to cope with migraines without using medications regularly. "The best non-drug method for treating migraines is to minimize light and sound and to fall asleep. Once asleep, the body can apparently 'snap out' of the migraine," Russo said. "But the best therapy is to learn what triggers the migraine and avoid that stimulus."

What actually causes a migraine may vary, and several triggers may occur in different combinations. Each individual, however, tends to have the same recurring triggers. These fall into three main categories: foods, environmental factors, and physiological factors. Food triggers can vary, from chocolate, dairy products and citrus fruits to preserved meats, coconut oil and salt. Environmental triggers include strong odors, loud noises, weather changes and even fluorescent lighting. Physiological triggers, like food, can be controlled. Keeping stress low, exercising, and getting adequate sleep are a few examples of ways to help prevent a migraine from occurring.

Understanding all the various migraine symptoms, triggers, and treatments can be tricky. Therefore, it is important for individuals to know what their symptoms and triggers are, as well as what treatment works best for them. Keeping a doctor regularly informed about any changes will allow for better migraine management.

(Andrew Russo, 2000)
VII. According to the passage, are the following statements true (T) or false (F), or is it impossible to know (IK)?

1. According to the writer, migraines are comparable to other serious diseases. ...........
2. Environmental factors may worsen migraine symptoms. ...........
3. Some medications proved to be of no benefit for some migraine sufferers. ...........
4. Migraines usually begin in the sufferer's teens and may persist throughout the unfortunate victim's life. ...........

VIII. For each of the following statements choose the word or phrase that best completes the statement according to the information contained in the passage.

1. Which of the following is not a symptom of migraine headaches?
   a. A throbbing head pain.
   b. Vomiting.
   c. Sleeplessness.
   d. Nausea.

2. The exact cause of migraine is unknown, but there is strong indication that triggers of migraines are primarily…
   a. environmental.
   b. genetic.
   c. nutritional.
   d. hormonal.

----------------------------------------

Glaucoma: Get an Examination

Glaucoma, a disease of the optic nerve, can become quite advanced before someone with the condition recognizes he or she has a problem. To prevent irreversible vision loss, Wallace Alward, MD, University of Iowa professor of ophthalmology and visual sciences, suggests that people with certain risk factors or those who have never been examined for glaucoma set up an examination with their eye doctor.

The disease is the second leading form of permanent blindness in America and the leading cause among African-Americans, who also are more likely to have the disease at a younger age. "Nearly half of Americans with glaucoma don't know that they have it," Alward said. "The optic nerve gradually becomes damaged, and people tend to very slowly lose
vision. In addition, people can have profound vision loss in one eye and not know it because when both eyes are open, the functional eye makes up for the loss."

The AAO recommends glaucoma screenings for people who have a family history of glaucoma, are over age 40, are of African ancestry or who have not had a medical eye exam in the last two years.

Glaucoma damages the optic nerve, which normally takes information from the eye to the brain so the brain can determine what the eye is seeing, Alward said. "Glaucoma usually takes away the peripheral vision first, and leaves the straight-ahead, reading-the-eye-chart type of vision to the very end," he said. "With advanced glaucoma, it can be like looking at life through a soda straw."

Alward said it is important for people to get a complete eye exam, not just an eye pressure check. A glaucoma examination includes a check of the optic nerve and/or measurement of the visual field to check for side vision loss. It is not sufficient only to check eye pressure because a person can have normal eye pressure and still have glaucoma.

Alward explained that high pressure in the eye is a risk factor for glaucoma, similar to the relationship between high blood pressure and heart attacks. "Not everybody with a heart attack has high blood pressure, and not everyone with high blood pressure gets a heart attack," Alward said. "But the higher your blood pressure, the higher your risk for developing a heart attack. That's the exact same relationship between eye pressure and glaucoma." He added that the main reason eye pressure is often the focus of glaucoma treatment is because the other risk factors--age, race or family history--cannot be changed, and the optic nerve damage cannot be reversed.

"We can change eye pressure, so that's why you hear about it so much in relation to glaucoma," Alward said. "But it is important to keep in mind that a thorough glaucoma evaluation includes assessment of the optic nerve or visual field." Drug and surgical treatments are available to stop the blindness caused by glaucoma.

As with all medical care, it is best to consult with your health care provider before making any changes to your health care routine.

(Wallace Alward, 2000)
IX. According to the passage, are the following statements true (T) or false (F), or is it impossible to know (IK)?

1. Loss of vision, caused by glaucoma, normally occurs gradually over a long period of time and is often only recognized when the disease is quite advanced.  

2. One person may develop nerve damage at a relatively low pressure, while another person may have high eye pressure for years and yet never develop damage.  

3. Eye pressure must be controlled if one wants to treat glaucoma.  

4. When discovered at an advanced stage, glaucoma can be treated with medical and surgical means.  

X. For each of the following statements choose the word or phrase that best completes the statement according to the information contained in the passage.

1. may develop glaucoma more than others.
   a. Those with damaged visual field
   b. People who have a family history of glaucoma
   c. Americans
   d. Victims of heart attack
**Vocabulary**

I. **Instructions:** Use your knowledge of word parts to match words in Column B with their definitions in Column A. Answers in Column B will be used only once. (1 point each)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>........1. Inflammation of the skin</td>
<td>A. Cardiectasis</td>
</tr>
<tr>
<td>........2. The condition of having an abnormally low body temperature</td>
<td>B. Dermatitis</td>
</tr>
<tr>
<td>........3. The surgical removal of the whole or a part of the stomach</td>
<td>C. Diplopia</td>
</tr>
<tr>
<td>........4. The study of the origin and development of the mind</td>
<td>D. Gastrectomy</td>
</tr>
<tr>
<td>........5. The study of the anatomy and diseases of the ear</td>
<td>E. Histokinesis</td>
</tr>
<tr>
<td>........6. The free discharge of a thin nasal mucus</td>
<td>F. Hypothermia</td>
</tr>
<tr>
<td>........7. Double vision, in which a single object is seen as two objects</td>
<td>G. Leukodystrophy</td>
</tr>
<tr>
<td>........8. Conjoined twins united at the chest</td>
<td>H. Oncotomy</td>
</tr>
<tr>
<td>........9. The incision of a tumor or swelling</td>
<td>I. Otology</td>
</tr>
<tr>
<td>........10. Disturbance of the white substance of the brain</td>
<td>J. Psychogenesis</td>
</tr>
<tr>
<td>........11. An agent that increases the effectiveness of another agent when combined with it</td>
<td>K. Rhinorrhea</td>
</tr>
<tr>
<td>........12. Movement in the tissue of the body</td>
<td>L. Synergist</td>
</tr>
<tr>
<td>........13. Dilation of the heart</td>
<td>M. Thoracopagus</td>
</tr>
<tr>
<td></td>
<td>N. Vasculitis</td>
</tr>
</tbody>
</table>
II. Instructions: Match words in Column A to the systems where they can be found in Column B. Answers in Column B will be used only once. (1 point each)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rib cage</td>
<td>A. Cardio-vascular</td>
</tr>
<tr>
<td>2. Thyroid</td>
<td>B. Digestive</td>
</tr>
<tr>
<td>3. Larynx</td>
<td>C. Endocrine</td>
</tr>
<tr>
<td>4. Alimentary canal</td>
<td>D. Integumentary</td>
</tr>
<tr>
<td>5. Urethra</td>
<td>E. Nervous</td>
</tr>
<tr>
<td>6. Medulla oblongata</td>
<td>F. Respiratory</td>
</tr>
<tr>
<td>7. Vena cava</td>
<td>G. Skeletal-muscular</td>
</tr>
<tr>
<td></td>
<td>H. Urinary</td>
</tr>
</tbody>
</table>

III. Instructions: Match the terms in Column B to their definitions in column A. Answers in Column B will be used only once. (1 point each)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Infectious agents given to patients to establish resistance to particular diseases</td>
<td>A. Antidote</td>
</tr>
<tr>
<td>2. A dead body</td>
<td>B. Atria</td>
</tr>
<tr>
<td>3. A substance that neutralizes poisons or their effects</td>
<td>C. Cadaver</td>
</tr>
<tr>
<td>4. The upper champers of the heart</td>
<td>D. Hemorrhaging</td>
</tr>
<tr>
<td>5. A combination of symptoms usually found in a particular disease</td>
<td>E. Hysterectomy</td>
</tr>
<tr>
<td></td>
<td>F. Immunity</td>
</tr>
<tr>
<td></td>
<td>G. Plasma</td>
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<td></td>
<td>H. Stapedectomies</td>
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<tr>
<td></td>
<td>I. Syndrome</td>
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<td>J. Vaccines</td>
</tr>
<tr>
<td></td>
<td>K. Antiseptic</td>
</tr>
<tr>
<td></td>
<td>L. Stapedectomies</td>
</tr>
<tr>
<td></td>
<td>M. Syndrome</td>
</tr>
<tr>
<td></td>
<td>N. Vaccines</td>
</tr>
</tbody>
</table>
Recall Test

Instructions: Choose the letter of the correct answer to complete each sentence below.
(1 point each)

1. Which of the following helps eliminate the different kinds of body waste?
   a. the digestive system.
   b. the rectum and the urethra.
   c. the digestive and urinary systems.
   d. the digestive, urinary, and integumentary systems.

2. Ali suffers from otitis. Which specialist should he see?
   a. A urologist.
   b. An otolaryngologist.
   c. An ophthalmologist.
   d. An allergist.

3. _______________ interact more with patients than with medical personnel.
   a. Internists
   b. Pathologists
   c. Radiologists
   d. Pathologists and radiologists

4. A surgery of "crossed eyes" is done by______________
   a. an ophthalmologist.
   b. an otolaryngologist.
   c. a plastic surgeon.
   d. a thoracic surgeon.

5. Pediatricians may subspecialize in______________
   a. pediatric surgery.
   b. obstetrics.
   c. cardiology.
   d. pediatric surgery and cardiology.

6. _______________ are subspecialists.
   a. Allergists
   b. Obstetricians
   c. Orthopedic surgeons
   d. Allergists and orthopedic surgeons

7. A complete physical exam usually includes all of the following except______________
   a. palpation.
   b. auscultation.
   c. dissection.
   d. percussion.
8. A fatigued muscle leads to……………………
   a. a strain.
   b. bursitis.
   c. myositis.
   d. cramping.

9. The …………………….protects the body from microbes.
   a. kidney
   b. skin
   c. liver
   d. nose

10. It is possible to diagnose and treat certain diseases by…………………..
    a. transfusions.
    b. cauterization.
    c. transplants.
    d. X-ray.

11. Acupuncture is an old medical method that is………………..
    a. therapeutic
    b. prognostic.
    c. diagnostic.
    d. Both a & c are correct.

12. Which of the following helps in the breakdown and digestion of food?
    a. salivary enzymes, hydrochloric acid, bile, and pancreatic fluid.
    b. thyroxin, collagen, and melanin.
    c. bile and pancreatic juices.
    d. hormones, enzymes, and peristaltic movements.

13. Severe burns require serious hospitalization to avoid…………………..
    a. severe bleeding.
    b. dehydration and shock.
    c. swelling.
    d. grafting.

14. Any first-aid kit should contain, at a minimum, ……………………..
    a. ammonia.
    b. a sphygmomanometer.
    c. a tetanus shot.
    d. Both b & c are correct.

15. Victims of……………………lose consciousness.
    a. compound fractures
    b. neck injuries
    c. concussion and asphyxiation
    d. simple hematomas and concussion
16. A(n)…………………. is a wound caused by superficial damage to the skin, no deeper than the epidermis.
   a. contusion
   b. puncture
   c. sprain
   d. abrasion

17. A tourniquet is applied when one is suffering from…………………..
   a. severe bleeding.
   b. overexertion.
   c. gangrene.
   d. cessation of breathing.

18. …………………..is the soft, gelatinous tissue that fills the cavities of the bones.
   a. Collagen
   b. Periosteum
   c. Bone marrow
   d. Melanin

19. The aorta is the largest…………………..in the body that carries blood away from the heart.
   a. arteriole
   b. vein
   c. capillary
   d. artery

20. Samar is a subspecialist in the diseases of the joints, muscles, bones, and tendons. She is a………………….
   a. rheumatologist.
   b. nephrologist.
   c. geriatric.
   d. hematologist.

21. The era of modern surgery began in the nineteenth century with the introduction of…………………
   a. vaccines and X-ray techniques.
   b. anesthesia and antiseptic methods.
   c. blood transfusion.
   d. anesthesia and organ transplantation.

22. X-ray technology was discovered in 1895 by the ……………………..
   a. French physician Ambroise Paré.
   b. English physician William Harvey.
   c. German physicist Wilhelm Roentgen.
   d. Greek physician Galen.
23. .................. is an old surgical procedure in which a hole is drilled into the human skull to relieve pressure on the brain.
   a. Trephining
   b. Enkephalins
   c. Cauterization
   d. Grafting

24. Circulatory shock is a serious, life-threatening medical condition in which victims suffer from ..................
   a. severe headaches.
   b. vomiting.
   c. memory loss.
   d. paralysis.

25. Drugs such as .................. may induce sleep.
   a. laxatives
   b. antibiotics
   c. narcotics
   d. penicillin

26. To treat common cold, doctors prescribe ..................
   a. aspirin.
   b. acetaminophen.
   c. digitalis
   d. tranquillizers.

27. Streptomycin is prescribed to patients with ..................
   a. bacterial infection.
   b. heart failure.
   c. diabetes.
   d. viral infection.

28. .................. remove water from the body by increasing the amount of urine the kidneys produce.
   a. Sedatives
   b. Pep pills
   c. Insulin injections
   d. Diuretics

29. Symptoms of abdominal pain, vomiting, and liver dysfunction are associated with ..................
   a. food poisoning.
   b. dysentery.
   c. Reye's syndrome.
   d. inner-ear disorders.
30. A patient suffering from ...................... will show symptoms such as headache, vomiting, and nausea.
   a. allergy
   b. anemia
   c. influenza
   d. ulcer
Appendix B
Students' Attitude Questionnaire

عزيزي الطالبة:

الغرض من هذه الاستبيان هو التعرف على مدى تأثير الرسوم التوضيحية على مستوى طالبات

التمريض في مادة ١١٤ نعم في سبيل تطوير الأساليب التعليمية المتبقية. لذا نرجو منك التكرم بتعبئة هذه

الاستبيان بكل تأمل و موضوعه. رأيك سيكون محل تقدير و اهتمام منا.

شكرًا لك تعاونك
غزيل محمد العتيبي

أرجو الإجابة على الأسئلة التالية قبل البدء بتعبئة الاستبيان.

العمر: ..............................................................................
عدد سنوات دراستك للغة الإنجليزية: ......................................
المستوى الأكاديمي: ..........................................................
استبانة أراء الطالبات حول مدى فعالية استخدام الرسوم التوضيحية كوسيلة تعليمية

عبر عن مدى تأييد من عدمه لكل من العبارات التالية بوضع علامة (√) تحت الأرقام كما هو موضح أدناه:

<table>
<thead>
<tr>
<th>الرقم</th>
<th>أوافق بشدة</th>
<th>أوافق بمعنى</th>
<th>أوافق</th>
<th>إطالة أوقات</th>
<th>منعدمة</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>√</td>
<td></td>
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<td>5</td>
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<td>√</td>
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</tbody>
</table>

مدى فعالية استخدام الرسوم التوضيحية كوسيلة تعليمية

1. أسهمت الرسوم التوضيحية في تخسيس مستوى في اللغة الإنجليزية.
2. استخدام الرسوم التوضيحية ساعدني في زيادة عدد مفرداتي الطبية.
3. ساعدتني الرسوم التوضيحية في فهم النصوص الطبية.
4. أثرى استخدام الرسوم التوضيحية معرفتي الطبية.
5. كانت الرسوم التوضيحية نافعة في ترتيب محتويات الدروس.
6. كان من السهل تذكر الأفكار المهمة بعد استخدام الرسوم التوضيحية.
7. كانت الرسوم التوضيحية مفيدة في تلخيص النصوص الطبية.
8. ساعدتني الرسوم التوضيحية في المراجعة والاستعداد لامتحان.
9. يُساعد استخدام الرسوم التوضيحية على التفكير بشكل عميق.
10. ساعدتني الرسوم التوضيحية على التعلم بشكل ذكي.
11. ساعدتني الرسوم التوضيحية على توضيح العلاقة بين محتويات المنهج.
12. ساعدتني الرسوم التوضيحية على فهم العلاقة بين المفاهيم الطبية.
13. تقبل الطلبات للرسوم التوضيحية كوسيلة تعليمية
14. أتقبل استخدام الرسوم التوضيحية كوسيلة تعليمية
15. استخدامي للرسوم التوضيحية كان ممتعًا بشكل عام.
16. أتقبل استخدام الرسوم التوضيحية في مقررات أخرى.
17. أتقبل استخدام الرسوم التوضيحية عند دراسة مقررات أخرى في المستقبل.

آراء حول رسم الرسوم التوضيحية

18. رسم الرسوم التوضيحية باستخدام الحاسوب كان ممتعًا.
19. رسم الرسوم التوضيحية باستخدام الحاسوب كان نافعًا.
20. كثرة الأشكال والروابط في أي رسم توضيحي تجعل رسمه صعبًا.
### Students' Attitude Questionnaire

Please rate each statement by marking the box below the number according to the following scale:

1 = Strongly Disagree (SD)  
2 = Disagree (D)  
3 = Neutral (N)  
4 = Agree (A)  
5 = Strongly Agree (SA)

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The effectiveness of the technique of CASM as a learning tool</strong></td>
<td></td>
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</tr>
<tr>
<td>1. CASM helped me improve my English.</td>
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<tr>
<td>2. CASM increased my vocabulary range.</td>
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<tr>
<td>3. CASM improved my reading comprehension level.</td>
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<tr>
<td>4. CASM helped me improve my medical knowledge.</td>
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<tr>
<td>5. CASM was useful for organizing lesson contents.</td>
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<tr>
<td>6. It is much easier to catch the essential concepts after map construction.</td>
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<tr>
<td>7. CASM was useful in summarizing medical texts.</td>
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<td>8. CASM helped in revision for examination.</td>
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<td>9. CASM encouraged thinking more deeply.</td>
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<td>10. CASM stimulated me to think and learn independently.</td>
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<tr>
<td>11. CASM helped me clarify the interrelationships among curriculum contents.</td>
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<tr>
<td>12. CASM helped in understanding the relationships between concepts.</td>
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<tr>
<td><strong>Affective acceptance of CASM as a learning tool</strong></td>
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<tr>
<td>13. Learning the skill of CASM was easy.</td>
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<tr>
<td>15. I feel that CASM was enjoyable in general.</td>
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<tr>
<td>16. I wish more teachers would use CASM in other courses.</td>
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<tr>
<td>17. I would like to use CASM in my future studies.</td>
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<tr>
<td><strong>Opinions about semantic-mapping construction</strong></td>
<td></td>
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<tr>
<td>18. Constructing a semantic map using a computer software was interesting.</td>
<td></td>
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<tr>
<td>19. Constructing a semantic map using a computer software was helpful.</td>
<td></td>
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<tr>
<td>20. The increasing number of concept nodes and relation links made map-construction difficult</td>
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</tbody>
</table>
Appendix C
Teacher-created Semantic Maps

Chapter 1: Highlights from the History of Medicine

I. Reading
1. Dark Ages (500 A.D.-1000 A.D.)
- Ignorance
- Lack of progress

1. Christian compassion led to...
2. The building of hospitals
3. The building of first medical schools

3. As in ancient times...
- Disease was considered supernatural
- Treatment was a mixture of prayer and magic

4. Bubonic plague (mid-14th century)
- Killed one-fourth of the European population
- Scientists searched for better medical treatments

II. MIDDLE AGES (500 A.D.-1500 A.D.)

1. Defeat: Great revival in learning
- Human dissection allowed accurate human anatomy books to be printed
- Medical knowledge increased rapidly

1. 1546: First pharmacy was opened in London
2. Medicine became accepted as treatment for illness
3. Treatment with drugs

1. Renaissance (11th century - 17th century)

1. Used for diagnosis by analysis of:
- Blood
- Urine
- Tissue

2. Other valuable information discovered

3. Treatment with drugs

4. 1560: The invention of the microscope

5. Early 1600's: William Harvey's discovery of blood circulation

1687: First blood transfusion performed

Opposed cauterizing
- Used ligatures to stop bleeding

Began in Italy: spread through Europe

1. Defeat: Great revival in learning
- Human dissection allowed accurate human anatomy books to be printed
- Medical knowledge increased rapidly
II. Vocabulary

Mental conditions:
- 1. The patient's past
  - Complaints
  - Behavior
  - Lifestyle
  - To determine the cause of an illness.
  - Why?

Physical conditions:
- 2. Medical problems of close family members
- To determine the nature of an illness.
- Why? To determine the presence or absence of disease or abnormality.
- Inspection (looking)
- Palpation (touching & feeling)
- Percussion (hitting)
- Auscultation (listening)

Case History:
- 1. Case History

Diagnosis:
- 2. Diagnosis
  - Def. the use of scientific methods

3. Testing:
- 3. Testing

Treatment:
- 4. Treatment
  - Def. treatment of a disease or pathological condition

Conclusion:
- 5. Conclusion
  - Def. the course of the disease
  - Def. the end of the disease
  - Def. the outlook of the disease
Chapter 2: Human Anatomy

I. The skeletal-muscular system

II. The cardiovascular system

III. The endocrine system

IV. The respiratory system

V. The integumentary system

VI. The digestive system

VII. The urinary system

VIII. The nervous system

1. Supports and gives shape to the body.
2. Protects the vital internal organs.
3. Helps the body move.

A. Functions

B. Parts

1. Bones (more than 200)
   a. Composed of minerals, organic matter, and water held together by a cement-like substance called collagen.
   b. Filled with red blood cells transporting oxygen.
   c. Covered by the periosteum which allow bones to be nourished by blood.
   d. Ends

2. Skull
   a. (Location) at the top of the vertebral column
   b. Protects the brain
   c. Attached to the vertebral column
   d. Base
   e. 12 pairs of ribs
   f. Protects the vital internal organs

3. Spinal column
   a. Composed of
   b. Vertebral column
   c. Bony vertebrae
   d. Ligaments
   e. Spinal nerves
   f. Sacrum (bottom part) connecting the vertebral column to the pelvis

4. G. VERTEBRAE
   a. Runs up and down the back
   b. PERIODIC the spinal cord

I. SKELETAL-MUSCULAR SYSTEM

B. Parts

2. Connective Tissue

a. Ligaments
   1. Unite bones at joints

b. Tendons
   2. Unite vertebrae in the spinal column

Function-attaches muscles to bones & to other muscles
I. SKELETAL-MUSCULAR SYSTEM
   A. Bones
   B. Parts
   C. Muscles (more than 650)
   a. Voluntary (skeletal) muscles
   b. Involuntary (e.g., stomach, heart)
   c. Allotted to muscles & connective tissue

II. CARDIOVASCULAR (CIRCULATORY) SYSTEM
   A. The heart
   a. Left & right atria (chambers), upper chambers
   b. Left & right ventricles, lower chambers
   a. Contraction phase (systole): oxygenated blood pumped through aorta & arteries to all organs
   b. Relaxation phase (diastole): deoxygenated blood is pumped through veins & the vena cava & through the pulmonary arteries to the lungs
   1. The most important muscle
      a. Left & right atria (auricles), upper chambers
      b. Left & right ventricles, lower chambers
   2. Function
      a. Contraction phase (systole): oxygenated blood pumped through aorta & arteries to all organs
      b. Relaxation phase (diastole): deoxygenated blood is pumped through veins & the vena cava & through the pulmonary arteries to the lungs
   3. The average pulse rate = 72 heartbeats per minute
   4. Heart muscles are arranged in circles & spirals
   5. Arteries: carry blood away from the heart
   6. Veins: return blood to the heart
   7. Arterioles: smaller than arteries
   8. Venules: smaller than veins
   9. Capillaries: thinnest blood vessels unite the two systems

1. Plasma
2. Blood cells
   a. Red cells (erythrocytes): carry the protein hemoglobin, which carries oxygen to body cells
   b. White cells (leukocytes): fight diseases
   c. Platelets: prevent excessive bleeding
IV. RESPIRATORY SYSTEM

A. Parts
1. Nose (nasal passage)
2. Pharynx
3. Tonsils
4. Larynx (voice box)
5. Trachea (windpipe)
6. Bronchi (2 tubes going into lungs) & bronchioles (smaller tubes inside the lungs)
7. Lungs-cleanse deoxygenated blood
8. Alveoli-little air pockets in the lungs
9. Pleura-protective membranes surrounding the lungs

B. Functions (respiration)
a. Inspiration-brings oxygen into the body
b. Inspiration-removes carbon dioxide from the body
c. Rate=16-20 times per minute

V. INTEGUMENTARY SYSTEM

A. Skin
1. Largest organ of the body
2. Consists of 3 layers
   a. Epidermis which contains
   b. Dermis which contains
   c. Subcutis contains

B. Associated structures
1. Hair
2. Nails
3. Oil & sweat glands (exocrine)
4. Sensory receptors

C. Functions
1. Protects the body from microbes
2. Prevents loss of fluids
3. Regulates body temperature
4. Enables body to react to sensation such as touch, cold, heat, pain, pressure.
VI. DIGESTIVE SYSTEM
(Parts of the Alimentary Canal)
Function-Process food for energy

1. Mouth-ingestion of food
2. Salivary glands (exocrine) produce enzymes to break down food in the mouth
3. Teeth-chop & grind food in the mouth
4. Esophagus-uses muscle contraction (peristaltic movement) to push food to the stomach
5. Stomach-glands (exocrine) in the stomach lining secrete hydrochloric acid to mix food
6. Food is converted into a semiliquid state to be passed into the small intestine (a tube of 20 feet)
7. Pancreatic fluid (from the pancreas) and bile (from the liver) complete the digestive process
8. Nutrients are absorbed into the blood through the villi which line the walls of the digestive organs
9. Large intestine (colon) passes what can't be absorbed as feces out of the body
10. Rectum-stores feces
11. Anus-the opening where feces pass out of the body

A. Function-eliminates liquid wastes from the blood

VII. THE URINARY SYSTEM

B. Parts
1. Kidneys
2. Ureters
3. Bladder
4. Urethra

VIII. NERVOUS SYSTEM

1. Motor impulses control muscles
2. Sensory impulses affect the senses

A. Function-controls all other systems & body movements

B. Parts
a. Function-sends impulses to voluntary muscles
b. Consists of:
1. Brain
2. Spinal cord

a. Consists of nerves that connect the CNS to muscles & sensory organs
b. The autonomic system regulates the involuntary muscles & organs
II. Vocabulary
Chapter 3: Disease: Its Symptoms and Treatments

I. Reading

1. Cause
   2. System of the body affected
   3. Severity
   4. Usual form of treatment
   5. Likelihood of recurrence
   6. Expected outcome (prognosis)

A. Classified according to...
   a. Major or minor
   b. Chronic or acute
   c. Benign or malignant (cancerous)
   d. Localized or widespread
   e. Infectious or non-infectious
   f. Communicable (contagious) or noncontagious
   g. Physical or mental
   h. Curable or incurable
   i. Fatal or is the patient terminally ill?
II. SYMPTOMS
A. Noticed by patient himself. B. Ex.

1. Bleeding (hemorrhaging)
   a. Headache for...
   b. Stomach ache for...
   a. Temperature higher than 98.6 Fahrenheit or 37 Celsius
   b. May indicate infection
3. Fever
4. Cough
   a. Dry or producing phlegm or sputum
   b. May indicate ailments of the ... 
5. Nausea & vomiting
   a. Stomach ache
   b. Intestinal disorder
6. Sweating, itching, & rashes may indicate...
7. Fainting, dizziness, & persistent fatigue indicate anemia (low red blood cell count).

III. SYNDROMES
A. Group of symptoms indicating a particular disease
B. Ex.

1. Abdominal pain
2. Vomiting
3. Severe weakness
4. Liver dysfunction

IV. IDENTIFYING THE CAUSE OF THE DISEASE
A. Infectious-caused by microorganisms (minute living bodies invisible to the naked eye)
B. Communicable (contagious)-spread by direct or indirect contact
C. Noninfectious-diseases -not caused by pathogens

Infectious diseases are often communicable

1. Chronic degenerative diseases-from aging
2. Congenital diseases-existing from birth
3. Hormonal disorders
4. Environmental & occupational diseases
5. Immunological diseases
6. Mental illness
7. Iatrogenic disorder-from doctor's maltreatment
8. Idiopathic diseases-no known cause
V. IMMUNITY-ABILITY TO RESIST MICROORGANISMS

A. Natural - from bodily defense mechanisms
   1. Skin, tears, mucous membranes lining the...
   2. Harmless bacteria
   3. Acidic juices in the stomach
   4. Specialized white blood cells in...

B. Acquired - developed by exposure to germs
   1. Depends on antibodies produced by sensitized plasma cells
   2. Stimulated by artificially introduced germs (vaccination)
   3. May not last for life; reimmunization may be necessary

VI. DRUGS (MEDICINE)

A. Information available to modern medical personnel

B. Prescription drugs
   1. Strictly controlled by prescriptions because they can be...
   a. Penicillin
   b. Streptomycin
   1. Ex.
   a. Antibiotics- against infection
   b. Narcotic drugs- painkillers
   2. Addictive
   a. Morphine
   b. Codeine
   3. Overdose can cause...
   a. Coma
   b. Death
   2. Ex.
   a. Anticoagulants- prevent blood clots
   b. Diuretics- remove excess fluid from the body
   c. Others
   4. Insulin- treats diabetes

VII. OTHER (NON-DRUG) TREATMENTS

1. Surgery
2. Radiation therapy
3. Chemotherapy
4. Special equipment
   a. Change lifestyle (diet, exercise, etc)
5. Non-medical recommendations
   b. Change climate
   c. work less
II. Vocabulary

EXAMPLES OF DISEASES & SYMPTOMS

1. Difference between symptoms & symptoms
   - Syndrome: a combination of symptoms marking a disease
   - Objective signs found by medical personnel (e.g., tests)
   - Subjective symptoms described by the patient

2. Anaemia: insufficient number of red blood cells
   - Associated with:
     - Iron deficiency anaemia
     - Folic acid deficiency anaemia

3. Cough: expectoration from the lungs suddenly & noisily
   - May produce:
     - Phlegm
     - Mucus

4. Fever: an abnormal body condition
   - Caused by:
     - An inflamed system
     - Pregnancy

5. Hemorrhage: excessive bleeding externally or internally

6. Feeling unwell:
   - Caused by:
     - An inflamed system

FOREIGN MATERIAL & THE BODY'S RESPONSE

1. Antibody: a protective protein that is produced in response to foreign material (an antigen, such as bacteria)
   - Function:
     - Antibody-Def: antibody that is specific to the antigen

2. Immunity: Def: the body fights an infection with antibodies & white blood cells. This action is called an immune response

3. Infection: Def: invasion of the body by microorganisms

4. Pathogen (germ): Def: disease-causing microorganism
   - Types:
     - Bacteria
     - Viruses

5. Vaccine: Def: inoculating living, weakened, or killed microorganisms into the body so that the body will produce antibodies to fight the infection caused by such microorganisms

MEDICATION VOCABULARY

1. Addictive-Def: a condition indicating that a certain drug should not be used in this particular situation or by a particular patient
   - Dose: Def: a specified quantity of a drug recommended for a patient
   - Overdose: Def: an excessive amount of that quantity

2. Contraindication: Def: the body cannot handle a substance
   - As a result:
     - It dulls the senses
     - It releases pain
     - It sometimes induces sleep

3. Prescription: Def: a written instruction by a physician to permit a pharmacist to dispense medication to a patient

OTHER MEDICAL VOCABULARY

1. Acute: describes an ailment that...
   - Comes on suddenly
   - Has severe symptoms
   - Is of short duration

2. Chronic: describes an ailment that is likely to persist or recur in the patient over a considerable length of time
Chapter 5: Physicians and Medical Specialties

I. Reading

1. Using layman’s terms when explaining the nature of the disease to a patient

2. Giving advice and offering alternatives to patients

3. Possessing the ability of persuasion

4. Bad news should be carried out with kindness

5. Physicians comforting and reassuring patients are said to have good “bedside manner.”
IX. OVERLAPPING OF CARE PROVIDED BY VARIOUS SPECIALTIES

A. A rhinoplasty can be done by...
B. A hysterectomy can be done by...
C. Nasal allergies can be treated by...

1. A general surgeon
2. An obstetrician-gynecologist
1. An allergist
2. An otolaryngologist

X. DISADVANTAGES OF SPECIALIZATION

A. Specialists don’t know the patient’s medical history and the medical history of the family. Therefore, medical care has become impersonal.
B. Specialists may not see how medication for one condition affects the patient in other ways.
C. Different specialists might prescribe different types of medication that are a poor combination.
D. Therefore, it is wise if a person has a primary physician

1. Children should have a pediatrician.
2. Adults should have...
   a. A general practitioner
   b. An internist
   c. A specialist in family practice

XI. WHY PATIENTS SEEK A SECOND OPINION

A. The original physician suggests it
B. The patient wants it
C. An insurance company might require it

XII. BEING SELF-EMPLOYED OR WORKING FOR HOSPITALS (ADVANTAGES & DISADVANTAGES)

A. Working for hospitals
   a. They work only when they are on duty
   1. To their office to see patients
      a. Checking on their hospitalized patients
      b. Writing orders for their nursing care
   2. To the hospital to make rounds
   1. Working for hospitals may take turns with their colleagues, alternating nights & weekends “on call”

B. Self-employed physicians
   a. Going to 2 different locations in the course of a day
      b. Physicians in partnership practice may take turns with their colleagues, alternating nights & weekends “on call”
II. Vocabulary

PHYSICIANS (BY LEVEL OF TRAINING)

1. Resident
   - A member of the house staff of a hospital receiving training in a medical specialty
   - Def. a physician who continues clinical training after an internship

2. Intern
   - Def. a student receiving training in medicine by assisting
   - An internship may be completed during the final year of medical school
   - Def. a specialist taking additional training in a branch of his specialty
   - sub specializing requires a year or more of additional full-time education in a program called a fellowship

3. Specialist
   - A specialist passing an exam given by this specialty's board becomes a board-certified specialist

4. Subspecialist
   - Def. a specialist trained to perform a wide range of surgical procedures such as:
   - Endoscopic and laparoscopic surgery
   - b. Reproductive endocrinology
   - c. Forensic (legal) pathology
   - d. Gynecologic oncology
   - e. Geriatric medicine
   - f. Pediatric surgery is a subs. of general surgery
   - g. Child psychiatry is a subs. of psychiatry

5. General practitioner (GP)
   - Def. a physician treating all medical problems without specialization
   - Today, many GPs have completed a residency in family practice
   - a. Physician teachers
   - b. Attending physicians
     - a. During the final year of medical school
     - b. After graduation
     - c. In conjunction with the first year of specialty training

SOME MEDICAL SPECIALTIES

1. Anesthesiologist
   - Def. a specialist who provides pain relief and maintained a stable condition during...

2. General surgeon
   - Def. a specialist in internal medicine providing nonsurgical care for adults & adolescents

3. Internist
   - Subspecialties include...

4. Obstetric-gynecologist
   - Subspecialties include...

5. Ophthalmologist
   - Def. a specialist in the medical & surgical care of the eye
   - a. Ophthalmic surgery
   - b. Reproductive endocrinology (dealing with infertility problems)
1. Tissue
2. Specimens
   a. Microscopic examination of...
3. Cells
4. Body fluids
   1. Body fluids
   2. Secretions

SOME MEDICAL SPECIALTIES

1. Otolaryngologist - an ear, nose, and throat (ENT) specialist.
2. Pediatrician - a specialist treating children
3. Radiologist - a specialist working in one of the following branches...
4. Pathologist - specialists diagnose diseases by...

SURGICAL PROCEDURES

1. Hysterectomy - Def. surgical removal of the uterus because of...
2. Mastectomy - Def. excision (surgical removal) of a breast
3. Rhinoplasty - Def. plastic surgery of the nose

OTHER MEDICAL VOCABULARY

1. Anomaly - Def. an organ or structure that is abnormal in its...
2. Congenital (Adj) - Def. present at birth
3. Rounds - Attending physicians make rounds with...

a. Form
b. Structure
c. Position

a. Externs (medical students)
b. Interns
c. Residents

a. Therapeutic radiology
b. Radiation oncology (treatment of malignancies)
c. Diagnostic radiology

d. Pediatric oncology
b. Allergy
c. Endocrinology
d. Nephrology
e. Cardiology
Chapter 8: First Aid in Medical Emergencies

1. Reading
II. Vocabulary

Def. burns that involve the outer surface of the skin a. First-degree burns
Def. burns involving the tissue below the skin and occasionally underlying organs 1. First-degree burns
a. A burn with a blisters or blisters
b. Second-degree burns 2. Second-degree burns
a. A burn with a blisters or blisters
b. Third-degree burns destroy 3. A charred black color
the ability of the affected epidermis layer to regenerate, and treatment requires skin grafting
2. Treatment of burns
a. First-degree burns—leaves a blisters or blisters
b. Third-degree burns destroy the ability of the affected epidermis layer to regenerate, and treatment requires skin grafting
c. Serious burns require prompt medical attention & hospitalization to avoid shock, dehydration & to relieve severe pain

1. First-aid kit is only the first step
2. Expert advise should be obtained while these measures are being taken
3. Mobile emergency medical vehicles operated by trained paramedics can render first aid beyond what the layman can do until the patient can be seen by a physician

A. A first-aid kit should contain at a minimum
B. When helping victims

WORDS RELATING TO EMERGENCY CONDITIONS

A. Arrest
B. Asphyxiation
C. Concussion
D. Dehydration-excessive
E. Fracture

Def. the cessation of heartbeat or breathing
Cardiac or pulmonary arrest
cause-insufficient oxygen in the blood
Def. loss of consciousness
Effect-Permanent damage may result to the brain, heart, & other organs, & death may occur

Cause-a blow to the head
Effect-impairment of brain function
D. Dehydration-excessive loss of water from the body
E. Fracture
Def. a break of a bone