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The Linkages between Concept Maps and Language Learning

Luu Trong Tuan[1]
Le Thi Bich Thuan[2]

Abstract: So as to know how to apply effectively concept mapping into practice to solve the problem of language learning, it is noteworthy to work out its theory. This paper reviews the literature to investigate the construct of concept maps as well as the relationships between concept maps and language learning.
Keywords: Concept maps; Language learning

1. CONCEPT MAPS

1.1 Overview of the Emergence of Concept Mapping

Concept mapping has been widely used in science, mathematics, educational psychology, management and language pedagogy. The purpose of this section is to present an overview of the main trends of thought that have led to the interest in concept mapping as an instructional and learning tool to facilitate the development of learners' critical thinking, understanding, and remembering the facts.

It would be fascinating to see some historical examples of early graphical organizers. Since the term "concept mapping" was not around at that time, they were referred to as tree diagrams. The earliest known graphic knowledge representation of concepts and their relationships is the tree of Porphyry, emerging in 280 A.D (Ahlberg, 2008). Ramon Llull (1232-1315), whose writings developed Romance Catalan language and influenced Neoplatonic mysticism throughout 17th – century Europe, also used these structures of tree diagram to arrange knowledge (Horton, Lovitt and Bergerud, 1990). In one of his diagrams called the "Tree of Knowledge" (approximately 1270 A.D), the core concept is the central theme and this theme is surrounded by subordinate concepts (Nast, 2006). It is surprising to know that the graphical display of knowledge or concept of knowledge visualization using color, lines, and association to assist human thinking was well known by medieval times and already 1000 years old by this time.

The notion of concept maps dates back to research team at Cornell University in 1972 when they studied science concept learning in children (Afamasaga-Fuata'i, 2009). In 1979, Stewart et al. (1979, p. 171) claimed in their book "*The American Biology Teacher*" that they developed concept maps. However, the links in their concept maps were not named and therefore no propositions were formed from concepts. This means these concept maps can be understood only when the authors explain. Later, in 1984, Novak and Gowin referred to Stewart et al. (1979) and emphasized the importance of identifying relationships through

[1] National University of Ho Chi Minh City, Vietnam
[2] University of Technical Education, Ho Chi Minh City, Vietnam
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labeled links and concept maps were subsequently developed. In Novak's concept maps, the links were named and meaningful propositions were created out of concepts. This is the form of Novakian concept maps that has been spread over the world (Âhlberg, 2004) and is considered as significant innovation in education.

1.2 Defining Concept Maps and Concept Mapping

Many researchers tried to give out the definition of concept maps and concept mapping. Novak (1992) shortly described a concept map as an organizational tool to represent knowledge. Lanzing (1996) described concept mapping as a technique that can demonstrate how people visualize relationships between various concepts. Chularut and DeBacker (2004) proposed that concept mapping is "a tool for representing the interrelationships among concepts in an integrated, hierarchical manner" (p. 249). Later, the definition for concept maps is given in the latest introduction and instructions of the Novakian types of concept maps by Novak and Cañas (2006):

> Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases, specify the relationship between the two concepts. The result of linking two concepts is a proposition […] Propositions are statements about some object or event […] Propositions contain two or more concepts connected using linking words or phrases to form a meaningful statement. (p. 1)

In other words, concept maps represent meaningful relationships between concepts in the form of propositions. Also for Novak (1992), concept is defined as a "perceived regularity in events or objects" and represented by words or symbols while propositions, a unique feature of concept maps, are considered as "statements about an object or event, natural or constructed" and they consist of two or more concepts connected by a linking relationship that form unit of meaning (Novak, 1992, p.1). Cross-link, which shows interrelationships between ideas in different map segments, is a variation of proposition. It helps us "see how a concept in one domain of knowledge is related to a concept in another domain represented on the map" and "represents creative leaps" of the map creator in his or her new knowledge development process (Novak & Cañas, 2006). Linking words may be general or specific to the content area mapped. Examples of general linking words include "contains", "occurs in", "is", "uses", "produces", "involved in", "have", "such as", etc. (Noyd, 1998, para. 4).

Traditional concept maps include labeled concepts, directional arrows, linking words, lines suggesting hierarchical relationships, graphic representation of concepts and propositions conveying relationship among different concepts (Wheeldon & Faubert, 2009). For Novak and Cañas (2006), concept maps have the hierarchical structure in which the most general and inclusive concepts are put at the top and the more concrete and specific ones are at the bottom of the map. Figure 1 illustrates the concept map about "concept maps". The figure shows that the domain is concept map; key concepts are "organized knowledge", "focus questions", "concepts", "propositions", etc.; linking words are "show", "is", "begin with", etc.; propositions are "concepts are hierarchy structured", "concepts are labeled", etc.; and cross-link is "linking words are used to form propositions."

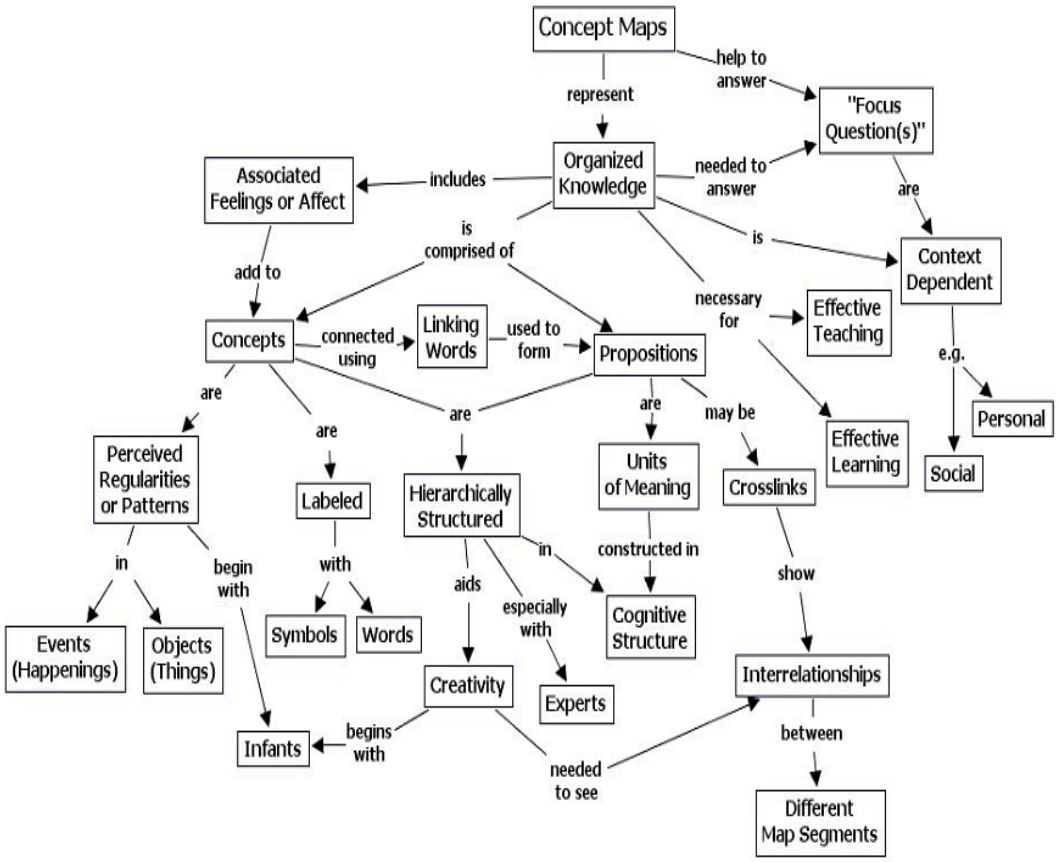


Figure 1: Concept Map about Concept Maps by Novak

(Source: the IHMC Internal Cmap server, part of the CmapTools network (Cañas et al. 2003))

As seen above, these definitions about concept maps have something in common: concept maps are diagrams that represent relationships among concepts and concept mapping is a tool that visually displays the knowledge structure of given topics and the connections between this structure.

As mentioned above, the ideal concept map has hierarchy. Nevertheless, many researchers raised question about the basic assumption concerning this hierarchical structure of knowledge in concept maps (Ruiz-Primo & Shavelson, 1996; Hibberd et al., 2002; Âhlberg, 2004). For example, Ruiz-Primo and Shavelson (1996, p. 578) showed their concern about this issue and proposed that it is not necessary to assign the hierarchical structure to concept maps because "if the content structure is hierarchical, a hierarchical map should be observed". In a similar vein, Hibberd et al. (2002) argued that concept maps allow hierarchical and network structures. Likewise, in his "Varieties of concept mapping", Âhlberg (2004) gave strong support to the view that there is no need to follow some unnecessarily complex rules in Novak's standards and proposed some elements of an improved method of concept mapping. For instance, he suggested that many words can be included in a concept label instead of short verbal labels, that it is not only when links are horizontal or are read upwards that arrows are used but all links between concepts have arrowheads to show in which direction the connection from one concept to another is to be read, that multimedia resources can be inserted to concept maps, and numbers may be included to clarify the order in which the propositions should be read, etc. (For the full list and further explanation, see Âhlberg, 2004)

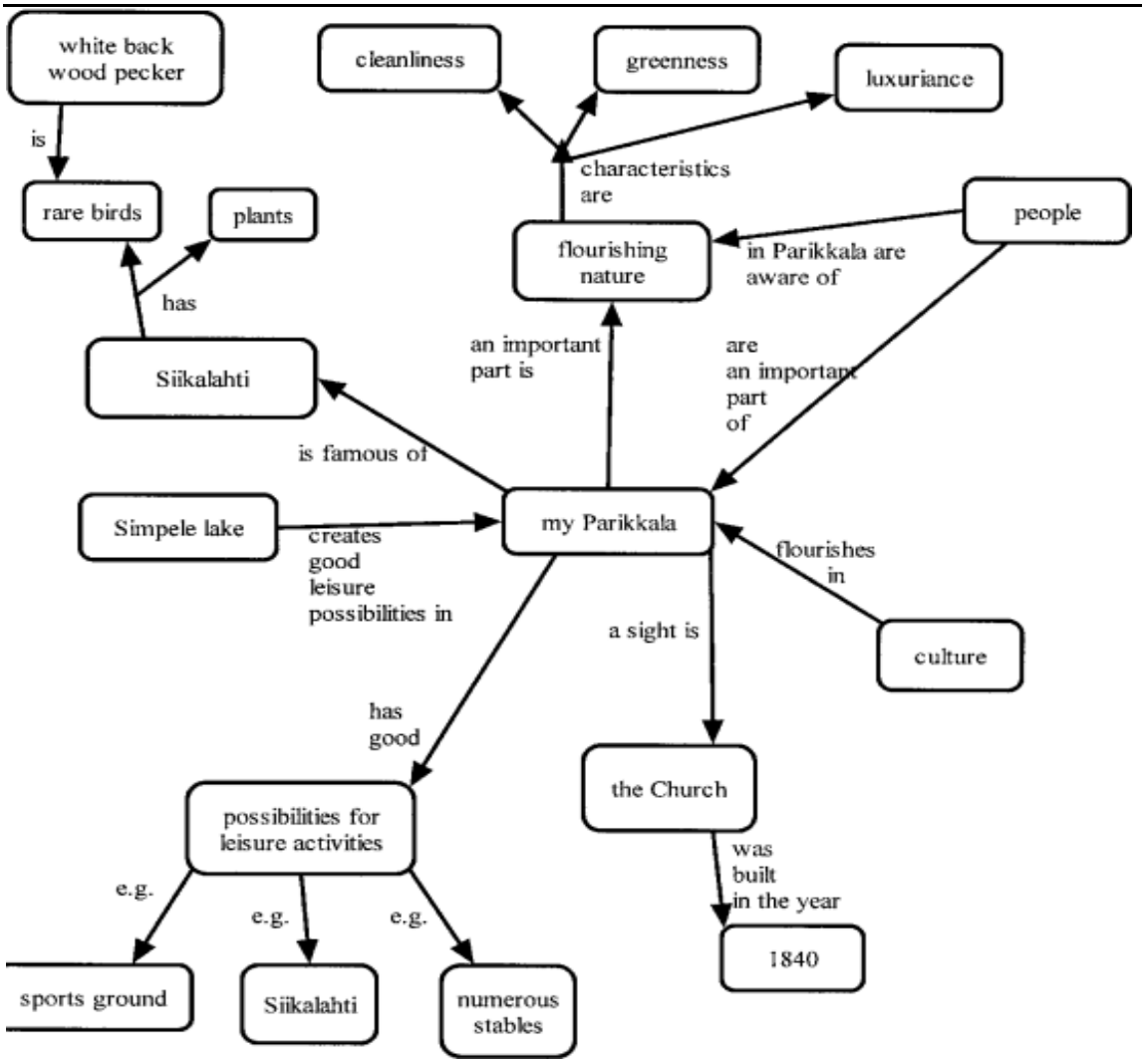


Figure 2: Improved concept map of Johanna concerns her municipality 'Parikkala'

(Source: Ahlberg and Ahoranta, 2002)

Âhlberg's view is that although hierarchies are natural ways of presenting human knowledge, we should consider how concepts are linked to each other in our thinking. Because the world is a system and everything in the universe is connected in some way so network or conceptual system can be the best conceptual representation of concept maps. In order to give sound support for this, he added "any learning theory is compatible with improved concept mapping, because it is as general as language itself" (Ahlberg, 2008, para. 12).

1.3 The Theoretical Underpinning of Concept Maps

It can be said that the idea of concept map is based on two cognitive theories of memory: Assimilation Theory of Ausubel (1968) and Associationist Theory of Deese (1965) (Croasdell et al., 2003, p. 397).

According to Fraser (1993), the fundamental idea in assimilation theory is that "memory is hierarchical and new information is processed and stored as either a more general or more specific concept to other, related and added, i.e., assimilated into the existing structure" (as quoted in Croasdell et al., 2003, p. 397). As can be noticed, Ausubel's learning theory stressed the assimilation of new information into the students'

prior knowledge structure. In that light, meaningful learning [3] takes place when the students integrate new concepts and propositions into his or her existing conceptual frameworks in order to remember and receive meaning for new knowledge.

For example, if you have known the concepts "dog", "bird", "cat", "human", when you learn the concept "animal", your brain will naturally place it into the hierarchy "above" the other already learned concepts. Likewise, if the concepts "eagle" and "canary" were studied later, they would be put "under" the concept "bird" (ibid., p. 397).

In contrast, associationist theory states that memory consists of a conceptual network that is not organized in a top-down fashion, although it is supported by hierarchies. In this manner, memory structure in Deese's theory is much more flexible and natural. When two concepts, which have nonhierarchical connections, overlap on some dimensions, relationships between them are formed naturally. In this learning process, the learner's network of concepts and relationships becomes more complicated and sophisticated. The memory structure in Associationist Theory, in the end, seems to be more or less the same as Assimilation Theory, except the rigid hierarchical framework.

In sum, although two theories above are different in their explanation of memory structure, they both "eventually arrived at the same place" – a concept map (Shavelson et al., 1994, p. 16). Whatever theories support it, concept map is used to display explicitly an individual's cognitive structure.

1.4 Concept Map Creation

In his doctoral dissertation "Theory Based Use of Concept Mapping in Organization Development: Creating Shared Understanding as a Basis for the Cooperative Design of Work Changes and Changes in Working Relationships", Fraser (1993) based on Novak and Gowin (1984), Shavelson et al. (1994), and Ausubel's (1968) Assimilation Theory, has proposed the rules for the construction of concept maps:

> 1. Concepts are located in rectangles or other geometric forms. Concepts can be represented by single key words or phrases or simple drawings. Arcs are lines used to connect the concepts. Linking words are sometimes written on the arcs to describe the relationship between the two concepts.
> 2. The linking words should specifically explicate the relationship between the two concepts. Together with the two concepts, the linking words form a proposition – such as "the grass is green" from the concepts "grass", "green", and the linking word "is". It should be noted that the literature views these linking words as optional in terms of concept map construction.
> 3. No right map exists, as all maps are idiosyncratic to each individual. Different people may produce very different maps for the same conceptual domain. A concept map can be wrong, however, if propositions are incorrect, such as "the bear speaks English".
> 4. The interconnections between concepts give rise to the power of the concept map. More interconnections and cross-linkages are an indication of a greater complexity and sophistication of understanding.
>
> (p. 398)

It should be noted that the relevance to a lecture topic of concepts and key words might be diverse. The same topic may, as Croasdell et al. (2003, p. 398) point out, be developed in different ways by using different concepts or key words of the map creators. As a result, different concept maps are created. Regarding the use of concept map as a teaching tool, they argue that pre-constructed expert maps [4], which

[3] Meaningful learning: learning with understanding which is not manifested in behaviour, but which can be described as 'a clearly articulated and precisely differentiated conscious experience that emerges when potentially meaningful signs, symbols, concepts, or propositions are related to and incorporated within a given individual's cognitive structure'(Ausubel, 1967, p. 10)

[4] Expert maps: have been previously prepared by an expert on the topic, and permits both students and teachers to build their knowledge on a solid foundation (Novak, & Cañas, 2006).

are used in the tradition of lecture outlines, can be used for imparting knowledge. Although these pre-drawn maps can "create biases in the number of key words on a map and in the way the associations are defined between nodes", their structure allows "consistency more aligned with teaching goals and pedagogy and the interconnectedness provides more information than the standard outline" (ibid., p. 398). Therefore, using structured expert maps as an instruction tool, according to him, is significantly important in recalling information.

Although concept maps may be designed in different ways due to different methods employed, Croasdell et al. (2003) provide specific instructions which they think are the easiest and most straight-forward to create concept maps.

> 1) determine the topic or domain of interest to be modeled
> 2) write that term (concept) in the middle of a sheet of paper
> 3) think of related concepts to that initial one and begin writing them down on the paper near the first term
> 4) connect related concepts with lines
> 5) keep adding more concepts and relationship lines to the map as it grows. Keep in mind there is no minimum or maximum size to a concept map – the size will depend on the understanding of the topic and the concepts the subject relates to the initial term.
>
> (p. 398)

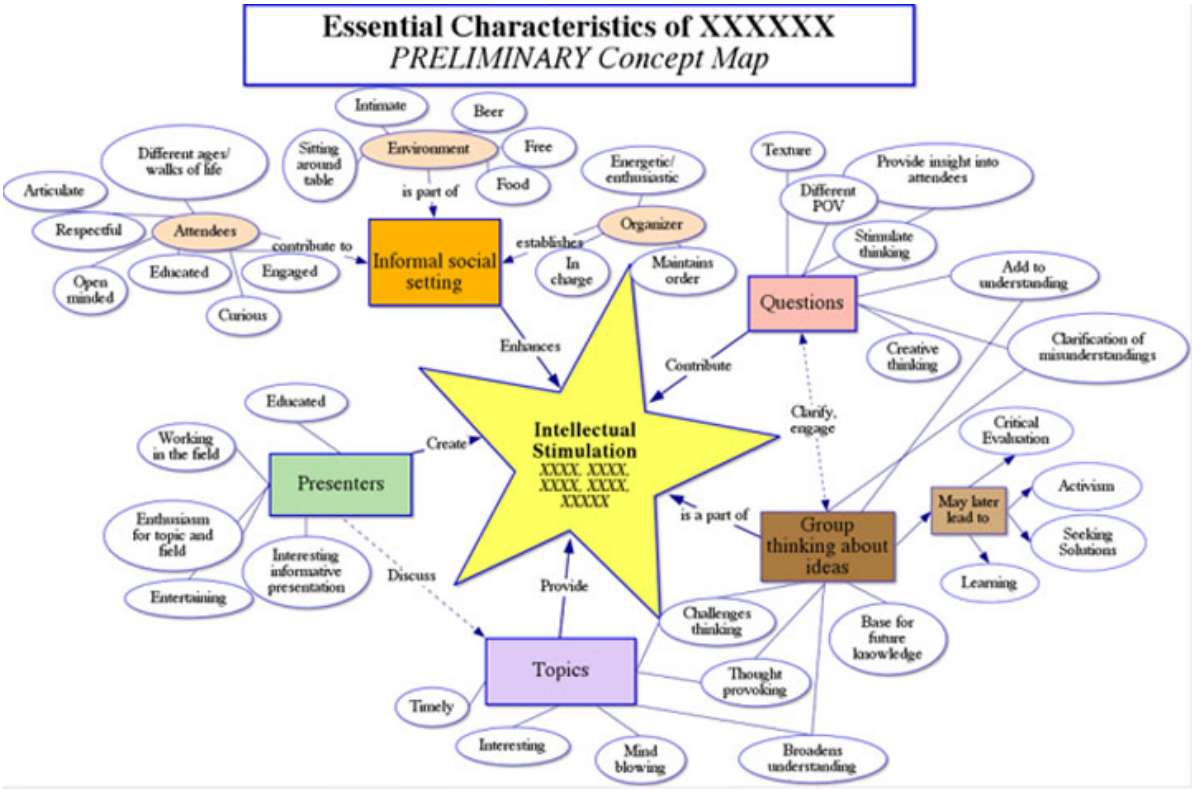


Figure 3: Concept map of "Intellectual Stimulation"
(Source:http://www.academicladder.com/gblog/uploaded_images/Concept-map2-789715.jpg)

For instance, the concept map of Intellectual Stimulation can be constructed by writing the term "Intellectual Stimulation" in the center of a page. Next, identify the concepts, descriptive words, or questions that may be associated with the main concept at hand and begin writing them down. In this example, sub-concepts related to the main concept are "questions", "informal social setting", "presenters", and "group thinking about ideas". Linking the sub-concepts to the main concept with lines. Then one keeps adding more related concepts and connecting them to each other and to the initial term already on the map

center. There is no limit to the size of concept map or the number of relationships a single concept can have because one concept relates to many others. This complex and interrelated relationships makes the concept map uneasy to read and understand. However, this map is a helpful way to represent learner's conceptual understanding of Intellectual Stimulation and we can use this to "understand the creator's point of view much better than if it were just explained in words" (ibid., pp. 398-399). The concept map of "Intellectual Stimulation" could look like Figure 3:

1.5 Other Visualizatio Techniques of Ideas Mapping

As already stated, concept mapping is by no means the only visualization technique that facilitates learning or fosters knowledge sharing in a systematic manner nor is it necessarily the best way for any given situation. There are countless visualization techniques for ideas mapping that use graphics for items, concepts, and arrows to indicate relationships such as mind mapping, cognitive mapping, conceptual diagram, visual metaphor, dialog mapping, semantic mappings, clustering, etc., (Eppler, 2006). Hence, some debate exists about what is and what is not a concept map (Ahlberg & Ahoranta, 2004) because there are many different types of graphic representation tools nowadays and in literature, concept maps and other tools are not properly understood. As a result, if you are not an expert in this field, you are easily confused. After many years of study about concept maps and concept mapping, Âhlberg (2004) stated that only mapping techniques that are based on the study of "Novak and his research group from 1981 to 2002" and meet the requirement that "meaningful propositions may be produced out of linked concepts" can be called concept mapping (as cited in Tergan, 2005, p. 189).

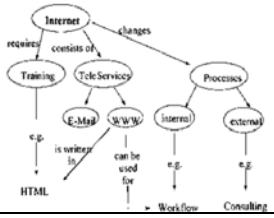
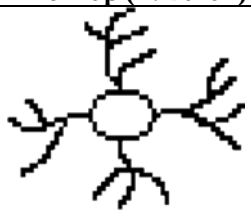
In fact, many researchers refer to Novak and Gowin (1984) but mix concept maps with other educational graphic knowledge representation tools such as: mind maps, cognitive maps, dialog maps, conceptual diagrams, etc., (Âhlberg, 2004). For example, Slotte and Lonka (1999, pp. 522 – 523) misleadingly call Buran's (1974, 2000) mind maps, which are much simpler association maps, as concept maps or some researchers circle full propositions, connect them with lines, and call the end product "concept maps" (e.g., Palmer, 1995; 1998, p. 113). Therefore, it seems very necessary to compare concept maps with other visualization techniques by presenting an overview of their key features, main application parameters, advantages and disadvantages and demonstrating difference between them. For the reason of space, we have chosen one widely used technique, mind mapping for this comparison. Below is the summary of key characteristics of the two visualization techniques for ideas mapping (Table 1).

From the table 1, we can notice that both visualization types have the same purpose that is "encouraging a high level of critical learning" (Brightman, 2003. p. 8) or "fostering knowledge sharing in constructive and systematic manner" to "enhance motivation, attention, engagement, facilitate understanding and recall" (Eppler, 2006, pp. 202 - 204). More specific, each format, to a greater or lesser degree, helps us to clarify thinking, organize ideas, and develop different interpretations and new understanding about the subject in question by expressing and exploring relationship between items. In terms of format, they all have the "stepwise completion", integrate text and image, and "relate (boxed, circled, or otherwise framed) items to others through (labelled or unlabelled) arrows based on explicit and sequential rules" (ibid., pp. 204-205). From the angle of function, these visual mapping techniques give the overall picture of ideas for organizing and analyzing a topic by illustrates the various relationships among items. Furthermore, both visualization types share common application that is they are used as thinking and learning tools not only for individuals but also for group sharing understanding (Brightman, 2003).

Although these visual mapping techniques have a number of attributes in common, each of them has their own distinctive features which make them unique or different from each other. (For further details, read Eppler, 2006, especially table 1 & 2). From the profile of these visualization types, we can see that concept maps, which express relationships of multiple concepts both in a hierarchical manner and network representation by using arrows, are contrasted with mind maps, which is restricted to radiant or tree structures with one central node in the center and many branches emanating from the center. As a result, a mind map has only one main concept and it reflects what you think about a single topic, while a concept map may have a set of concepts to present a system view. According to the father of mind maps - Buzan (1995), the main difference between concept maps and mind maps is that in mind maps, "concepts and ideas are represented, without signifying the particular meaning imposed on the relationships" (as quoted

in Tergan, 2005, p. 189). Furthermore, according to Ahlberg and Ahoranta (2002, p. 119), "concept map is an accurate representation of the main features of cognitive structure, while the mind map is an ordered association map open to multiple interpretations" because concept map presents ideas accurately not just hints as in mind map. In terms of simplicity, spontaneousness, and speed in creating the resulting map, concept maps are more complex, free form with various clusters so they take longer to develop whereas mind maps are simpler, fix on a single conceptual center and faster to create. This comes down to the point that concept maps have web representation while mind maps have radiant structure. In terms of emphasis, concept maps focus on the "clarity of display and making explicit the relationship between ideas" by employing occasional icons whereas the "artistic layout" with the maximum use of attractive, colourful pictures, shapes, images, etc., is what mind maps stress. (Brightman, 2003, p. 8). Another contrast is that in concept maps, the representation of cross-relationships between mapped elements is a typical feature, unlike mind maps which typically make sparse use of representing interrelationships between ideas (as cited in Tergan, 2005, p. 189).

Table 1: A comparison of concept maps and mind maps
(Source: Eppler, 2006, pp. 203 – 204)

Format Parameters	Concept map (J.D Novak)	Mind map (T. Buzan)
Sample thumbnail representation		
Definition	A concept map is a top-down diagram showing the relationships between concepts, including cross connections among concepts, and their manifestations (examples)	A mind map is a multicoloured and image-centred, radial diagram that represents semantic or other connections between portions of learned material hierarchically
Main function or benefit	Shows systematic relationships among sub-concepts relating to one main concept	Show sub-topics of a domain in a creative and seamless manner
Typical application context	Classroom teaching, self study and revision	Personal note taking and reviewing
Application guidelines	Use it as a learning support tool for students, that is, to summarize key course topics or clarify the elements and examples of an abstract concept	Use it for pre analytic idea jostles or rapid note-taking, or to structure the main contents of a course or topic hierarchically
Employed graphic elements	Boxes/bubbles with text and labelled connect or arrows	Central topic bubble and colored (sub-) branches with text above branches, pictograms
Reading direction	Top-down	Center-out
Core design rules or guidelines	Start with main concept (at the top), and end with examples (bottom, without circles); boxes/bubbles designate concepts, arrows represent relationships; include cross-links among elements	Start with main topic (center) and branch out to sub-topics, employ pictograms and colors to add additional meaning. Write text above the branches
Macro structure adaptability	Flexible, but always branching out	Somewhat flexible, but always radial
Level of difficulty	Medium to high	Low
Extensibility	Limited	Open
Memorability	Low	Medium to high
Understandabi-lity by others	High	Low

The difference in their structure creates the distinction in their application. Mind mapping is of most use as a personal learning tool because of its highly personal nature in reflecting the unique networks and patterns of thought in individual brain which is reflected in its hand drawing with a lot of images to enhance memory (Brightman, 2003). Thanks to the exceeding use of colorful and peculiar visual aids which stimulates different parts of the brain, triggers learning and understanding, and sorts ideas into groups by giving each sub-group a different sign to easily recognize, mind maps tend to be more memorable. Thus, mind maps would be best used for personal note taking in class (Eppler, 2006; Brightman, 2003). Concept mapping seems to have much effect on both conceptual and linguistic development (Heimlich and Pittelman, 1986) so it is widely used as an instructional strategy in class to develop concepts. Because its principles are based on schema theory [5], instruction for concept mapping usually includes a brainstorming session where students are encouraged to activate their prior knowledge of a topic and focus on the relevant content schema (Carrell et al., 1989; Afamasaga, 2009). In addition, due to its occasional icons which tend to be less memorable and time-consuming construction, concept maps can be used as personal learning tool at home for review purposes (Eppler, 2006; Tomlinson, 2001).

1.6 Procedures for Constructing a Concept Map in Second and Foreign Language Teaching Class

In the previous section, we know that concept mapping is an effective teaching tool. Therefore, many models for the concept map construction in teaching practices have been proposed.

Adapted from Novak and Gowin (1984) and White and Gunstone (1992), Birbili (2007, para. 27) suggests a procedure involving three steps that teachers can apply to construct concept maps in class.

A. The teacher announces the topic of the lesson, write and circle the key concept of the topic in the center of the board or on a large piece of paper. Pictures, photos or drawing images can be used.

B. Students are asked to think of the other sub-concepts, words, ideas, and specific examples associated with the topic and discuss in groups (15-25 concepts will suffice). Then teacher invites students to share what they already know about the topic. As students talk, teacher writes on the side of the board the sub-concepts arising from the learners' ideas. After discussing with students about the focus of the lesson, teacher selects some sub-concepts and writes them downwards the key concept. Line and arrow are used to connect the key concept and sub-concepts. As teacher links the two concepts, state in a simple and short sentence the relationship between them (proposition). Label the line using simple action words (linking words) that specify the relationship between the concepts, write the connecting word on the line and use different colored chalks for circles and links to help students see these as different types of information.

C. Students group other related sub-concepts that they brainstormed in the previous step into categories, assign category names and put them in the secondary levels in the concept map by identifying the relationships among concepts. Then they rank the concepts from most general at the top to most specific at the bottom. Teacher asks students to discuss to tell the reason for putting a sub-concept under another sub-concept. Based on students' ideas, teacher connects concepts from the list, one pair at a time, with directional links, label the linking lines, enclose concepts in a box or oval, and identify crosslinks. This process is continued until all concepts appear on the map.

Besides proposing a process for the construction of concept maps in pre-task activity, some writers attempt to incorporate concept mapping into while-task activity (Skinner, 1996; Zygouris-Coe, 2004; Vitale & Romance, 2007). For example, in their *"A Knowledge-Based Framework for Unifying Content-Area Reading Comprehension and Reading Comprehension Strategies"*, Vitale and Romance (2007), based on the question of how to optimize the effectiveness of reading comprehension strategies in school settings, have suggested an implementation procedure for employing concept mapping as one of the three complementary substrategies to enhance comprehension. In this procedure, the students are provided

[5] Schema theory presupposes that information is stored in the brain as abstract mental structures, categorical rules, or scripts that humans use to interpret the world (Schmidt, 1999).

with the reading passage (or series of passages) containing more information about the topic than what they listed on the pre-reading map. Their duties here are identifying, arranging in hierarchical form, linking the core, subordinate ideas, and illustrative examples together in a visual display, and discussing in groups to add or eliminate the information from the initial map. When the class reaches a consensus of the information should be presented, the final concept map which indicates what they knew before from what they know now will have different shapes and colors. In other words, this process shows the development in the learners' thinking and learning. Concept mapping, in general, helps students not only to "actively relate what they are reading to their prior knowledge in general and to what they previously have read with understanding in the passage itself" but also to "actively organize the knowledge about which they are reading by identifying key concepts and concept relationships to enhance comprehension" (ibid., pp. 88 – 89).

Moreover, in order to successfully utilise concept mapping as a potential teaching tool, teachers should take the following guidelines into consideration. Although some researchers regarded concept mapping as an easy tool to capture (Birbili, 2007; Avery, Baker & Gross, 1996), it can easily make the students confuse and embarrassed if the construction is not controlled well. In fact, when asked to think of concepts related to the topic, students often give out too many concepts which distract the lesson content. Therefore, Novak and Cañas (2006) recommended generating 15 to 25 concepts for a specific topic. In addition, as Sparks Linfield and Warwick (2003, p. 126) point out, teachers must emphasize the linking words in order to help the learners recognise that "they are what makes the whole thing have meaning". These words will create propositions or cross-links, which are the most "difficult aspect of constructing" (Safayeni et al., 2003), however they are the unique characteristics of concept maps. Also, different colored chalks and shapes for nodes & links, which differentiate types of ideas or relationships, are encouraged to use (Birbili, 2007).

Furthermore, the teachers must begin planning by making clear themselves about the knowledge and skills that they want each students and the whole class to grasp at the end of each unit. Above all, clarifying their own thinking about the key concepts of a topic or unit and "generalizations that give meaning and structure to the topic" they are planning, teachers can "ensure that all learners gain powerful understandings" (Tomlinson, 2001).

Another aspect relating to the way to skillfully employ this tool in teaching is the patience of the teachers. As Ojima (2006) claims, in order to utilise the concept mapping strategy effectively, the learners need a certain period of training and practice to make themselves familiarise with it. Indeed, teachers should introduce concept maps after the learners have "had some experience with simple, less-structured graphic organizers such as webs as a way of summarizing and presenting information" and the first concept maps should be constructed with "simple, familiar topics" and "a small number of concepts (e.g., 2 to 4)" (Birbili, 2007, para. 18).

In a nutshell, it is apparent that these suggestions are important for successfully employing concept mapping in teaching and they require the teachers' skillful and flexible manipulation and the confidence in mastering the topic. Once the teachers keep in mind these guidelines and apply them in their teaching, concept maps will show all their beauty.

2. THE LINKAGES BETWEEN CONCEPT MAPS AND LANGUAGE LEARNING

Apparently, it can be said that concept mapping has set its role as an extremely effective strategy because the benefits it brings about are seen in language learning. Following are the relationships between concept maps and language learning.

2.1 Concept mapping as a Form of Pre-task Planning

In the investigation of the impact of planning time on second language learners' task performance, a number of researchers have used concept mapping as a form of pre-task planning to facilitate this process.

In an effort to enhance the students' reading comprehension, Carrel, Pharis and Liberto (1989) implemented a pre-reading activity with concept mapping. In this stage, the students brainstormed about a given topic, made connections between ideas clusters, and displayed ideas on a graphic map. The researchers found that when used as a form of pre-task activity, concept mapping provided students not only the concepts and words that they were about to encounter in the reading text but also an overview of the content to be learned.

Ojima (2006) used it as an instructional strategy in a planning phase for writing. The researcher considered whole connected process - a description of associated word clusters and brainstorming activities such as discussion - as concept mapping strategy in a form of pre-writing activity. This study examined the effects of concept mapping as a pre-task activity on three Japanese ESL learners' writing product as well as on their writing process. In this activity, the instructor introduced concept mapping as a pre-writing activity for both in-class and homework compositions. In the procedure of describing concept mapping, the instructors first chose the topic "watch", wrote the word on the board then told the students how to create a concept map by choosing a topic first, writing the key word or concept in the centre circle of the map and then expanding their ideas on the topic. Next, she conducted demonstrations of how to develop ideas on the topic by writing the words "fashion" and "be on time" on the board, saying that they are idea subsequences of "watch", drawing lines to connect these words with the topic, and adding more subsequent ideas to the map. The instructor continued by asking the students to discuss in groups in 10 minutes to share their ideas for writing. After that, each student wrote their own compositions in 20 minutes (ibid., pp. 571 – 572). The results of this investigation revealed that pre-task planning activities help the learners to produce better written texts in ESL classes. This research also showed that each learner made distinct applications of the concept mapping strategy in their writing processes due to individual experience, motivation, and task conditions.

The positive effect of concept mapping in pre-task activity is further supported by Fadhilah's (2009) study. In an attempt to improve the low ability of the students in comprehending the texts, the researcher applied Concept Mapping Strategy as one of the strategies in teaching reading. This study consisted of two meetings. The first meeting covered the pre-reading and while-reading activities whilst the second meeting embraced the post-reading activity and reading comprehension tests. In the pre-reading activity, the teacher announced the objective of the lesson, conducted brainstorming activities to stimulate the students' prior knowledge, and recorded the information gained in the form of a concept map as a model for the students to make their own version based on the text. The findings of the study indicate that concept mapping as a pre-reading activity makes the students get involved actively in teaching and learning process and improves the students' reading comprehension ability.

2.2 Concept Maps Facilitate Knowledge Acquisition Via Meaningful Learning

A rewarding aspect of concept map is that it organizes ideas in a logical manner which helps to develop critical and logical thinking. According to Novak and Cañas (2006), concept maps facilitate creative thinking thanks to "the hierarchical structure that is represented in a good map and the ability to search for and characterize new cross-links". In this diagram, every concept is connected to another and linked back to the original concept. By visually expressing clearly the association of various related concepts, concept maps help the learners to find unseen connection between ideas, organize information easily, create new knowledge and understanding which in turn, clarify their thinking, enhance understanding of the conceptual structure of selected topics (Afamasaga-Fuata'i, 2009), and "develop different interpretations and new ideas about the subject in question" (Brightman, 2003, p. 8). This process of making knowledge explicit makes the learners aware of what they know and as a result they can modify their old information. In fact, students start with a topic at the centre or at the top then generate a web of related ideas from that, and arrange these concepts in different categories. This organization of making associations reflects the

way our brains organize ideas. The mind is highly organized and appears to store lexical items in semantic fields. So when we think of one idea or word, we automatically think of others which are associated with it. According to Chamot et al. (1999, p. 29), "Information is retained and connected in the brain through mental links or pathways that are mapped onto an individual's existing schema". In order to create a meaningful concept map, the learners have to select key terms, identify related sub-concepts, links and cross-links, and choose link words or symbols.

In addition, by visually demonstrating complex relationship among ideas, concept maps present information in a condensed way that fosters the understanding of complex information without elaborative explanations as in a written narration. In fact, learners can clarify easily their own thinking about the core of a topic and develop different interpretations about the subject in question by creating a concept map of the unit or topic with key terms and essential questions (Tomlinson, 2001). In a similar vein, Gul and Boman (2006) argue that it's the flexibility of concept maps in terms of expressing relationships among ideas allows the deep understanding for new points and cross-linkages from one idea to another. And because of their ease in conceiving and retaining a visual configuration of information for later recall, concept maps are considered as a useful tool to take notes and review for exams. (Tomlinson, 2001; Arslan, 2006; Gul & Boman, 2006). These visual aids and associations in this organization make recalling the loads of words easier than in linear notes.

Indeed, concept map is a promising tool to facilitate critical thinking. Adler (1978) is particularly insistent that "the goal of education, should not be to provide information, but rather to enable students to question, examine, and reflect upon ideas and values presented to them" (in Gul & Boman, 2006, p. 200). Indeed, in learning, it's crucial that the learners organize their own thinking in such a way that they can make ideas meaningful, communicate clearly, retain and recall easily information for latter use. As some learners have difficulty in reading text or listening to a lecture because they do not have a tool to help them visualize the organization of information, working with concept maps, which identifies the important concepts in order to follow the flow of ideas in the text or lecture, would help them overcome this problem. Put simply, this tool not only helps the students focus on key ideas but also helps them see how teacher or author develops a line of thought. Therefore, as Tomlinson (2001, p. 77) believed, concept map can be of "great assistance to students who struggle with print materials, lectures, or even organization of information".

Inspired by the work of Ausubel et al. (1986), Daley et al. (1999) explained why the construction of a concept map can enhance understanding about a given subject. They come up with an explanation that concept learning occurs in three ways: subsumption, differentiation, and integrative reconciliation.

> Subsumption requires rearranging and reordering conceptual understanding and meaning […] to develop a conceptual hierarchy and in turn, to learn and remember it. For instance, communication skills may be learned in one course as discrete interpersonal skills and then later be subsumed under managerial kills in a subsequent course. Where progressive differentiation involves learning how to analyze parts of a greater whole (e.g., learning that tenderness, redness in skin color and swelling are signs of inflammation), integrative conciliation involves synthesizing (e.g., knowing that inflammation as a whole includes tenderness, redness in skin color, and swelling).
>
> (as quoted in Gul & Boman, 2006, p. 202)

Furthermore, because of its strong point in making complex relationships among concepts of the structure knowledge explicit for easily constructing and integrating, concept maps can serve as scaffolds for content and language learning when they are well designed by the teacher. The learners can not remember everything so the teacher should help them to see the big picture of the topic as well as build a scaffolding of meaning, a governing framework for future success by just emphasizing the main ideas, key concepts and principles. By providing the framework for students to tackle a specific learning task that encourages deep learning, concept maps "frame a specific task and identify a meaningful purpose for the activity" (Le Thai Hung, 2007, p. 22). Effective teachers could take advantage of concept maps by creating a one page capsule of ideas in a topic or unit to make the knowledge more easily accessible and integrated by students.

Last but not least, concept map construction and discussed concepts keep the students engage in class activities and give them ownership of the class content to better remember the lesson. As in domino effect,

when equipped with a helpful tool of high attention, engagement, and recall in order to understand and use specific language structures like concept maps, the students gain much progress in their learning.

As can be seen, the formation of concept maps, whose process is from the prior knowledge to the new concepts, creates meaningful learning. In this process, the students should think in more complex and critical manner which involves categorizing, inferring, summarizing, comparing and contrasting, evaluating, etc., rather than in a simple linear manner. As a result, learners can understand, retain and recall the subject better when they employ concept maps to represent and organize information (Chularut & DeBacker, 2004).

2.3 Concept Maps Assess Learners' Critical Thinking

In this part, we appeal for the need to now consider the potential role of concept mapping as a strategy to evaluate critical thinking as a learning outcome. Concept mapping shows it values not only in facilitating the learner's development of critical thinking abilities but also in assessing whether and how those abilities have been acquired (Beissner, 1992; Daley et al., 1999; Thayer-Bacon, 2000; Castellino & Schuster, 2002; Wheeler & Collins, 2003). It can be noted that assessment is an integral part of the learning process concerning the relationship between learning and professional practice latter. As an effective tool to visually demonstrate students' thinking and reasoning, concept mapping can be used for illustrating their understanding development of a subject, or "measuring the growth of student learning" (Akinsanya & Williams, 2004, p. 43). By making visible the unseen changes in students' cognitive structure, concept maps reveal students' misconceptions in learning and make it "easier for the faculty and student to recognize any development of knowledge that has occurred" (Harpaz et al., 2004, in Gul & Boman, 2006, p. 203). Kathol et al. (1998) advocate that concept maps can assess student knowledge in a given moment as well as its development overtime. In this light, King and Shell (2002) reported that the creative and flexible nature of concept mapping fitted well with learners at any levels. They observed that the beginning learners created simple maps with one major concept whereas more advanced learners developed complex maps with changes in the numbers, hierarchies, and interrelatedness of various concepts.

Also, it's important for the students to have a chance to amend their concept maps after "a first round of feedback" because the refinement showed that significant developments in thinking and learning had occurred (Gul & Boman, 2006, p. 203). Through actively discussing in class to develop a big map, learners received constructive feedback from other students and teacher to improve their individual concept maps. As a result of critical thinking and reflecting on their own understanding, interacting with others, the learners' final concept maps will be more complex than the initial ones. Teacher can check a student's understanding and learning through the ideas and words reiterated by that student in his or her creation of a concept map. Then these ideas and words are "analyzed and rated according to given criteria related to arrange of possible differences in simple to more complex thinking processes" (Gul & Boman, 2006, p. 203). More specific, through incorrect ideas, misconceptions or wrong relationships between concepts created when students develop their own concept maps, the teacher can have an insight into what and where the students do not understand. This information will be very useful for the teachers in adapting or changing their ineffective instructions.

Although concept maps have demonstrated their positive effects on student learning for various topics and in diverse teaching situations, they also show some drawbacks. In particular, they may "not fit all types of target groups" such as novices or non-academics, "learning tasks" as in developing procedural skills, "application situations" such as rapid note-taking or "topics" like processes or developments (Eppler, 2006, p. 202). The reasons for their application limitations lie in their "strict formal rules" in concept map creation and the stress on identifying concepts and their various relationships make them difficult and time-consuming to develop (ibid., p. 202). Thus, in order to create a meaningful concept map, students need a lot of time, extensive training, systematic assistance and feedback from teachers.

In addition, as Eppler (2006) explains, because the main function of concept maps is displaying and making explicit the relationship between ideas, their overall pattern do not assists memory much. Another feature that prevents concept mapping as a versatile tool for representing efficiently numerous related ideas

is their "boxes and arrows format" although concept maps have an accessible format (ibid., p. 202). As a result, some learners have problems understanding the complex concept maps of others because of the complicated web of relations.

2.4 Concept Mapping as a Means to Facilitate Reading Comprehension

The use of concept mapping in the planning phase has positive effects on the learners' task performance in many ways. It helps to stimulate creativity, activate prior background knowledge, prepare the learners concepts and words in advance for the task, give a concise summary of the content, assess their readiness for the task, encourage the interaction with others, arouse their interest to stay on task, and thus promote the quality of their language production. Evidence has also been found to prove concept mapping enhances learners' reading comprehension at many levels.

For instance, Dyer's study in 1985 was to find out whether concept mapping could benefit students in reading stories. The researcher found that the students who used concept maps scored significantly higher on a comprehension test than the students who did not use them.

In an attempt to investigate whether concept mapping strategies are beneficial for all or specific levels of students, Chiang and Guo (1997) found out that students with middle and lower proficiency benefited more from concept mapping strategies in terms of organizing information and promoting comprehension.

In their research, Chang, Sung and Chen (2002) designed three concept mapping approaches – map correction, scaffold fading and map generation – and examined the impact of each on learners' reading comprehension and summarization skills. The final result proved that map correction is more effective on reading comprehension and summarization skills than other concept mapping approaches because it requires critical thinking and concept mapping process seems like steps necessary for summarization. The remarkable point in this study is its emphasis on text comprehension than on concept comprehension and the focus on the learners' ability to summarize. This is also what Dolehanty (2008, p. 8) called "compelling new research for applying concept mapping strategies to text comprehension".

The most recent, study of Liu, Chen and Chang (2010) was to investigate the effects of a computer-assisted concept mapping learning strategy on EFL college learners' English reading comprehension. They conducted the research with four classes of students - 192 freshmen who were divided into low-level and high-level groups according to their English proficiency. Two classes were chosen as experimental group and other two classes as the control group. The numbers of poor and good readers are nearly the same in both groups. The treatment was administered in ten weeks, two hours a week. The participants took three tests in reading comprehension: pre-test (before the experimental teaching), test 1 (after the first practice of concept mapping was completed), test 2 (after the second practice of concept mapping), test 3 (after their third concept map practice). As the researchers found, concept mapping reading strategy was more valuable than the traditional reading teaching strategy to enhance poor readers' reading comprehension and poor readers benefited more from concept mapping reading strategy than good readers. In other words, "the computer-assisted concept mapping reading strategy improved poor readers' reading ability and narrowed the reading proficiency gap between good and poor readers" (ibid., p. 442).

Drawing on Novark and Gowin's (1984) work and other researches, these authors explained the positive effects of concept mapping reading strategy on learners' reading ability. Thanks to its ability to visualize the relationships among concepts, concept mapping allows the learners to analyse structure, group ideas into categories, get the main ideas of a text easily in order to understand the reading material. Through concept mapping procedure, which requires the learners to find sub-concepts, classify and arrange them, link related sub-concepts, build new cross-links, link old information in one's background knowledge and new information, give examples to interpret the map, etc., concept mapping stimulates the learners' meta-cognition perception, helps them build appropriate monitoring strategy, memorize and withdraw their knowledge. This complex process promotes understanding by helping readers apply higher level reading strategies to enhance comprehension and reduce reading difficulties. In addition, the authors gave out the reasons for the result that good readers did not get much benefit from concept mapping reading strategy is

that "good readers already have their own effective learning strategies and knowledge structure". (ibid., p. 443)

Another study was conducted in Vietnam by Le Thai Hung (2007) in reading classes at An Giang University. The experiment with 2 classes of second year students showed that students learning with concept maps better comprehending the texts, consequently the better test performers.

All in all, these studies show that concept mapping not only facilitates reading comprehension in the pre-reading stage but also in the whole reading process. However, they were carried out in context of foreign countries or rural areas in Vietnam not big city like Ho Chi Minh City. Thus, the need for investigation the impacts of concept maps on reading comprehension in new context and different perspectives are still worth researching.

2.5 Concept Maps Enrich Classroom Discourse

The utility of concept maps does not stop as an individual thinking and learning tool but explores as a tool for group building understanding and knowledge communication when each learners contribute his or her own knowledge to a given topic in order to build a big picture of group sharing knowledge. The concept maps provide the context for expanding and enhancing interactiveness among students which are essentially beneficial for language learning. As the learners discuss concepts and the relationships between them in a topic, they engage in the process of communicating, exchanging thinking, checking comprehension, negotiating and clarifying meaning, reasoning publicly in a social setting (e.g., English classrooms). This process is useful for the learners' reflection and revision which can result in the development of their conceptual understanding and meaningful learning.

Many teachers who used concept mapping within the context of cooperative groups of learners recognize that their students viewed it as an ideal tool to stimulate creativity, enhance interactiveness, and create fun (Castellino & Schuster, 2002; Daley et al., 1999; Wheeler & Collins, 2003) because it make students less anxious, embarrassed and insecure, highly motivated and hence promote greater achievement in their study (Beitz, 1998). The more diversity and authenticity of the classroom discourse, the more increase in motivation and the acquisition of the target language.

3. SUMMARY

This paper has explored the main issues relating to concept maps. It has also showed that there are the linkages between concept maps and language learning. These relationships are illustrated in the following conceptual framework (Figure 4).

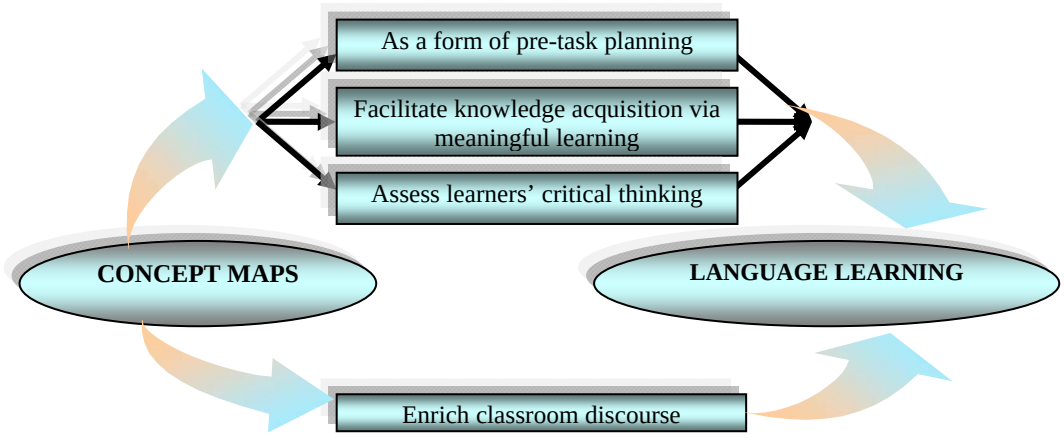


Figure 4: Conceptual framework

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