RESEARCH ARTICLE

CONCEPT MAPPING AS A TOOL FOR MEANINGFUL LEARNING

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Manuscript Info

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Abstract

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Concept maps have now been used as a research and evaluation tool. It enables students to visualize the structure of knowledge, interrelated concepts and the relationships among various concepts and sub-concepts. Concept mapping has been found to be an effective teaching method which enhances meaningful learning. Concept mapping was significantly more effective than the traditional or expository teaching strategies in enhancing learning. Cognitive mapping differs from traditional methods by making underlying cognitive structures transparent and giving a focus to the set of propositions by which learners construct meaning. Concept map structure correlates with the perceived data. They provide quick summary and help to identify topics to elicit new information. Concept mapping is a strategy that can be used to impart content knowledge with sense within a limited period of time.Concepts learned by rote learning tends to be quickly forgotten. Teaching methods and tools should transform knowledge from short-term memory to long-term memory. Several research studies have supported Concept mapping in academic and non-academic fields. This article describes how the concept mapping can be used to transform abstract knowledge and understanding into concrete visual representations. It is underlined that the Concept maps will serve as a suitable tool to support educators in promoting students comprehension and understanding of new concepts.

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Introduction:-

Teachers have long been concerned with the problem of facilitating the students in their learning and understanding of concepts. Concept maps provide a unique graphical view of how students organize, connect and synthesize information. A concept map can be considered as somewhat similar to a spider chart, an organized chart of a flow diagram. A concept map for teaching and learning is one, arranged in a hierarchical organization in which the more inclusive concepts at the top of the map and the more concrete and specific ones at the bottom.

Concept maps were developed by Joseph Novak in 1972 at Cornell university. Concept maps are developed on the basis of Ausubel's theory of Meaningful learning. Meaningful learning refers to the concepts that the learned knowledge is fully understood by the individual and that specific facts relates to other stored facts. The material to be learned must be conceptually clear and presented with examples related to learners prior knowledge. A person learns concepts by consciously identifying logical relationships between the new concept and concepts already

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known. Meaningful learning involves cognitive processing, include building connections between visual and verbal representations (Mayer & Moreno, 2003) and integrating new information with existing knowledge (Novak, 1990), which is a goal of multimedia learning (Mayer & Moreno, 2003).

Concept mapping has been found as an effective tool for aiding students comprehension. The technique enables the students to visualize the structure of knowledge. The highly conceptual nature of many subjects makes it particularly difficult for students and the strategies used in the classroom have not sufficiently eased the learning process. Part of the problem stemmed from a pattern of passive learning that simply requires memorization of information, and no evaluation of the information is required. As a result students failed to construct powerful concept and propositional frameworks, leading them to see learning as a blur of myriad facts, dates, names, equations, or procedural rules to be memorized. Rote learning cannot promote reflective thinking or novel problem solving. If students can see a clear organized picture of board, unit covering various concepts, then they would build a deeper understanding and appreciation of these concepts. Concept mapping builds explicitly on Ausubel's (2000) assimilation theory of meaningful learning and fits well with constructivist learning perspectives (Trowbridge & Wandersee, 1998).

Concept mapping would be an excellent strategy to enable the students to think about connections between science terms being learned, organize their thoughts, visualize relationships between key concepts in a systematic way and reflect on their understanding. Concept map stresses meaningful learning and appears to be ideally suited to address biology content.

Key Components of a Concept Map:
Not all diagrams that have words/phrases inside nodes are concept maps. Concept maps have specific characteristics that distinguish themselves from other diagrams that are used to represent knowledge. They are,

Nodes:
Nodes are the circles or the boxes that are used to represent a concept or an idea. These may vary in size, according to their hierarchy on the map; for example, more general nodes at the top of the map may be bigger than the more specific nodes that follow them.

Cross-links:
Concept map consist of concepts in different domains.The relationship between these different domains of knowledge are shown with cross-links.

Linking words:
Linking phrases if contain more than a word. These describe the type of relationship between the two concepts and appear on the line connecting them.

Hierarchical structure:
Usually, concept maps are organized hierarchicaly. The most general and inclusive concepts are placed at the top of the map.

Propositional structure:
An oncept map illustrates a set of meaningful propositions about a topic.

Every two concepts or more than two along with the linking phrases, form a meaningful sentence, otherwise known as a proposition.
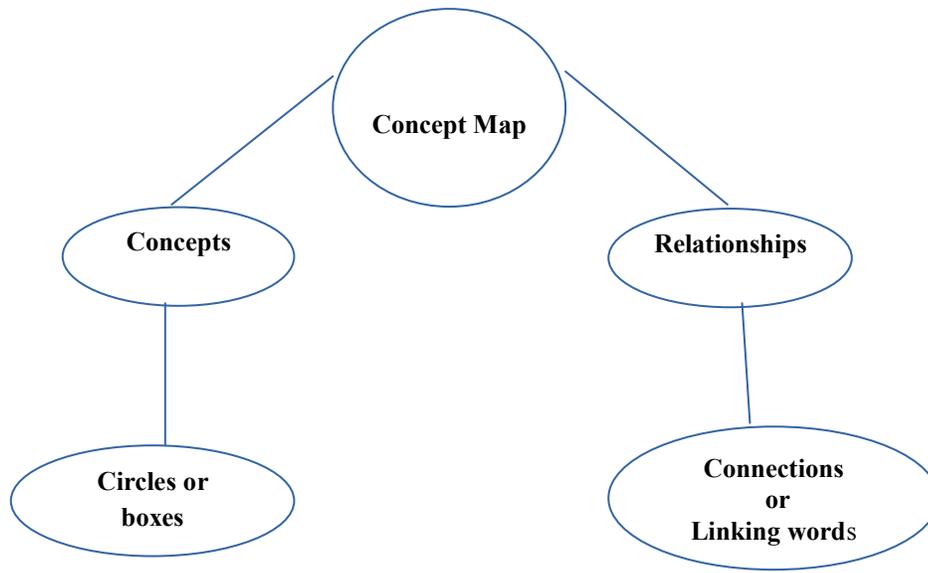
Figure 1:- Basic structure of a Concept map.

Importance of Concept Mapping:
Concept mapping has powerful utility for the demonstration of understanding. It can be used to display individual knowledge structures for comparison at different stages in the learning process. The characteristics of concept maps that have made them a popular tool in learning include:
1.   It is the visual presentation of ideas.
2.   It develops teacher-student relationship.
3.   Provides clarity to the concepts involved with each other.
4.   It is a good way to work to prepare for the exams.
5.   It is suitable for many different topics, instructional stage and grade level.
6.   It is easy to learn, teach and use.
7.   Scope based.
8.   Concept maps are student - Centered active methods for students.
9.   It can be used for assessment.
10. It can be used effectively for revision and students are able to rank topics which they learned
11. It provides easiness to establish a link between topics.

Construction of concept map:
Some general principles have to be followed while constructing a concept map. The concepts are represented in boxes or circles and their relationships are connected using lines.The sequence of steps for the development of a concept map are:

Selection of topic and a focus question:
A good way to define a context for a concept is to form a focus question. It is a question that clearly specifies the problem. A question forces the learners to be active and concentrate on the exercise.

Identification of key concepts:
A list of key-concepts and sub-concepts related with the topic are identified. The teacher should involve the students in the preparation of list.

Hierarchical arrangement:
The most inclusive or focus topic is placed on the top and other concepts and sub concepts lower down in the hierarchy. The sub concepts should be more specific as one goes down the hierarchy.

Linking of concepts:
The concepts are placed in boxes and are connected by lines. The linking lines are labelled with action or linking words. The linking lines between concepts can help to illustrate how these are connected to one other. The use of accurate and appropriate words as linking words is extremely important. Hence great care and concentrated thinking is needed for the selection of linking words.

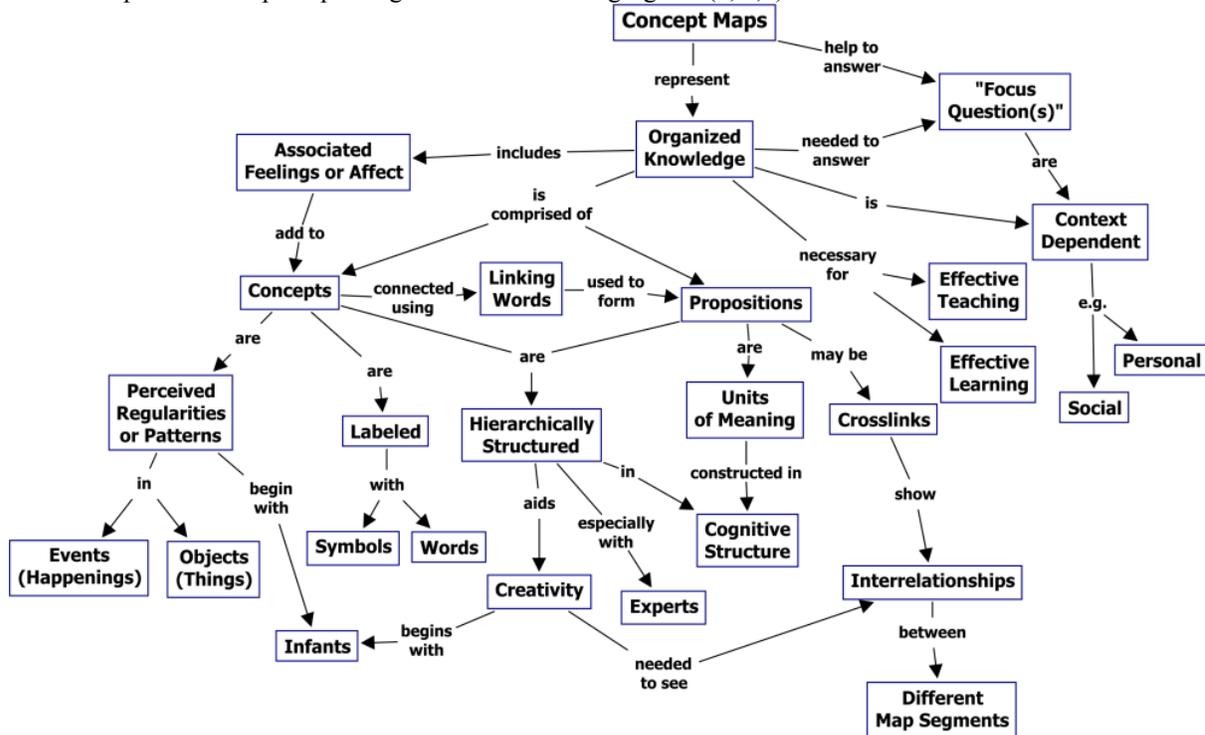Examples of concept maps are given in the following figures (2, 3,4)

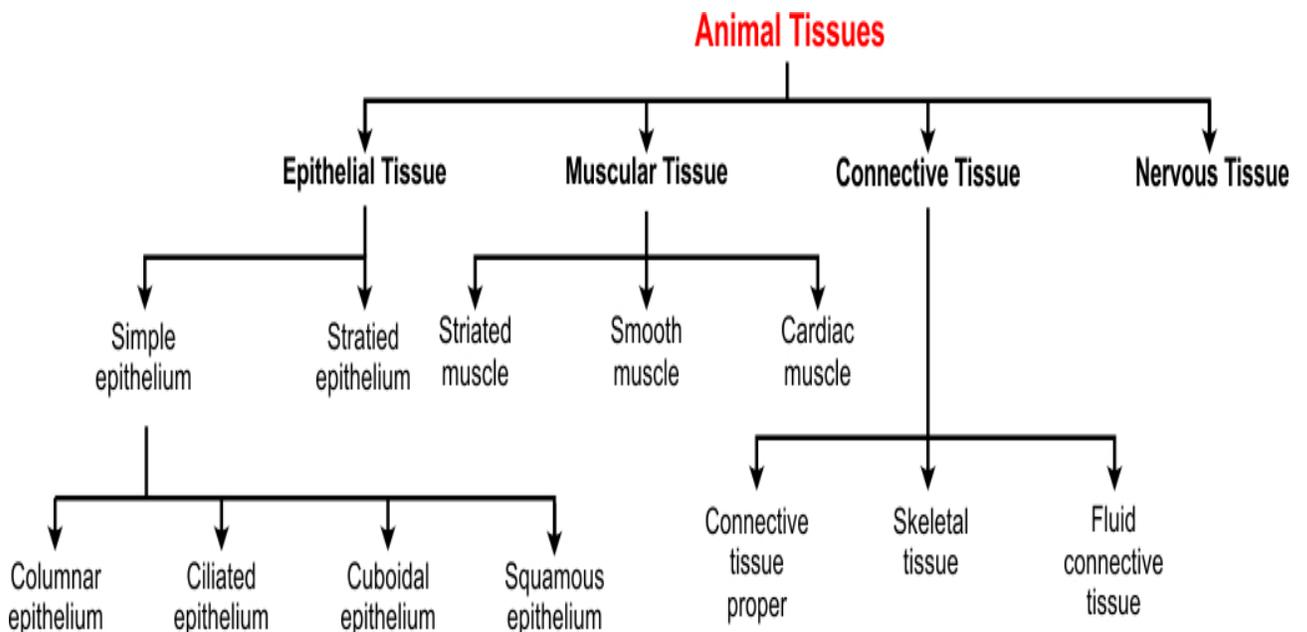**Fig 2:-** A Concept Map showing the key features of Concept Maps (retrieved from cmap.ihmc.us).

Figure 3:- Concept map from Biological science (retrieved from topperlearning.com).
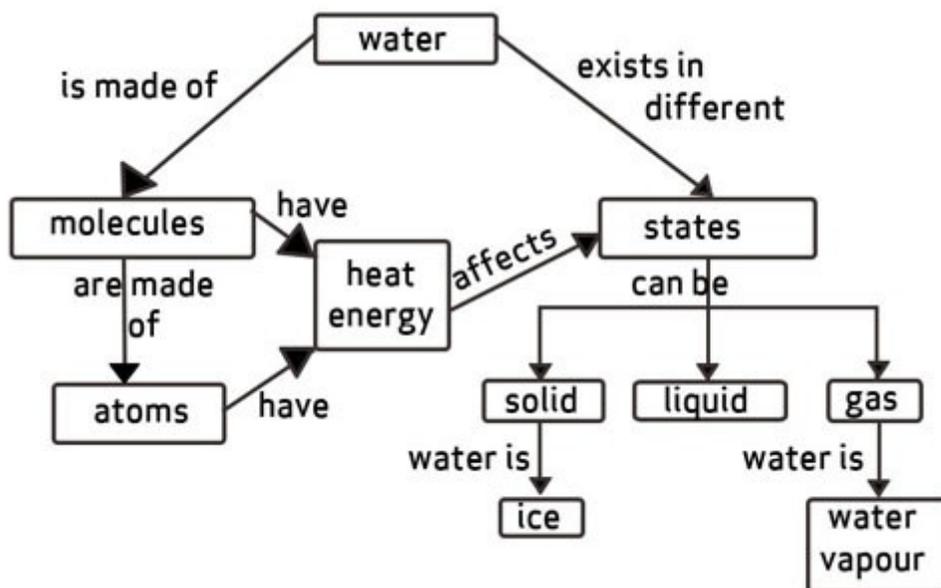
Figure 4:- Concept Map from Physical science (retrieved from open.edu).

Types of Concept mapping:
Concept maps can be defined in a more narrow sense as by Novak & Cañas (2006)

Spider Concept Map:
A spider map is a brain storming or organizational tool that provides a visual framework for students to use. Sometimes this graphic organizer is called "concept map" or a "spider web graphic organizer". A spider map has a maiidea or topic in the centre or the body, of the diagram. Each sub-topic associated with the main idea has its own leg or branch surrounding the main idea.

Figure-5:-(retrieved from slideshare.net)

Hierarchy Concept map:
This is a chronological type of map which follows a definite pattern. Concepts are organizes from more general to more specific. It presents information in a descending order of importance. The most important concept is placed on the top.
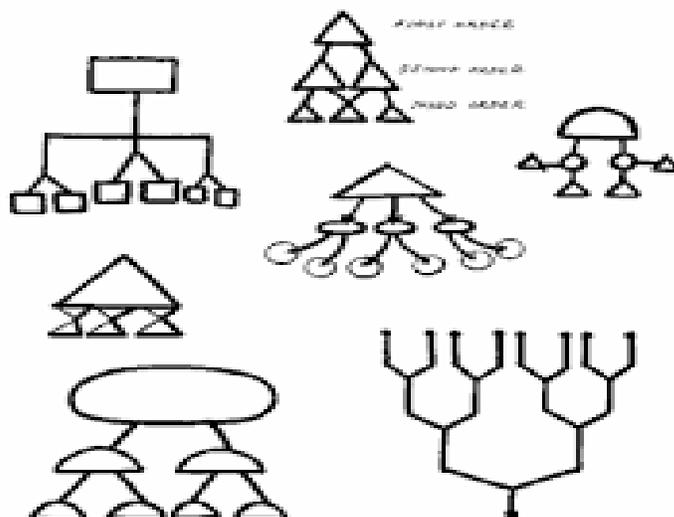

Figure -6:-(retrieved from slideshare.net).

Flow chart concept map:
This is a more linear approach to making a map. It is very easy to read as the data is organized in a very orderly and logical way.
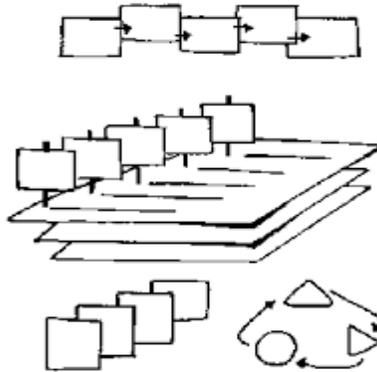

Figure -7:-(retrieved from slideshare.net)

The system concept map:
It organizes information in a format which is similar to a flow chart with the addition of 'INPUTS' and 'OUTPUTS'.
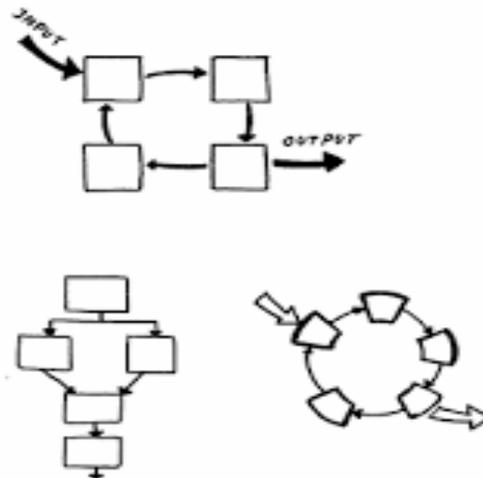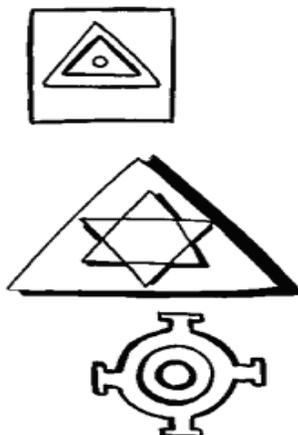

Figure -8:- (retrieved from slideshare.net).

Multidimensional (3Ddimensional) concept map:
A multidimensional concept map arranges complex or difficult concepts into a multiple dimensions to simplify the representations of concepts.

Mandala concept map:
Here the informations are presented within a format of interlocking geometric shapes.
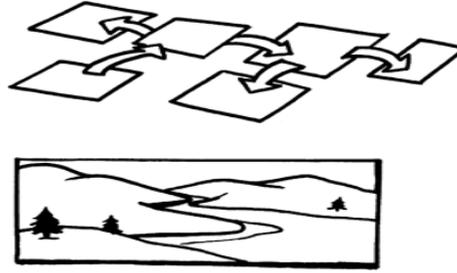
Figure -9:- (retrieved from slideshare.net).

Picture landscape concept map:
It presents information in a landscape format.

Figure -10:-(retrieved from slideshare.net)

Uses of Concept Maps:
Representing Concepts in the visual format of a concept map allows one to gain an overview of a domain of knowledge. Concept mapping can be used for several purposes.**.** They include:

As a method of teaching:
Concept map help to identify, understand and organize the concepts which are planned to teach. Concept map can be presented to the whole class to highlight the key concepts and connections.

As a method of learning:
Concept maps are now widely used in the process of learning. It helps to improve understanding of various concepts and to build connections among abstract concepts. Traditional method and the rote learning did not develop creative thinking or problem solving skills. Concept mapping help in the construction of knowledge and develops meaningful learning. It is a way to engage learners actively in the learning. It helps in the development of thinking skills.

Slow learners:
Concept maps are used to identify the weak and slow learners and help them in solving their special problems. Concepts can be simply presented and as it serves as a visual organizer it help gain attention of learners.

Planning of lessons and curriculum:
Concept maps can be used for planning the units of study as well as curriculum. It helps to make the instruction more transparent to the students. The hierarchical organization of concept maps suggests more optimal sequencing of instructional materials.

Assessment and Evaluation:
Concept mapping can be used as a powerful tool for evaluation.(Edmondson, 2000 & Cafias & Novak, 2005). It could be a key to developing strong performance assessments that ought to be designed to generate both an assessment of how students are applying concepts and deep understanding that students gained.
1. To generate ideas (brain storming, etc.)
2. To design a complex structure (long texts, hypermedia, large web sites, etc.);
3. To communicate complex ideas;
4. To aid learning by explicitly integrating new and old knowledge;
5. To assess understanding or diagnose misunderstanding.
6. To define processes and flows.

Conclusion:-
Several researches have shown the significant benefits of concept mapping as a teaching and learning strategy. Concept mapping is widely used in various fields as a means of meaningful learning. Concept maps can improve understanding of various concepts and help build connection among abstract concepts. It can be used as a misconception-correction tool.

Concept maps help learners to think deeply and to organize what they learn. Teachers can easily identify the gaps in learning and modify their lesson plans accordingly. To make concept mapping a success, it is assumed that the mentor teacher himself should posses the mapping skill as well as theoretical knowledge.

Concept mapping sharpens the reflective abilities. Computer software have been developed to aid the concept mapping.Electronic innovations enables to save time."students have become more motivated and more willing to use concept mapping", for learning purpose (Anderson- Inman, l, et al., 1993).

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