CHAPTER - II

CONCEPTUAL FRAME WORK

Means Matter Most

2.0 Overview

Conceptual modelling of which concept mapping is an offshoot has been deeply analysed with regard to categories relevance and uses. The areas in which concept maps could be used have been shown special reference to the topic of research which deals with chemistry.

This chapter attempts to study the various Concept Maps in vogue with a view to assimilating all relevant aspects of a Concept Map which in turn will help the researcher design a set of specially constructed Concept Maps to be used as a strategic tool for teaching Chemistry especially to students of the Higher Secondary level.

2.1 Different categories of Concept Maps

Conceptual modeling is a vast area with various applications using a tool such as Concept Map especially for imparting knowledge of chemistry to students at the Higher Secondary level forms a part, of course an integral part of conceptual modeling. Table 2.1 lists the different categories of Concept Maps that are in vogue. A study of these maps will help formulate a design for the Concept Maps that are to be used in the present study as a strategic tool to impart knowledge of Chemistry to students at the Higher Secondary level in order to enhance their performance in the subject.
2.1.0 Kinds of Concept Maps

1. Narrative / story line Concept Map
2. Spider Concept Maps
3. Hierarchy Concept Maps
4. Flowchart Concept Maps
5. System Concept Maps
6. Visual landscape Concept Maps
7. Multidimensional / 3D Concept Maps
8. Mandala Concept Maps
9. Fishbone Concept Map / Ishikawa Concept Map
10. Problem – solution map
11. Process development map
12. Persuasive Argument Concept Map
13. Research Topic Concept Map

2.1.1 Narrative / Story Line Concept Map

While constructing a Concept Map one should define the terms that are to be used as also the structure of the map. If one attempts to construct the Concept Map of a narrative / story line Concept Map would look like something shown in Fig 2.1.
The Concept Map in Fig. 2.1 shows a traditional setting, cast of characters, problems, attempts a solution and finally the resolution. These need to be constructed as a representation of visually meaningful relationships among concepts in the form of propositions.
2.1.2 The Spider Concept Map

The Spider Concept Map as shown in Fig 2.2 is organised by placing the central theme or unifying factor at the centre with outwardly radiating sub themes which surround the centre.

**Fig. 2.2 The Spider Concept Map**

The spider has got eight legs radiating in different directions, from its body. The Concept Map in a similar fashion has as central theme of focus in which the main idea is represented at the centre with radiating lines which culminate in bubbles of information which are relevant and / or inter linked. The Spider Concept Map is a useful device when one is trying to explain one central idea and those bits of information that are connected to the main theme of focus. For instance if one wants to show food and its components
such as proteins, carbohydrates, fats, minerals and vitamins the spider concept structure would be most ideal

2.1.3 Hierarchy Concept Map

The Hierarchy Concept Map represents information in descending order of importance. The more significant aspect or what is considered the most important information is placed right at the top. The other distinguishing factor of the concepts determine their placement in a descending order as shown in Fig 2.3.

Fig. 2.3 Hierarchy Concept Map

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Fig. 2.3 shows the Hierarchy Concept Map which title itself denotes that information will be presented in a step by step fashion, most often in a
descending order of importance. This kind of map is often used as organizational chart in various work places. Starting from the CEO or MD the various departments their officers, right down to the last grade employees get represented in the Hierarchical Concept Map. The Hierarchical Concept Map is not confined to organizational charts alone but can be used for concepts like the classification of organic compounds which can be represented in a hierarchical fashion.

2.1.4. Flow Chart Concept Map

The Flow Chart Concept Map which organises information in a format coinciding with that of the Flow Chart but with an addition of inputs and outputs as shown in Fig 2.4.

Fig. 2.4 Flow Chart Concept Map

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The Flow Chart Concept Map is a representation of one idea leading on to another and can be represented as shown in the Fig 2.4. The information is grouped together in categories and the cause and effect get represented in the map. The Flow Chart Concept Map could be used quite effectively to represent illnesses and the do’s and don’ts as also treatment methods, side effects and consequences of taking or not taking a particular course of action.

2.1.5 Systems Concept Map

System Concept Map organises information in a linear format, and this is represented in Fig 2.5

Fig. 2.5 Systems Concept Map

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The Systems Concept Map as shown in Fig 2.5 is a modification of the Flow Chart. This kind of Concept Map is useful to catalogue information and compartmentalising those facts which have to be considered in relation to other inputs. In the same way certain facts might lead to other outputs which may fall under one of the already mentioned category or could be a new concept leading to more information.

2.1.6 Visual Landscape Concept Map

The Visual Landscape Concept Map represents information pictorially as in Fig.2.6

Fig.2.6 Visual Landscape Concept Map

The Landscape Concept Map presents information through pictures with interlinking factors and can be used very effectively in areas of tourism.
where a single map can be a tour guide giving the various places of interest and pictorially depicting the important places of interest at each venue and through interlinking arrows, distance and time of travel can be designated and the entire tour guide can be presented through a single map comprising all details of one’s tour itinerary.

### 2.1.7 Multidimensional / 3D Concept Map

The Multidimensional Concept Map describes the flow or state of information which are too complicated for a simple two dimensional map and therefore needs to be represented in a three dimensional format as shown in Fig 2.7.

**Fig.2.7 Multidimensional / 3D Concept Map**

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Multidimensional Map are useful to convey information within information and also to project or focus certain aspects. The multidimensional technique is also useful for presenting information at various levels or tiers.

### 2.1.8 Mandala Concept Map

This method as in Fig 3.8 presents information within a format of interlocking geometric shapes.

Fig. 2.8 Mandala Concept Map

Compelling visual effects are created by a telescoping factor which in turn focuses the attention and thought processes of the viewer as in Fig.2.8.
2.1.9 Fishbone Concept Map/Ishikawa Concept Map

The Fish Bone Concept Map is named after the inventor of this map Dr. Kaoru Ishikawa. This fishbone diagram is an analysis tool which provides a systematic way of looking at effects and the causes that create or contribute to those effects. This can also be called a cause and effect diagram as shown in Fig 2.9.

Fig 2.9 Fishbone Concept Map/Ishikawa Concept Map

The information in a fish bone Concept Mapping spreads in different directions giving out vital facts.
2.1.10 Problem-Solution Concept Map

The Problem Solution Concept Map states a problem, describes the steps for problem solving and finally provides the solution as shown in Fig 2.10.

Fig. 2.10 Problem-Solution Concept Map

These Concept Maps as in Fig 2.10 include process development starting from the simple problem and it goes through the process of definition courses and effect and culminates in the solution. These maps are handy tools for presentation of discussion graphically with information exchange between the management and the employees.
2.1.11 Process Development Map

The process development map is another instrument for exchanging information as in Fig 2.11.

A process is developed step by step and the pros and cons or alternatives, are considered for each step from beginning to end. This kind of Concept Map would be very useful in the planning stages of a project.
2.1.12 Persuasive Argument Concept Map

Concepts can be presented as a persuasive argument leading to a conclusion as shown in Fig. 2.12

Fig 2.12 Persuasive Argument Concept Map

Fig 2.12 represents one more avenue for presenting various facts in a concise manner. An argument needs a subject and a subject can be argued from different angles. These various arguments need proof to arrive at a proper conclusion. The argument and the counter arguments of a particular
subject can be mapped along with the required tools to enable an acceptable and valid conclusion.

2.1.13 Research Topic Concept Map

Even a research topic can be presented in the form of a Concept Map as shown in Fig. 2.13

Fig.2.13 Research Topic Concept Map

Fig.2.13 represents the Research Concept Map where the research subject is analysed from the point of view of how, why, where, when, what and who and the significance arrived at. By filling the various boxes of how, why, where etc the researcher arrives at the significance of the study and the entire research concept is presented in a nut shell of a Concept Map. For instance filling up the bores with information about the present study evolve a map as follows.
Fig 2.1.14 Shows the outcome of filling the boxes as shown in Fig 2.13

Fig 2.14

The Concept Map in Fig.2.14 provides a gist of the present study.

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2.2.1 Selected area

In consonance with the detailed analysis of Concept Maps the researcher has evolved a set of Five Concept Maps for specifically enhancing the students performance in the selected areas of study in Chemistry. The areas of study such as

1. Discoverers and Discoveries
2. Classification of Organic Compounds
3. Periodic Table
4. Structure of Atom
5. Chemical Bonding
2.2.2 Reason for choice of topic

These have been selected from the syllabus of the Higher Secondary level for the following reasons:

1. These are very important topics which need to be concentrated on not only during the period of study from the examination point of view but more so because of their relevance to life and its various situations.

2. These topics are wide spread and a random choice from the syllabus though the irrelevance cannot be disputed.

3. These topics are pliable enough to be condensed into a one page Concept Map.

The present study on the effect of conceptual modelling as a strategic tool to enhance students' performance in Chemistry, aims at focusing on the specific strategic tool of Concept Maps with a view to imparting knowledge of Chemistry which in turn will significantly enhance students' performance.

The researcher has specially designed Concept maps on the five selected area and has used them to teach Chemistry to the experimental group of 50 boys and girls at the Higher Secondary level(+1 level). A similar number of 50 boys and girls have been studied as a Control Group and these have been taught through the Traditional Instructional method without the use of concept maps.

2.2.3 What are these Concept Maps?

Concept Mapping can be used in various situations. But one needs to bear in mind the following in order to understand the full implications of Concept Maps.
• The concept map is to be used to highlight the important aspects and therefore what appears to be trivia needs to be thrown out or eschewed while mapping.

• The constructor of the concept map should study the themes that need to be emphasized in a map.

• While constructing the concept map it will help to look at the information to be presented from the other person’s point of view. What one considers important need not be so for the other or vice versa.

• The concept map is a visual aid to understanding complex situations and a properly constructed map might make it possible to give information even beyond the traditional boundaries.

• Concept Maps can be the basis for interactive discussions among students and between the staff and students. Therefore efforts should be made to initiate discussions using Concept Maps.

• Concept Maps will help develop course material and curriculum content. Hence it is necessary to ensure that the Concept Maps are integrated with logical sequences and have continuity.

• It has been held that the teacher should design units of study that are meaningful, relevant, pedagogically sound and of interest to students. (Pandia Vadivu – 2010).

• Care should be taken to develop Concept Maps bearing in mind the above factors.

• Visual symbols make the grasping of a concept easy and quick. The minimum use of text will go a long way in comprehending the information contained in the Concept Maps.
2.2.4 Where and how to apply Concept Mapping

Concept Mapping is a creative tool and will be a vital asset of brainstorming sessions. Drawing a concept map of one’s idea helps one to work without somebody breathing down one’s neck or in other words working without criticism. The Concept Mapping techniques make one’s ideas cleaner and inspires the mind to receive fresh ideas. The interlinking of new ideas to the ones already put on paper may bring in further associations and means to use them.

Concept Maps can be used as hypertext in the present day where netizens abound. There is a structural correspondence between the hypertext document and Concept Maps. The structure of both can be seen as a directed knowledge graph. When a concept map is placed in hypertext, it will prove to be a navigational tool on the web where the clickable areas often marked in blue will take the user immediately to those parts of the hypertext documents that are to be accessed.

2.2.5 A communicative tool for concept map

When a concept map for a particular area of knowledge is designed the information contained in that concept map can be shared with others. The concept map is a propagating tool for information, especially from the point of view of all users.

2.2.6 A learning tool for concept map

Concept Maps integrate existing knowledge into a concise format and give scope for bringing in new angles of thought and furthering innovative ideas through the avenues of association, linking and interlinking. Therefore in keeping with Novak et. al., (1983), it can be said that those using Concept Maps will outperform non users of Concept Maps especially in the retention of knowledge over a long period of time. Concept Mapping as a learning
tool enhances the problem solving capabilities through the method of generating alternating solutions and options.

2.2.7 Concept Mapping for assessing Misconceptions

This technique of teaching through Concept Maps has enabled researcher including Novak and his team to detect as also illustrate misconceptions in learners Many a time students have incomplete or deficient knowledge leading to the misunderstanding of instructions. This gets exposed when students are asked to make a concept map of what they have learnt. It should be remembered that any kind of instruction depends on the imparter of knowledge to a large extent, the capacity of the learner, and the method of instruction. The present study will prove that learning through the techniques of Concept Mapping plays a large role in students comprehending instructions fully and devoiding their minds of misconceptions.

The methodology for the questions studied includes an experimental design of an Experimental Group which has been exposed to the strategic tool of teaching through Concept Maps and a Control Group which has been given instruction using the Traditional Instruction (TI ) method.

The third chapter presents a detailed review of related literature pertaining to the present study.