

USE OF CONCEPT MAP AS A TOOL FOR EXPLORING UNDERSTANDING OF CONCEPTS AMONG IXth GRADE SCIENCE LEARNERS

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Abstract: The main challenge faced by Science teachers is not merely to create a teaching environment but also to stimulate meaningful learning process among learners. Keeping this challenge in mind, the present paper has been conceptualized. The paper mainly focuses on the use of concept maps as a tool for exploring understanding among school learners. A sample of 40 learners of class IXth of a school of Indore city participated in the study. The researchers developed a concept map task sheet in which the key terms of four selected concepts of Biological science were given. The learners were familiar with these selected concepts of Biological science. The learners were already trained by researchers that how to construct the concept maps. The learners had to develop the concept map by using the key terms, which were given in concept map task sheet for each concept separately. The researchers analysed concept maps of learners through self-made criteria. The self-made criteria were framed according to the elemental guidelines of concept map construction of J. D. Novak (1970). By analysing the map, it can be concluded that concept maps play a significant role in exploring the understanding of science concepts.

Keywords: Concept Map, Understanding of Concepts, Learners

I. INTRODUCTION

We all know that teaching and learning are closely associated with each other. The effective learning is the essence of effective teaching. The role of science teacher is not only to deliver the lectures but also to explore some innovative learning tools. Every learner has individual difference and hence, learns according to his own-pace. Learning tool should be supportive in maintaining the self-pacing of learners. Generally, the traditional learning tools are based on rote skills and focus on the mug up ability of learners. Through these traditional tools, the learners just express the information of text book and become unaware about the exploration of understanding of concepts. In the process of teaching learning, the concept maps are introduced as an emerging learning tool. As learning tool, the concept maps support individual differences and maintain self-pacing of learners. The law of learning “learning by doing” also work here. The concept map has a special feature to increase the receptive ability of learners. The receptive ability makes the learners attentive in acquiring a better understanding. The better understanding works as a foundation for establishment of authentic relations between the various concepts. In foreign countries, the concept maps are widely accepted tool of learning which helps learners in expanding their understanding regarding concepts.

WHAT IS CONCEPT MAP?

Concept map is a graphical tool which helps in visualizing the concepts information in a hierarchical fashion. By using this tool, learners think on various dimensions of concepts, interlink them and establish a meaningful relation between concepts. Concept map helps the learner to memorize all the information of concept and to negotiate such information in a meaningful way. J.D. Novak (1970) firstly used concept maps at Cornell University. According to him, concept maps are the effective ways of understanding the structure of knowledge and wilfully make new structures of knowledge befitting the existing organization of concept in mind.

Elements of Concept Map: The elements of concept map are concepts, propositions, linking words, and crosslinks. Generally the concepts are used to interpret any event, object and phenomena. The concepts are presented by name like Animal, Fruit etc. Concepts are enclosed in boxes and boxes can be in **circular** and **rectangular** shape. The boxes are the first element of concept map and known as **nodes** also. Second element is **propositions** which show the semantic relationship between two concepts that are connected by using related words or phrases. Some common examples of propositions are is, under and below. The third element is **linking words** and it can be prepositions, conjunctions and verbs. Some common examples of linking words are to, for, where, as, eat, so forth. The fourth element is **cross-link**. The cross links are the arrows (single or double) and lines which are used to relate concepts in different segments of the map. They help in illustrating the relationship between concepts. Concept maps can be in the form of spider, flow, chronological and system map.

Uses of concept map: According to Novak, concept map tool can be used for various purposes in teaching learning situations such as:

1. Learning tool: The concept maps are the best learning tools as they help the learner in transmitting information in a visual manner. The visual information is retained for a longer time in learners’ brain.

2. Communication tool: The concept map generates a collaborative environment in classroom due to which the learners share their ideas with each other and with teacher also. So it works as a communication tool.

3. Assessment tool: The knowledge of learners can be easily assessed with the help of concept maps. Whatever the learners had grasped in their memory can easily be visualized through the construction of concept maps.

4. Creative tool: It provides freedom to the learners so that they can select, arrange and present concepts in a different way. Such kind of openness promotes creative ability among learners.

WHAT IS MEANT BY UNDERSTANDING OF CONCEPTS?

Understanding is a psychological process related with abstract or physical objects like person, situation and information. Understanding shows the relation between the knower and an object of understanding. It implies abilities and disposition with respect to an object of knowledge that are enough to support intellectual behaviour. In this paper, we are discussing about understanding of concepts. Concepts are the abstract or generalized ideas related with the event, phenomena or things. Understanding is connected with learning of concepts. If the learners have knowledge about objects, things and events, they can predict their behaviour. This prediction will be based on the understanding. In educational context, understanding is connected with the level of cognitive domain. Cognitive domain represents that how the information is processed from concrete to abstract in learners mind. The levels of cognitive domain are categorized by Benjamin Blooms (1956). The levels are remembering, understanding, applying, analysing, evaluating and creating. Understanding is the second level of cognitive domain. The learners should have a good understanding of concepts as it assists in their ability to follow instructions and be specific in what they are talking about. Before starting the use of concepts in speaking, the learners firstly need to have a good understanding about what concepts are and what they meant. By developing this understanding ability the learners can better represent the concepts.

Pre-requisites for understanding of concept: There are some necessities which are required in the process of understanding of concept.

- 1. Attention and concentration:** Attention comes through the senses and concentration comes through the brain. The learners need adequate hearing ability to ensure that they hear appropriate language models and use appropriate language.
- 2. Voluntary engagement:** Voluntary engagement involves self-motivated activities which are goal directed and associated with pleasure.
- 3. Receptive language:** Understanding process is associated with appropriate use of language. The learner needs to understand the specific terms.

Besides the theoretical aspects of terms related with paper, it is also necessary to discuss the methodology which was employed by the researchers for the gathering the data.

II. METHODOLOGY & DATA GATHERING PROCEDURE:

The study was conducted at Prerna Higher Secondary School, Indore. The sample for the study was taken only from one section of class IXth. A total of 43 learners, took part actively in the study. The learners were already trained by the researchers in construction of concept maps for duration of one month. The researchers had selected two topics of Biological Science that were Cell and Tissue. The first topic Cell included two concepts that were Structure of Cell and Organelles of Cell. The second topic was related with Tissue which included two concepts that were Plant tissues and Animal tissues. These two topics of Biological Science were not taken by researchers during the training of maps constructions. The researcher developed a Concept Map task sheet which included the key words of above mentioned concepts sequentially. In this concept map task sheet, the key words for each concept were given in a jumbled way. The learners were clearly instructed by the researchers that they had to read all the key words carefully and comprehend their relation with main concept. They had to construct the map by keeping the central concept or main concept in mind and follow a hierarchical pattern. Along with the concept map task sheet, separate sheets of paper were also provided to the learners. The learners had to construct the concept maps on these sheets of paper. The time duration was of four periods in which thirty minutes were given to the learners for the construction of each map. Here we are presenting a list of concepts with key words which were given to the learners for map construction.

Table-1: Concept Map task sheet includes following concepts

Concept-1	Concept-2	Concept-3	Concept-4
Unicellular	Endoplasmic reticulum	Meristematic tissue	Epithelium tissue
Prokaryotic cell	Ribosome	Apical	Squamous
Eukaryotic	Cell organelles	Parenchyma	Columnar
Cytoplasm	Lysosome	Simple permanent	Cuboidal
Protoplasm	Mitochondria	tissue	Ciliated
Cell	Plastids	Intercalary	Glandular
Nucleus	Vacuoles	Lateral	Stratified
Bacteria	Golgi body	Plant tissues	Animal tissues
Multicellular	Chloroplast	Permanent tissue	Connective tissue
Nucleoplasm	Rough endoplasmic	Complex permanent	Adipose
Genetic material	reticulum	tissue	Connective skeletal
Cell organelles	Smooth endoplasmic	Collenchyma	tissues
Osmosis	reticulum	Sclerenchyma	Muscular tissue
Plant cell		Xylem	Cartilage
Animal Cell		Phloem	Bone
Cell wall		Tracheids	Tendon
Plasma membrane		Vessels	Ligaments
Diffusion		Xylem parenchyma	Fluid
Active transport		Xylem fibres	Areolar
Endocytosis		Sieve Tubes	connective tissue
Exocytosis		Companion Cell	Blood
		Phloem parenchyma	platelets
		Phloem Fibres	White blood cell
			Red blood cell
			Plasma
			Lymph
			Striated muscle
			Unstriated muscle
			Cardiac muscle
			Nervous Tissue

III. ANALYSIS & DISCUSSION OF DATA:

The gathered data were qualitative of nature and the researchers decided to assess the maps in qualitative manner. The researchers framed some criteria which were based on the elemental guidelines of map construction given by J. D. Novak. The criteria are as follows:

1. Visual representation of concept map
2. Sequential involvement of key terms
3. Appropriate use of prepositions and linking words
4. Use of arrow heads between key terms.

Keeping all above criteria in mind, the researchers analysed the forty three concept maps which were constructed by learners. These are as follows:

1. **Visual representation of concept map:** The first criterion was the visual representation of concept map. Forty three students took part in this study. Out of them twenty eight learner's visualized information attractively in a hierarchical pattern using graphics. The remaining students presented the key terms in a non-hierarchical way or in a zigzag way.
2. **Sequential involvement of key terms:** The second criterion was the sequential involvement of key terms. After analysing the maps under this criterion, it was found that thirty one students used all the key terms which were given in concept map task sheet. Out of them, twenty five students arranged the key terms in hierarchical manner correctly. Out of forty three, twelve students created some mistakes in following the hierarchical pattern of maps.
3. **Appropriate use of prepositions and linking words:** The third criterion was the involvement of linking word with the main concept. Twenty nine learners mentioned the correct linking words with the main concept and key terms. Remaining fifteen students did not write linking words on the lines but arranged correctly. The third criterion included the correct use of preposition and cross words. All the learners used prepositions. They used simple prepositions like as, in, to, on, with, by. The Cross words used by learners were mostly like, for, where, such as etc.

4. **Use of arrow heads between key terms:** The fourth criterion was use of arrow heads between key terms. Thirty seven learners simply used the one way cross links and remaining six learners used two ways arrow heads for establishing the link between key terms of concepts.

IV. CONCLUSION

We know that visual representations are better recognised as compared to text and sustain a longer impression on learners mind. The content knowledge of every subject must be organised in the form of concepts and to be accessible for the development of higher cognitive ability. Concept maps provide flexibility to the learners to exhibit their content knowledge with accuracy and precision. Understanding of concept requires certain cognitive skills which are related with recognition and retention of concept. The concept maps are the appropriate tools which prepare learners for correct recognition of concepts. The correct recognition helps in retaining the correct understanding of concept in mind. In this paper, the researchers assessed the concept maps which were constructed by the learners on selected topics of science. After assessing the concept maps, the researchers found that the learners arranged the key terms of concepts and vocabulary in a hierarchical manner by thinking holistic as well as patristic. The learners creatively represented the key terms of related concepts and used correct linking words between the key terms. The learners developed new ideas about concepts. They connected all the key terms of concept with the suitable arrow heads. The understanding of learners regarding concepts were reflected through the connections those they established between the key terms. The maps provided a different kind of experience to the learners and enhanced their thinking in a multidirectional ways. The maps also explored their understanding of concept in a meaningful way. Besides it, the map construction activity enabled them to identify their understanding and misconception of concepts which they hold.

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