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EFFECT OF CONCEPT MAP ON LEARNING OF SCIENCE STUDENTS: A METACOGNITIVE INTERVENTION

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Abstract
Concept mapping has been applied in a variety of fields, including instruction, learning, curriculum development, and assessment because many empirical studies have proven the validity of conceptmapping.Studies show that traditional teaching methods, such as lecturing, do not lead to in-depth learning. Concept maps have been used for a long time by researchers and teachers to facilitate learning. The present study aimed to investigate the effect of concept mapping on the learning levels of students in science subject of class eight. In a quasi-experimental study with a pre-test/post-test design, 28 students were selected and divided into two groups: the experimental and the control groups. After administration of pre-test, the students in the experimental group participated in classes on designing concept maps. Next, lessons on cell were presented to the students in the experimental and control groups through concept maps and lectures, respectively. At the end of the semester, the learning levels of the students in both groups were evaluated by the post-test. The means of the scores of the students as determined by results of the pre-test revealed insignificant statistical difference between the two groups. However, the learning level of the students in the experimental group was significantly higher ($P < 0.05$). As a metacognitive intervention, concept mapping can contribute to in-depth learning of students. According to the findings, it is recommended that concept mapping should be used for teaching and evaluation. Further studies are needed to compare the effect of concept mapping with those of other metacognition approaches on different types of learner.

Keywords: concept mapping, in-depth learning, lecturing, metacognitive intervention

Introduction
Concept mapping (as developed in its standard form by Novak in 1984) is considered to be an offshoot of the Ausubelian approach. Novak himself asserts: “My work and the work of my students on concept mapping has been based upon Ausubel’s theory of meaningful learning (1963, 1968). It is this fundamental principle that has led our research group to search for better ways to represent what the learner already knows.”
Concept maps are graphical tools for organising and representing knowledge about certain concepts. A concept map represents an understanding of the relationship and hierarchy between important setof concepts. They promote meaningful learning in science. This can be understood by studying the components like concepts, linkages & labels for linkagesof a concept map.

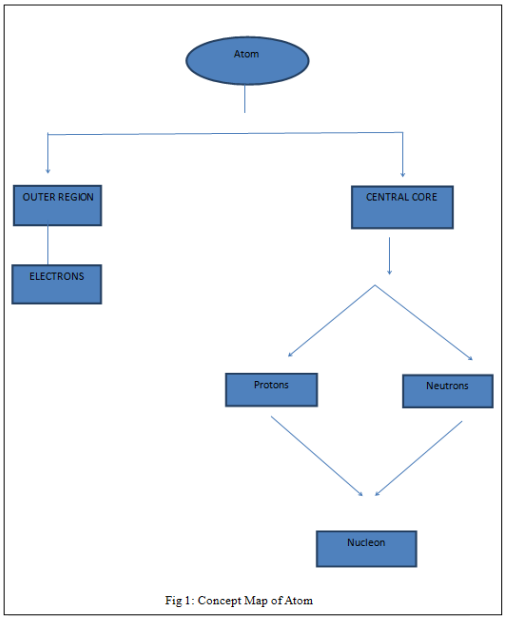

Fig 1: Concept Map of Atom

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By observing above concept map, we can say that the concept map is consists of different concepts. As we know that concepts are mental framework and it is thing or object which has some identifiable properties & ideas with it.In a concept map concepts are linked with each other by linkages. In a concept map, concepts are usually presented enclosed within a circle or a box. The first step is to identify and enlist various key concepts in the topic. These concepts are then arranged in a twodimensional array hierarchically in descending order, i.e. the more general concepts are placed at the top followed by the less inclusive concepts. Concepts occurring at same level of observation are placed at the same horizontal level.

Thus, we observe that concepts in a concept map are not isolated collection of the concepts. They are interconnected together through well labelled linkages. Cross-links are particularly powerful connections, which form a 'web' of relevant and interrelated concepts. These links enhance the anchorage and stability in the cognitive structure of concepts rather than just connecting general concepts to specific concepts. They tend to connect different subconceptual structure. There is no limit on the number of connecting lines. As a matter of fact greater number of connecting lines represents integrative thinking and depth of knowledge of the learner.

David P. Ausubel made an attempt to improve the effectiveness of the conventional lecture method used in the teaching-learning process. He propounded the theory of meaningful verbal learning. The theory ofmeaningful learning is concerned with three aspects of the teachinglearning process: (1) how knowledge (curriculum content) is organised (2) how the mind works to process the new ideas (learning) and (3) how these ideas about curriculum and learning can be applied by teachers when they present new teaching–learning material to students.Ausubel (1963) believed that a parallel exists between the way subject matter is organised and the way people organise knowledge in their minds (cognitive structure). He emphasised that every academic discipline has a structure of concepts (and/or propositions) that are organised hierarchically.

The potential of concept maps needs to be explored in our schools as they are of tremendous use for learners, teacher, curriculum developers and evaluators. Concept maps can be used by learners for meaningful acquisition of concepts. This can be accomplished through various mechanisms, such asproviding a visual representation of a particular material (e.g. text material). This helps the students to make better sense of the material, especially when the material is complex. A conceptual framework can be provided to elaborate on the key concepts.Helping learners develop new relationships among concepts in one or more related areas, thereby creating new meaning, summarising material when preparing for examinations.Motivating learners to think and engage in active learning as they try to construct the most plausible relationships.Helping learners identify gaps in their knowledge.Making learners aware of the explicit roles that language plays in the exchange of information. Promoting reflective thinking associated with pushing and pulling of concepts, putting them together and separating them again. Allowing learners to exchange views, thereby achieving shared meaning, which is possible, because concept maps are explicit.Analysing an activity and an experiment in terms of procedureor content and reduce subsequent burden on working memory. Providing practice by using specific concept labels which act as attention catchers especially for students struggling to learn. A study (Prabha, 2005) shows that concept mapping as a teaching-learning strategy can be applied to facilitate learners to draw the ray diagrams of the formation of images by the lens and mirrors for different position of the

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object. It provides a holistic view of the phenomena of reflection and refraction of light.

Research Methodology

Objectives

This study aimed to compare the effect of concept mapping on the learning levels of students of class eight students in science.

Method

An interventional quasi-experimental study with a pre-test/post-test approach was carried out, which aimed to assess and compare the effects of concept mapping and lecturing in two groups of class eight students of sciencelesson cell. The study subjects were two groups each including 14students. At the beginning of the study, the pre-test was given to both groupscontrol groups & experimental groups; the students in the experimental group were given lessons on designing concept maps.The control group was taught by traditional lecture method on the same content of science. After that post-test(achievement test of science) was carried out on both group i.e. experimental group & control group.

Analysis

The students' learning approaches in the experimental and control groups were assessed both before and after the test. Since there was no significant difference between the two groups regarding the assessed approaches in the pre-test, interpretations were based on the results of the post-test. The different sections of the questionnaire were scored according to different criteria; next, the results were coded and analysed using the software program SPSS . To compare the means of the scores on the pre-test and the post-test, the paired t-test was applied. In the current study, the significance level was considered < 5%.

Results

Table 1: Comparison Of Post Test Score Of Control Group & Experimental Group

Groups	Mean	SD	t-test
Control Group	17.35	1.18	2.27
Experimental Group	19.08	2.09	

The results (Table1) also showed that the post-test scores on the knowledge in the experimental group were higher than those of the control group; although the independent t-test did not reveal a significant difference between the scores, the post-test scores on the meaningful learning in the experimental group were significantly higher than those of the control group (t = 2.27), (P = 0.04). An analysis of the differences between the means of the scores before and after teaching in the groups showed that the difference between the pre-test and the post-test results on knowledge and meaningful learning were greater in the experimental group. It can be concluded that, even though both approaches contributed to the learners' knowledge and meaningful learning, concept mapping was more effective than lecturing in encouraging meaningful learning.

Conclusion

It can be said that modern educational approaches are more effective than the traditional ways to make learning long-lasting. In the current study, concept maps were presented by the teacher to help the learners quickly understand the key points and the relationships among them and interpret the conceptssometimes what a picture says is clearer than a thousand words. As shown in the current study, concept maps also help to organize courses and thus facilitate learning. It should be noted that learners should not be given the answers, but be presented with the problems and situations and told to discover the relationships and answers on their own; in other words, the educational programs should motivate learners to participate actively in the

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learning process. It is obvious that mere presentation of concept maps by teachers cannot lead to long-lasting and meaningful learning. Concept mapping leads to long-lasting learning only when students design the maps, choose the key points, analyze, prioritize and evaluate information and locate the concepts on the map after careful reasoning. It is important that students participate actively in the process of learning, deal with the various concepts and facts and locate the new information based on their prior knowledge; when students consciously place the information in their cognitive structures it results in deeper learning in advanced levels. In lecturing, however, information mostly flows from teachers to students: using the words and concepts existed in their own cognitive structures; teachers try to shape the cognitive structures in students. In this situation, it is highly probable that the incoming information does not agree with the prior knowledge present in the learners' cognitive structures, and consequently learners may face incomprehensible relationships in their cognitive structures. The results showed that students who were subject to concept mapping were more successful at meaningful learning than the students who only attended lectures.

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