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Study of Scientific Concept Structure by using Concept Attainment Technique

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ABSTRACT: This study examined the effects of concept mapping on the scientific concept structure of science students studying in M.P. Board and C.B.S.E schools of Bhopal. There were 50 students selected randomly from M.P. Board and C.B.S.E. Schools of Bhopal district for the study. The paper presents the use of Concept Maps as a strategy on selected topics of science.

Keywords: Concept Map; Knowledge Structure; Cognitive Learning; Categories & Schema and Visually Represent.

INTRODUCTION: Concept maps are spatial representations of concepts and their inter-relationships that are intended to represent the knowledge structures that humans store in their minds (Jonassen, Beissner, & Yacci, 1993). Joseph D. Novak of Cornell University is considered to be the one who, in the 1960s, started the systematic use of concept mapping for learning (Novak, 1993). His work was based on two important ideas in Ausubel's (1968) assimilation theory of cognitive learning.

Concept Maps provide a method to represent information. They have been defined as follows: "Concept maps are two-dimensional representations of cognitive structures showing the hierarchies and the interconnections of concepts involved in a discipline or a sub discipline" (Martin 1994:11).Novak developed the idea of concept mapping in the 1960's, in an attempt to visually represent the structure of information (Novak 1991:45).

Concept mapping is a promising teaching and learning method that enhances students' achievements by helping them to acquire structured knowledge. The human conceptual system is characterized by two main concepts – category and schema (Smith & Heise, 1992; Mervis & Rosh, 1981). The visual representations of these concepts are concept maps (Novak & Govin, 1984), mind maps (Buzan & Buzan, 1993), intellectual maps (Kostova, 1998, 2000).
Authors give different wording of a concept map explanation: "a nonlinear diagrammatic representation of meaningful relationships between concepts" (DiCarlo, 2006), "a mental model, a schematic representation, which is a hierarchical structure from interconnected words, ideas, problems, solutions, arranged around a key word in radial circles"(Buzan & Buzan, 1993). We stick to the definition of Buzan & Buzan (1993) and use a concept map as a study tool.

The use of concept maps within education varies widely, from schools which have adopted our ideas and use concept maps and CmapTools in all subjects and grades with extraordinary results like the Instituto de Educación Integral in Costa Rica (Silesky & Badilla, 2008), to efforts to introduce concept mapping into public schools at a country-wide level (Tarté, 2006) or having Cmapstools installed in all computers delivered to schools for a whole region (Garcia, 2010), but unfortunately also includes teachers that give the students pre-built concept maps to memorize, or partially filled concept maps to "fill-in-the-blanks.

Concept maps are effective tools that help teachers identify their student's prior knowledge and understanding. This is what led Novak and his team to the design and construction of the first concept map (Birbili; Novak 1998).Students can use concept maps as well. Students can use concept maps to organize notes. Students can use concept maps to identify when they do not understand information and identify where exactly the breakdown is in their comprehension. As described above, concept maps are very useful tools for both students and teachers.

LITERATURE SURVEY: Ruiz-Primo, Schultz, Li, and Shavelson (2001) shows the comparison of the reliability and validity of scoring from two concept-mapping techniques. **Objectives:** Reported the effectiveness of a 50-minute training program. The first part of the paper addresses how much training effort should be devoted and which issues about concept mapping should be emphasized in the training. This is

important because no consistent answer has been found due to the limited research available. The rest of the paper reports on several training techniques attempted with secondary school students about elementary geometry concepts. **Findings:** It will help to determine the quality of effective training in order to ascertain the validity of concept map as an assessment tool.

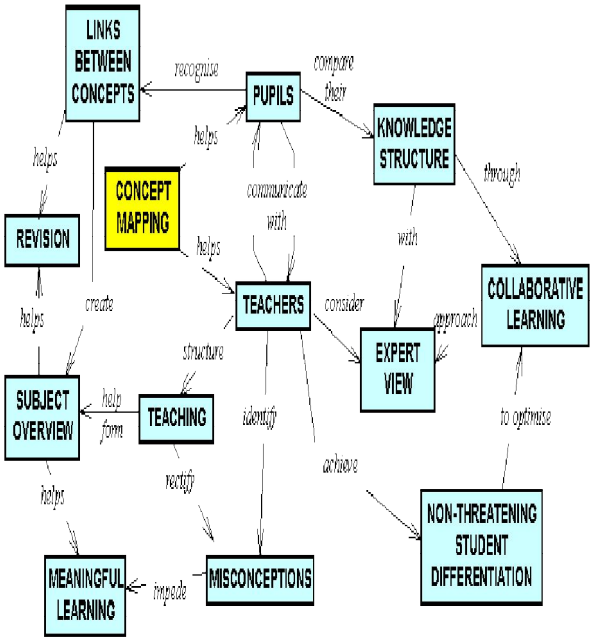

Figure 1: Knowledge management through Concept Maping.

Anderson-Inman and Zeith (1993) shows **Objectives:** Compare the use of the concept mapping program Inspiration with the paper-and pencil approach. **Findings:** Found that using this program encourages revisions to the concept map because deletions, additions, and changes are accomplished quickly and easily. Especially young students who still struggle with handwriting skills benefit greatly from concept mapping tools.

MATERIALS AND METHODS: The descriptive survey method was employed for the present study.

a) Sample unit & Tools: In the present work, school is the unit of study and out of thirty CBSE affiliated and M.P. Board, two were randomly picked. Total 50 students of grade VIIth and IXth of different M.P. Board and C.B.S.E. Schools of Bhopal district formed the sample of the study. Students were selected randomly from the lists of the schools and students.

Data was collected by survey method. A self-made questionnaire, Scientific Concept Attainment Test (SCAT) was used in the study by the researcher.

b) Data Analysis: In the present study the following statistics have been used to check the hypothesis:
Descriptive statistics (Mean, Standard deviation) and for significant difference ("t"- tests)

Objectives:

1. To study the concept structure of selected scientific concepts of science students studying in grade VIIth and IXth of M.P. Board and C.B.S.E. schools of Bhopal district (Table 1).
2. To study the gender differences in science achievement, process skills and attitude towards concept mapping (Table 2).

Hypothesis:

$H_0$1: There is no significant difference between the mean scores of Concept Attainment on the scientific concepts of science students studying in M.P. Board and C.B.S.E schools.

Table 1: Indicates class wise data on understanding selected concepts.

Concept	Group	No. of cases	Mean	S.D	Degrees of Freedom (DF)	Calculated t-values	Significance (.05level)
Cell	M.P. Board science students	26	19.65	5.49	48	.816	Not significant
	C.B.S.E. science students	24	18.20	6.99			
Environment	M.P. Board science students	26	32.38	10.48	48	.202	Not significant
	C.B.S.E. science students	24	31.83	8.61			
Temperature & Heat	M.P. Board science students	26	26.15	7.82	48	.981	Not significant
	C.B.S.E. science students	24	23.54	10.87			

Finding: The difference between the Scientific concept of Science students of M.P. Board and C.B.S.E schools is not significant but slightly differs perhaps due to the presentation of content was through simple learning material at both the systems or the students were not exposed to various concept teaching model & media for better understanding of the concept.

$H_0$2: There is no significant difference between the mean scores of applying Concept Attainment on the

scientific concepts of Male and Female Science students.

Table 2: Indicates genderwise data on understanding the selected concepts.

Concept	Group	No. of cases	Mean	S.D	Degrees of Freedom (DF)	Calculated t-values	Significance (.05level)
Cell	Male	25	19.57	6.74	48	.724	Not significant
	Female	25	18.29	5.70			
Environment	Male	25	31.38	9.68	48	.564	Not significant
	Female	25	32.91	9.51			
Temperature & Heat	Male	25	24.46	8.85	48	.340	Not significant
	Female	25	25.37	10.13			

Finding: There is no significant difference between the mean scores of Concept Attainment on the scientific concept of Male and Female Science students.

Female science students were found to have performed better than Male Science students in scholastic performance in science. This may be due to their interests in completing test items faster. It may be further study in respect of time & speed also.

Implications of the study:

- The research will be helpful in implementation of concept mapping technique as a strategy on selected topics of science text books for grade VII and IX.
- The research will be helpful in understanding the impact of concept mapping technique on the concept attainment of schools belonging to M.P. Board and C.B.S.E. schools of Bhopal district.
- The research will be supportive in study of the concept structure of selected Scientific concepts of science students studying in grade VII and IX of M.P. Board and CBSE schools of Bhopal district.
- The concept-based curriculum was more effective than the conventional method of teaching.

CONCLUSION: To move beyond "chalk and talk" by incorporating active and collaborative learning into economics courses, instructors can use a variety of exercises and tools. One such exercise is the in-class creation of Mind Maps on a specific topic by small groups of students. Buzan and Buzan (1993) argue that Mind Maps better harness the way the brain works. The radiant structure is consistent with the radiant nature of the brain. And the use of colors, graphics, and nonlinear branches stimulates the entire brain.

Teachers are becoming more aware of new teaching tools that can be used in the classroom however some of these require a large amount of time and often the resources are not available to most practising teachers. However, Concept Mapping offers a technique for revealing students' cognitive structure which is manageable within present classroom constraints. It is a new and alternative way of representing knowledge differing from written text in that information is presented in a hierarchical manner and there is no intended order for the reading of the map. The tool gives the students freedom to answer a specific focus question using concepts that they understand and hence encourages meaningful learning. The tool is extremely flexible and can be used both in instruction and assessment.

Different strategies of teaching facilitating the building of association, such as content analysis and mind map clustering, intellectual concept map construction, visualization of conceptual structure hardly used in school practice. The methods-content analysis, concept map construction and discussion could be used successfully together in teaching, learning and evaluation in human biology and in other school subjects. Applying them in school practice made students think of human biology as an interesting subject within their intellectual abilities.

The study points out to some shortcomings to subjects, curricula and modes of teaching Higher class students (IX) takes less interest in understanding while girls can better understand. Concept mapping is seen fruitful in middle class (VII).Both the genders takes interest in understanding and making it. But some provisions and qualifications made by researcher in the research covered here, all results found were positive. Concept maps appear to:

- Increase the efficiency of information retrieval,
- Increase the efficiency of teaching via better course content communication,
- Enhance collaborative learning,
- Produce positive attitudes toward learning,
- Enhance text comprehension,
- Increase students' understanding of topics and
- Bring order to complex tasks.

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