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# CURRICULAR INNOVATION FOR STUDENT CENTRIC LEARNING: CONCEPT ATTAINMENT THROUGH INFORMATION TECHNOLOGY

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**Abstract:**
*Curriculum is an integral part of education. The components of curriculum include – Aims and Objectives, the Subject Matter, Modes of Transaction involving appropriate and innovative learning experiences and Evaluation. The present study is a curricular innovation for student centric learning, aimed at integration of Information Technology for improving the Concept Attainment of learners. The concept attainment technology integrated tool is a student centric learning tool. It enhances the concept attainment capability of Students. The study involves pre-test, post-test parallel group design. A self-made Concept Attainment test was used for collecting the data from the sample consisting of 72 students. The 'Inspiration Software' was used for the treatment to improve the Concept Attainment in Students; use of this software marks the utilization of Information Technology as an innovative and effective practice. The results of the study indicated that: i) Computer-Based Concept Mapping Instructional Strategyis more effective than the conventional strategy in improving the Attainment of Concepts. ii) Intellectually above-average students of experimental group performed better than the above-average students of control group in Attainment of Concepts. iii) Intellectually below-average students of experimental group performed better than the below-average students of control group in Attainment of Concepts. This paper also includes challenges in student-centric learning.*

**Index Terms:** Computer-Based Concept Mapping Instructional Strategy & Concept Attainment

**Introduction:**

Science is a body of knowledge. Scientific knowledge exists in the form of facts, concepts, principles, laws, hypotheses and theories. An interconnected series of concepts and conceptual schemes have been developed as a result of experimentation and observation. The learning of concepts in science depends on careful planning of learning experiences. True learning is not merely acquisition of certain traits or skills; it is a change in behaviour brought about by training or experiences. This study attempts to provide a unique learning experience to students, to develop Concept Maps using technology for the Concept Attainment and enhance their learning outcomes in Science.
Concept maps were developed in 1972 in the course of Joseph D. Novak's research program at Cornell University where he sought to follow and understand changes in children's knowledge of science. Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes, and relationships between concepts indicated by a linking line. Words on the line referred to as linking words; specify the relationship between the two concepts.

Concept Mapping is an active, creative, visual and spatial learning activity. It is effective method to gain a meaningful understanding of new concepts and to integrate these new concepts with prior knowledge retained in long-term memory. Concept Mapping is an educational tool that helps in Concept Attainment to organize knowledge and to structure it. It helps in the creation of powerful knowledge frameworks that not

only permit utilization of the knowledge in new contexts, but also the retention of the knowledge for long periods of time (Novak, 1990).

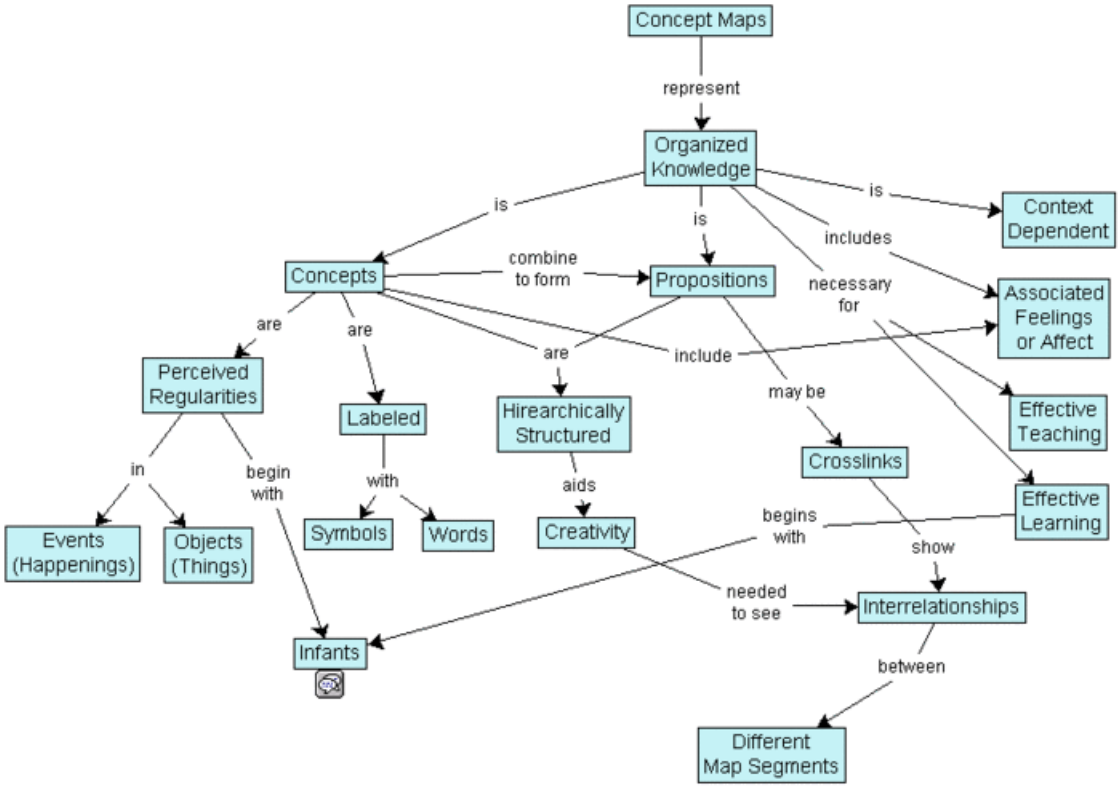


Figure 1: A concept map showing the key features of concept maps

Modern technology has given as an opportunity to improve traditional Concept Mapping with the help of Computer as an aid in the process of concept mapping. Computer-Based Concept Mapping is an Instructional Strategy that helps the learners to organize information through visual aids. When a learner is processing information, Concept Mapping stimulates meta-cognitive awareness, so that it assists the learner not only to establish an appropriate monitoring strategy but also to increase the use of retrieving and memorizing knowledge. Computer-assisted concept mapping leads the learners to organize concepts effectively and achieve meaningful learning. There is a number of Concept Mapping Software's available today. Inspiration is one such Concept Mapping Software used in the present study.

**Review of Related Literature:**

Computer Based Concept Mapping Strategy has been extensively used as teaching, learning and evaluating tool in different disciplines. In Science Asan, A. (2007) Conducted a study on" Concept Mapping in Science Class: A Case Study of fifth grade students." experimental group was treated through Inspiration, which is computer based concept mapping tool. The findings revealed that, Concept Mapping has a noticeable impact on student achievement in science classes. Kwon, S. Y. (2007) conducted a study on "Using Computers to Individually-generate vs. Collaboratively-generate Concept Maps." The findings revealed that, the Students who individually generated concept maps scored more. Rao, M. P. (2004) conducted a study on "Effect of Concept Mapping in Science on Science Achievement, Cognitive Skills and Attitude of Students". The study revealed that, the experimental group students had performed better when compared to the control group on the achievement test, process skills and concept attainment test.

In Biology Chang, K.E., Sung, Y.T., & Chen, S.F. (2001) conducted a study on "Learning through computer-based Concept Mapping with scaffolding aid." The study revealed that, the 'construct-on-scaffold' had better effect for learning on biology. Mayer, J. R. (2012) conducted a study on "Effects of using the concept attainment model with inductive Reasoning with high school biology students." The results indicated that, students' understanding of the concepts and thinking skills did increase with the use of the concept attainment model. Royer, R. & Royer, J. (2004) conducted a study on "Comparing Hand Drawn and Computer Generated Concept Mapping." The results revealed that, the group using the computer, created more complex maps than the group that used paper/pencil. This difference was significant. From the synthesis of the reviewed studies it is observed that, Computer-Based Concept Mapping is undoubtedly an effective practice for Concept Attainment. But very little effort has been done to use Computer-Based Concept mapping in teaching Science Content, although the teachers were aware of the present trends in the teaching of Science.

**Objectives:**

- ✓ To study the effect of Computer-Based Concept Mapping Instructional Strategy and Conventional Strategy in improving Attainment of Concepts of Students in Science.
- ✓ To study the effect of Computer-Based Concept Mapping Instructional Strategy and Conventional Strategy in improving Attainment of Concepts of Students in terms of Above- Average and Below- Average Intelligence levels.

**Hypotheses:**

- ✓ **$H_1$**: Computer-Based Concept Mapping Instructional Strategy is more effective than the Conventional Strategy of teaching in improving the Attainment of Concepts of Students in Science.
- ✓ **$H_2$**: Intellectually the performance of above-average students of experimental group is more effective than the above-average students of control group in Attainment of Concepts.
- ✓ **$H_3$**: Intellectually the performance of below-average students of experimental group is more effective than the below-average students of control group in Attainment of Concepts.

**Research Design:**

The pre-test, post-test, parallel group design was used in the study. This is diagrammatically represented in the Table 1.

Table1. Schematic Representation of Treatments and Levels

| Levels → / Treatments ↓ | Above Average ($L_1$) | Below Average ($L_2$) |
|---|---|---|
| Computer-Based Concept Mapping Instructional Strategy. ($T_1$) | n(18) $T_1$ $L_1$ | n(18) $T_1$ $L_2$ |
| Conventional Strategy. ($T_2$) | n(18) $T_2$ $L_1$ | n(18) $T_2$ $L_2$ |

**Sample:**

The sample consisted of 72 students within the age group 14 to15 studying in Standard Nine. Based on their Intelligence 'T' Scores, matched pairs were identified and distributed into two groups as Experimental and Control group with 36 cases in each

group. On the basis of their intelligence each group was further divided into 2 levels as Above- Average and Below- Average consisting of 18 cases in each group.

**Tools Used:**

Standardized Intelligence test developed by J C Raven, was used for the classification of levels of students (Above-Average and Below-Average). The data for the present study was collected by using the Concept Attainment test developed by the investigator. It consisted of 40 items. The content validity was established by expert rating. The coefficient of consistency by the split half method was found to be 0.95. The concurrent validity co-efficient of 0.64 was found against the external creation, the concept Attainment test developed by Anuradha Joshi.

**Procedure of the Study:**

In order to avoid the inter-personal and intra personal variation of two different teachers for the student groups based on Computer-Based Concept Mapping instructional strategy and Conventional strategy, it was decided to conduct both the classes by a single teacher having competence in both the strategies on the same dates. The two groups were pretested on Attainment of Concepts. The experimental treatment involved in the teaching of a selected unit in Biological Science namely, "Classification of living organisms" of standard nine. Each lesson was of one and half hour duration. The total fifteen lessons were taught by using Computer-Based Concept Mapping instructional strategy to the experimental group of students. Meanwhile, the students of Control group were taught the same lessons for the same duration of the time by the same teacher using Conventional Strategy. Immediately after the completion of the treatment both the groups were Post- tested on Attainment of Concepts.

**Delimitations:**

- ✓ Computer-Based Concept Mapping Instructional Strategy can be applied to any subject, at any level. In the present study, the background of the Researcher has enabled its application to Science at Secondary School level.
- ✓ Computer-Based Concept Mapping Instructional Strategy can be applied for different types of instruction. In the present study, it is applied to Group instruction as it is suitable to the Indian context.
- ✓ The study was confined to the teaching of Science for students of English medium of standard nine only.
- ✓ Computer Based Concept Mapping involved the use of only one software namely 'INSPIRATION'.

**Results:**

The objectives and related hypotheses were analysed by applying 't' test. The results of the study are given below:

⇒ **Instructional Strategy (Treatment):**

Table 2: Sum of Post-test scores of Experimental group and Post-test scores of Control group and 't' value with its significance on Concept Attainment

(n=36)

| Dependent Variable | $\sum D$ | $\sum D^2$ | Obtained 't' Value | Theoretical Value | Significance P<0.01 |
|---|---|---|---|---|---|
| **Concept Attainment** | 469 | 6747 | 18.32 | 2.72 | Significant |

Since the obtained 't' value (18.32) is more than the Theoretical 't' value (2.72) with df (35) at 0.01 level of significance the difference is significant.

From the results of the above table it can be concluded that; The Computer Based Concept Mapping Instructional Strategy when compared to that of Conventional

Strategy of teaching Science is significantly more effective in improving the Concept Attainment of students.

⇒ **Students' Level (Above-Average and Below-Average):**

Table 3: Mean and Sum of Post-test scores of Above-Average and Below-Average students of Experimental group and Control group and 't' value with its significance on Concept Attainment

(n=18)

| Students Level | Mean | | ∑D | ∑D² | Obtained 't' Value | Theoretical Value | Significance P<0.01 |
|---|---|---|---|---|---|---|---|
| | Experimental group | Control group | | | | | |
| Above Average | 32.94 | 19.17 | 248 | 3856 | 5.28 | 2.90 | Significant |
| Below Average | 25.83 | 13.56 | 221 | 2891 | 5.56 | 2.90 | Significant |

- ✓ **Above-Average Level:** Since the obtained 't' value (5.28) is more than the Theoretical 't' value (2.90) with df (17) at 0.01 level of significance the difference is significant. The Above Average level of Experimental group has a mean score difference of (32.94-19.17=13.77) 13.77 units higher in comparison with the Control group. This indicates that the treatment given to the Experimental group led to better test scores on Concept Attainment. Hence, the experimental treatment proved to be significantly more effective. Thus it can be concluded that**:** Intellectually above-average students of experimental group performed better than the above-average students of control group in Attainment of Concepts.
- ✓ **Below-Average Level:** Since the obtained 't' value (5.56 ) is more than the Theoretical 't' value (2.90) with df (17) at 0.01 level of significance the difference is significant. The Below Average level of Experimental group has a mean score difference of (25.83-13.56=12.27) 12.27 units higher in comparison with the Control group. This indicates that the treatment given to the Experimental group led to better test scores on Concept Attainment. Hence, the experimental treatment proved to be significantly more effective. Thus it can be concluded that**:** Intellectually below-average students of experimental group performed better than the below-average students of control group in Attainment of Concepts.

**Major Findings:**

The major findings of the present study are as follows:

- ✓ Computer-Based Concept Mapping Instructional Strategy is more effective than the conventional strategy in improving the Attainment of Concepts in students.
- ✓ Intellectually above-average students of experimental group performed better than the above-average students of control group in Attainment of Concepts.
- ✓ Intellectually below-average students of experimental group performed better than the below-average students of control group in Attainment of Concepts.

**Challenges in Student Centric Learning:**

- ✓ The "digital divide," caused by low computer literacy rates and lack of access to technology among some learner populations.
- ✓ This is technology dependent. This can create unique challenges for training that include: inadequate computers and related technology; and the need for students to have technical skills that may not otherwise be required for this type of learning.

- ✓ Students with low motivation, limited technical skills or bad study habits may fall behind or become frustrated.
- ✓ Students who need more training support might find it confusing.

**Conclusion:**

Education is a process of acquiring knowledge.The innovative methods like Computer-Based Concept mapping instructional strategy that helps the learners to organize information through visual aids. Concept Mapping stimulates learner's meta-cognitive awareness and also to increases the use of retrieving and memorizing knowledge. Present study has proved that Computer-Based Concept Mapping Instructional Strategy is more effective when compared to that of Conventional Strategy in improving Attainment of Concepts. This study has implications for student centric learning and development of instructional materials in line with Computer-Based Concept Mapping to achieve different learning outcomes. It has been found to be a systematic strategy to improve classroom instruction across various disciplines and hence its inclusion in the teacher education curriculum will be a major step in making its application possible at the grass root level. The teachers of all levels need sufficient training to use Computer-Based Concept Mapping software's like 'Inspiration' to improve Concept Attainment in their students. Efforts in this direction will surely bring in improvement in student performance.

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