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Conceptualization of the Group Concept Mapping Model with a Lesson Template in the Teaching of Science at the Secondary Level

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Abstract: Teaching is a powerful way of inculcating the essential knowledge that could be employed in helping students become responsible citizens in future. The teachers should integrate current topics and relevant concepts into their classrooms. They should choose a model that suits the reality and interest of their students, which is functional and effective. Creative thinking lesson plans provide children with opportunities to develop and practice higher-order thinking skills. The teachers incorporate concept maps into their instruction to visualize and measure the depth, breadth and organization of the students' knowledge. With its help, teachers can firstly understand the prior knowledge of students and consequently revise their misconceptions. The crude form of the Group Concept Mapping Model has been evolved in the CTE meeting. Inspired from that thread of innovation, a fundamental structure for the Group Concept Mapping Model of teaching is created and a lesson template based on the model is developed and subjected to further research and discussion. Further, the content areas in science, for the application of the model in actual classroom situations are identified.

Keywords: Concept maps, Group Concept Mapping Model, Lesson Template, Innovation, Science teaching.

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I. INTRODUCTION

The importance of science and technology in today's world is tremendous and therefore the education system has to gear itself to provide the required training in scientific skills to meet this growing challenge. Science thrives to be an unambiguous and rigorously structured body of knowledge, and learning science may be seen as a process where a novice is expected to be transformed into an expert. This has to be attained on two fronts-providing the incentives and motivation for the pursuit of science and changing the attitude of students. The content and structure should meet the objectives and stimulate children's interest in science. The instructors have to integrate the current topics and relevant concepts into their courses. We have to equip our school system so as to make it science friendly.

1.1 Concept Maps

Novak and Godwin define concept mapping as a technique, which sees words essentially as labels for concepts or ideas, and individuals to define the relationship between them. Concept maps, a specific kind of mental model, is a method of representing and measuring an individual's knowledge. In science education, concept mapping has been widely recommended and used in a variety of ways. It has been used to assist teachers and students to form systematised knowledge base in a specified subject or on a particular topic. Studies indicate that concept mapping is an efficient tool for supporting student understanding and retention of scientific concepts. Concept mapping has been used to stimulate constructive self- concepts, positive outlooks towards science and improved accountability for learning.

1.2 Group Concept Mapping

Group Concept Mapping engages two or more students in coordinated and sustained efforts in the creation of one or more concept maps in order to learn and construct knowledge. It is a potentially powerful instructional strategy in that it fosters meaningful learning and group knowledge construction and helps the building of common

ground among learners. However, limited research studies in this area have generated mixed findings. Group concept mapping enables students to expand their negotiation and reflection skills, allowing them to engage in questioning, reasoning, and resolving disagreements. It goes on to say that concept maps are valuable for pre-post evaluation of students' understanding of new information and can support instructional strategies or other types of interventions, which assist students directly to clarifying misconceptions.

1.3 Lesson Plan

Lesson plans can play a vital role in the teaching process. It gives the teacher an effective guide whilst handing out the lessons to the pupils. It helps a teacher use resources and time efficiently. It provides the much-needed preparation, which is essential, for it is not advisable to enter the classroom not prepared. The lesson plan is based on a line of thought and action. The teacher needs to choose a model that suits the reality and interest of their students that is functional and effective. Thus lesson plans mustcomprisethe development of thinking skills, instances of practical thinking, and variations for distinct student requirements.

II. STATEMENT OF THE PROBLEM

Conceptualization of the Group Concept Mapping Model with a Lesson Template in the Teaching of Science at the Secondary Level

III. OBJECTIVES OF THE STUDY

3.1 To create and develop a fundamental structure for the Group Concept Mapping Model of teaching for implementing in the classrooms.
3.2 To develop a lesson template on the group concept mapping model of teaching.
3.3 To identify the content areas in science, for the application of group concept mapping model in actual classroom situations.

IV. METHODOLOGY

The rapid explosion of knowledge and information-oriented society demands novel and continuously changing roles for teachers. This intensifies the need for innovation in the current classroom practices.The soul of this expedition has been evolved from the exemplary research conducted by Dr. K. Y. Benedict, Faculty of Education, University of Kerala, on 'Non Formal Models in Chemistry Education'. The basic idea of the Group Concept Mapping Model was then subjected to an intensive collaborative discussion at the CTE meeting, involving colleagues and subject experts in the field of education. The spark of inspiration acquired from that thread of innovation in such an overwhelming environment, prompted the investigator for this creative construction.

The idea of concept mapping has been widely accepted as an effective strategy for teaching- learning as well as an assessment technique. But the practical application of this concept in actual classroom situations it seldom traced. Through this study, the investigator attempts to create and develop a fundamental structure for the Group Concept Mapping Model of teaching, which facilitates its implementation in the real classroom settings. The five-part framework from Joyce and Weil (1980) for communicating an instructional model is used to explain the nature of the group concept mapping teaching model. Consequently, a sample lesson template on the group concept mapping model of teaching is constructed to illustrate the model, on the topic 'features of musical notes' in Physics. In addition, several content areas in Physical Science, appropriate for the application of the group concept model of teaching has been identified. This aids the utilitarian aspect of this model in future.

V. OUTCOMES OF THE STUDY

5.1 Syntax

The structure and nature of the group concept mapping teaching model is explained by means of the five-part framework from Joyce and Weil. Based on this, the fundamental structure of the model is designed as follows:
The phases of the group concept mapping teaching model are

Phase 1- Evoking the Concept
Phase 2- Construction of the Pre-Concept Map
Phase 3-Exploration of the Learning Material
Phase 4- Construction of the Post-Concept Map
Phase 5- Assessing the Conceptual Development

5.2 Social System

In the beginning of this model, the social system is highly structured, controlled largely by the teacher. He/ she may give focus questions, the phrasing of which will lead to different outcomes. The teacher ensures that all students include a list of concepts in their maps in the initial phase. But the later sessions witness a classroom atmosphere in which the students are the centres of activity. Students work in collaborative groups during the entire concept mapping sessions. Communication between pupils in using scientific ideas provides a worthwhile, effective learning task. It provides a means of structuring discussion about scientific meanings. There is a small amount of structure imposed by the teacher. The teacher's role shifts to that of an instructional manager and monitor. The teacher must pay attention to the level of participation of every student.

5.3 Principles of Reaction

The students expand their negotiation and reflection skills by engaging in questioning, reasoning, and resolving disagreements. The teacher adopts a passive role and remains outside the activity, without influencing the students' actions, thereby allowing them to be self-directive. The students get opportunities to articulate their thoughts and learn from each other. The dialogue created among the students when considering each concept and each connection between major concepts is of great value. In addition to the composition of the group, the group size, the reward structure, and the preparation for group work and the task itself shapes the quality of the student interaction.

5.4 Support System

Expert skeleton maps in the form of pictures, sketches or diagrams, which serve as inducers for the entire activities; Sheets of paper for drawing maps; Colour pens/ pencils for making the maps impressive; Proposed samples of pre-concept and post-concept maps; PowerPoint presentations; Resource materials to uphold the instruction and an Open atmosphere for the students for self-expression, serve as the support system for the model.

5.5 Effects of the Model

The applicability of the model produces two types of effects - Instructional (direct) effect and Nurturant (indirect) effect. Figure1 depicts the effects of the model.

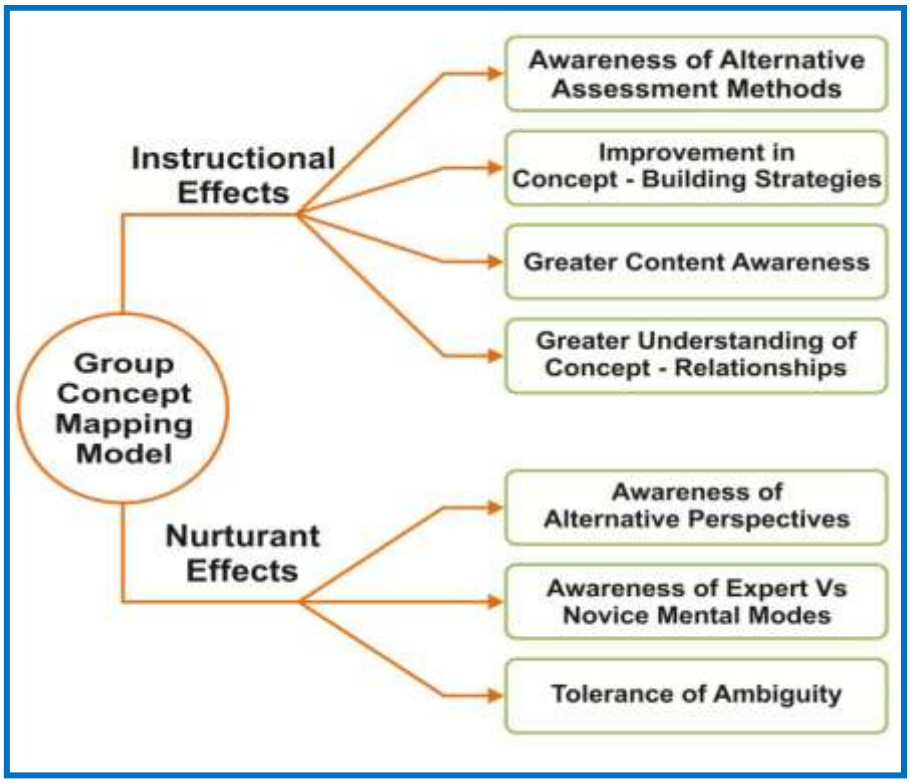

Fig. 1: Effects of Group Concept Mapping Model

5.6 Lesson Template Creation on Group Concept Mapping Model

A sample lesson template is constructed to illustrate the Group Concept Mapping Model of teaching, on the topic 'Features of Musical Notes' in Physics. This is attached as APPENDIX A. The proposed samples of the Pre-concept map and Post-concept map are drawn and attached as APPENDIX B and APPENDIX C respectively.

5.7 Identification of Content Areas in Science for the Application of Group Concept Mapping Model

In addition, several content areas in Physical Science, appropriate for the application of the group concept model of teaching has been identified. The various content areas in science where this model can be applied are Friction, Nuclear Particles, Relativity, Sound and Hearing, Travelling Waves, Light and Vision, Viscous Forces, Magnetism, Nuclear Structure, Redox Reactions, Carbon Compounds, Kinetic Theory etc.

5.8 Conduct of Classes using Group Concept Mapping Model

The developed model is the follow-up of a research conducted by an educational expert. The lesson template attached here was tested in the actual classroom situation. It was found to yield fruitful results. The investigator witnessed the enriched enthusiasm and interest of the students for being exposed to an innovative learning platform.

VI. DISCUSSION OF FINDINGS

According to the new curriculum, every student must develop a thorough knowledge of basic scientific concepts, which they can apply in a wide range of situations. The students must also develop the broad-based skills that are important for effective functioning in the world of work. Therefore concept mapping would be very useful in the science classroom as a learning tool.

Just like many other strategies, the Group Concept Mapping Model is not appropriate to all situations at any given time. However, there are many occasions where this model is an appropriate tool for assessing learning and synthesis of major areas as an additional tool to replace many other strategies. This attempt is expected to assist science teachers with developing new skills to apply the newly developed science and technology curriculum in a wide range of situations. A notable feature of the designed concept maps is that they have a set of nodes with a high clustering capability with respect to other nodes. Such nodes are also central to cycles in the map, and through them, map navigation is possible. This strategy involves the principle of integrative reconciliation. Thus we can reflect upon the ways in which concept mapping can be a teaching-learning activity and a formative and summative assessment tool, can provide insights into student development, and can spur creativity and impart specific skills in students.

VII. CONCLUSION

Concept maps promote and assess conceptual change in a higher education setting, and therefore become an innovative tool in the evaluation of students' learning. Concept mapping forms a helpful metacognitive tool, promoting understanding in which new material interacts with the students' existing cognitive structure. It can be used to help children build a widespread framework of concepts and the relationships between them, and externalize their ideas. This assists teachers to assess children's conceptual development and understanding, identify misconceptions, and facilitate learning by building new knowledge on old knowledge, thereby forming a comprehensive mental schema. For insights into the students' thinking about science, a carefully designed concept map activity can be a tremendous asset.

REFERENCES

[1] Benedict, K. Y. (2001). Non-Formal Models in Chemistry Education. Unpublished Doctoral Dissertation, University of Kerala, Thiruvananthapuram.

[2] Educational Goals and Objectives. A Guide to Developing Learner Based Instruction. Retrieved 10 May 2017 from http://www.ineedce.com/courses/1561/PDF/ed_goals_objctvs.pdf

[3] Briggs, G., Shamma, D. A., Cañas, A. J., Carff, R., Scargle, J., & Novak, J. D. (2004). Concept maps applied to Mars exploration public outreach. In A. J. Cañas, J. D. Novak & F. González (Eds.), Concept maps: Theory, methodology, technology. Proceedings of the first international conference on concept mapping (Vol. I, pp. 109-116). Pamplona, Spain: Universidad Pública de Navarra.

[4] Cañas, A. J., Ford, K. M., Novak, J. D., Hayes, P., Reichherzer, T., &Suri, N. (2001). Online concept maps: Enhancing collaborative learning by using technology with concept maps. The Science Teacher, 68(4), 49-51.

[5] Chiou, C. C. (2008). The effect of concept mapping on students' learning achievements and interests. Innovations in Education and Teaching International, 375-387.
[6] Concordia University, Canada. (2001). Supporting the Learning Process with Collaborative Concept Mapping Using Computer-Based Communication Tools and Processes. Retrieved, October 13, 2017 from http://www.stanford.edu/dept/SUSE/projects/ireport/articles/concept_maps/concept map - collaborative.pdf.
[7] Department of Physics and Astronomy, Georgia State University Atlanta (2005). About HyperPhysics Page. Retrieved, September 19, 2017 from, http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html
[8] Graduate Institute for Computer and Information Education, National Tainan Teachers College. (2000). The evaluation and influence of interaction in network supported collaborative concept mapping. Retrieved, October 13, 2017 from http://www.clab.edc.uoc.gr/hy302/papers/concept_mapping%20net.pdf.
[9] Novak, J.D. and Gowin, D.B., (1984). Learning How to Learn. New York: Cambridge University Press.
[10] A Framework for Assessing Student Understanding in Science. Retrieved 26 August 2017 from https://us.sagepub.com/sites/default/files/upm-binaries/31616_Chapter_1_A_Framework_for_Assessing_Student_Understanding_in_Science.pdf
[11] D. G. Lewis (1965). Objectives in the Teaching of Science. Educational Research, 7 (3), 186-199. Retrieved 10 March 2016 from http://www.tandfonline.com/doi/abs/10.1080/0013188650070307#.Ux6vmJG3LwI
[12] Developing Instructional Objectives. Jones and Bartlett Publishers, 27- 48. Retrieved 24 April 2017 from http://www.jblearning.com/samples/0763740233/40233_CH03_Final.pdf
[13] David L. Kirp. (2013). Improbable Scholars. New York: Oxford University Press.
[14] Ritchhart, R., Church, M. & Morrison, K. (2011). Making Thinking Visible. San Fransisco: Jossey- Bass.

Appendix A
Lesson Template on Group Concept Mapping Model of Teaching

Name of the teacher :	Viji V.	Name of School :	
Subject	: Physics	Std. & div.	: VIII
Unit	: Sound	Duration	: 40 minutes
Subunit	: Features of Musical Notes	Date	:

Syntax	Teacher Activity	Student Activity
Phase 1 Evoking the Concept	The teacher gives a brief summary of the group concept mapping strategy by showing a sample expert skeleton concept map, and divides the class into groups of 3-4 students each. The teacher conducts a recollection session, with probing questions on their present conceptual clarity on the topic 'sound', the answering of which helps the students focus on their maps.	The pupils get an idea of the process of group concept mapping. They form groups and answer the questions, based on their previous knowledge.
Phase 2 Construction of he Pre-Concept Map	The teacher insists the students to construct a pre-concept map on sound, focusing on the production and types of sound. The teacher reviews the maps.	The pupils draw the pre-concept map in groups.
Phase 3 Exploration f the Learning Material	The teacher leads a face-to-face interaction using appropriate teaching aids, on the types of sound, highlighting the features of musical notes including loudness, pitch and timbre, and the idea of echoes, with some additional information.	The pupils get a thorough understanding of the concept.
Phase 4 Construction f the Post-Concept Map	The teacher asks the students to draw post-concept maps, incorporating the meaningful linkage of the initial and newly introduced ideas.	The pupils draw the post-concept map in groups.

Phase 5 Assessing the Conceptual Development	The teacher asks the students to compare and analyse the pre-concept and post-concept maps. Throughcomparative analysis, the teacher identifies the progression of knowledge in relation to the topic.	The pupils compare and analyse the two maps, and identify their improvement.

Social System

In the beginning of this model, the social system is highly structured, controlled largely by the teacher. He/ she may give focus questions, the phrasing of which will lead to different outcomes. The teacher ensures that all students include a list of concepts in their maps in the initial phase. But the later sessions witness a classroom atmosphere in which the students are the centre of activity. Students work in collaborative groups during the entire concept mapping sessions. Communication between pupils in using scientific ideas provides a worthwhile, effective learning task. It provides a means of structuring discussion about scientific meanings.There is a small amount of structure imposed by the teacher. The teacher's role shifts to that of an instructional manager and monitor. The teacher must pay attention to the level of participation of every student.

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Support System

Expert skeleton maps in the form of pictures, sketches or diagrams, which serve as inducers for the entire activities; Sheets of paper for drawing maps; Colour pens/ pencils for making the maps impressive; Proposed samples of pre-concept and post-concept maps; PowerPoint presentations; Resource materials to uphold the instruction such as tuning forks, tape recorder etc., and an Open atmosphere for the students for self-expression, serve as the support system for the model.

Effects of the Model

Instructional Effects:

- Awareness of alternative assessment methods
- Improvement in concept-building strategies
- Greater awareness of the topic domain
- Greater understanding of the relationships between the concepts

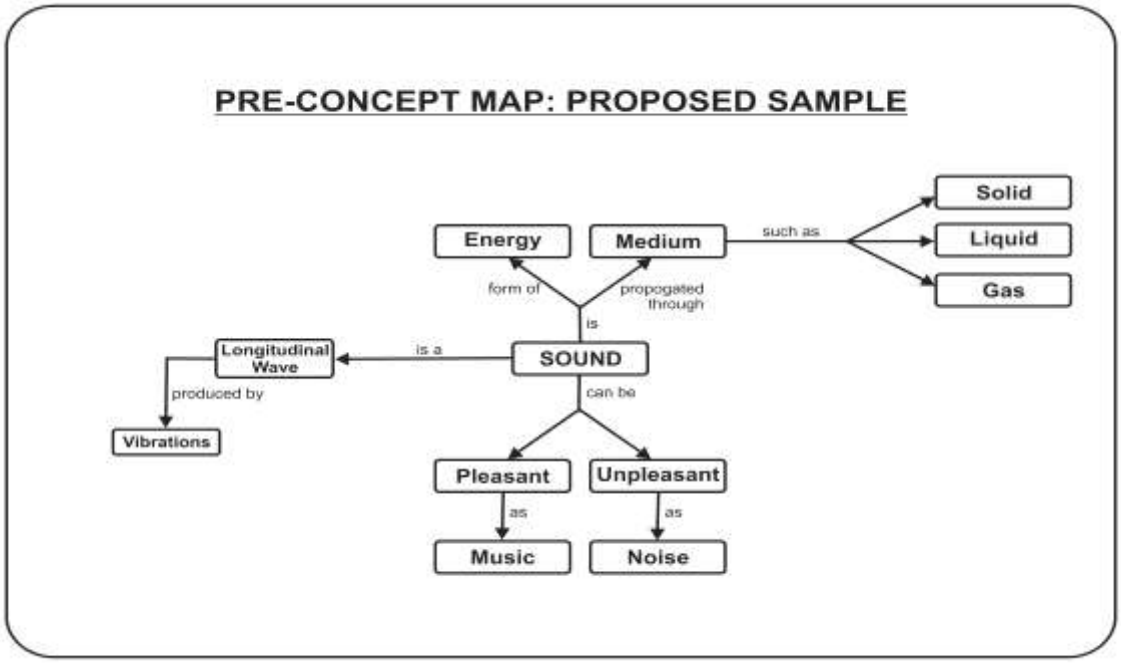
Nurturant Effects:

- Awareness of alternative perspectives
- Awareness of expert vs. novice mental models
- Tolerance of ambiguity

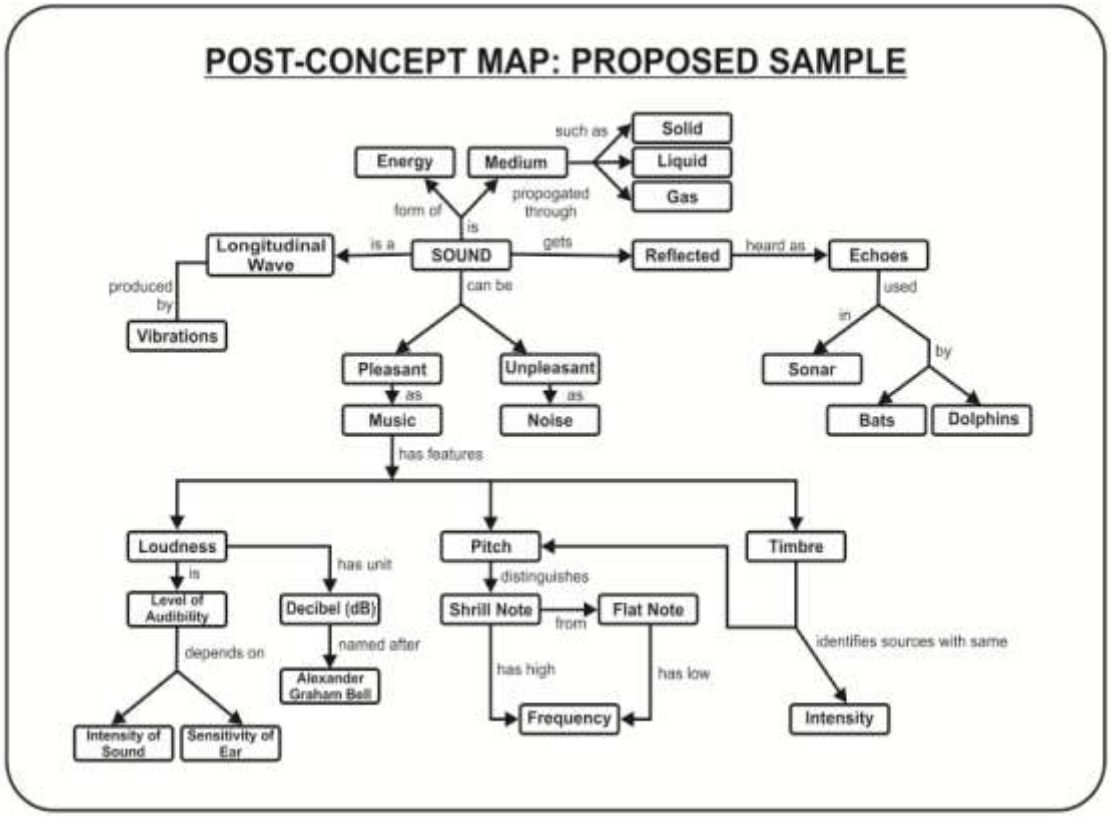
Follow-up Activity

Construct a concept map on the topic ‘production and propagation of sound’.

Appendix B



Appendix C



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