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Introduction:

Education is the process of developing the capacities and potentials of the individual so as to prepare that individual to be successful in a specific society or culture. The world is becoming more and more competitive quality of performance has become the key factor for personal progress. Parents desire that their children climb the ladder of performance to as high a level as possible. This desire for a high level of achievement puts a lot of pressure on students, teachers, and schools and in general education system itself. School achievement may be affected by various factors like intelligence, study habits, and attitudes of people towards school, different aspects of their personality, socio-economic status etc. The desire of success is divided from individual's concept of himself and in terms of the meaning of various incentives as they spell success and failure in the eyes of others thus a child who sees himself as top ranking as scholars may set as his goal the attainment of the highest grade in the class.

Mind mapping is a diagram used to visual form of note taking that offers an overview of a topic and its complex information, allowing students to comprehend, create new ideas and build connections. Through the use of colors, images and words, mind mapping encourages students to begin with a central idea and expand outward to more in-depth sub-topics. Mind maps can be drawn by hand, either as "rough notes" during a lecture or meeting, for example, or as higher quality pictures when more time is available. An example of a rough mind map is illustrated. In our society academic achievement is considered as a key criterion to judge one's total potentialities and capacities. Hence, academic achievement occupies a very important place in education as well as in the learning process.

So in view of this a study was conducted to see students' performance in science on the basis of constructive teaching method of mind mapping.

Review of Literature

The review of the literature uncovers many instances which demonstrate the potential applications illustrated by Buzan. Mind mapping is a technique for delivering effective and creative thinking (Buzan, 1989, as cited in Mento, Mantinelli and Jones, 1999; Buzan and Buzan, 1996; Buzan, 2005). The technique helps in arranging and presenting research concepts visually around a central key word or idea (Borchardt, 2011; Burgess-Allen and Owen-Smith, 2010; Buzan, 1995, as cited in Kern, Bush and McCleish, 2006; Crowe and Sheppard, 2012; Meier, 2007; Mueller, Johnston and Bligh, 2002; Wheeldon, 2011). This visual presentation helps organise thoughts (Mattos, Mateus Junior and Merino, 2012), create ideas (Cheng, Hu and Chen, 2012), focus discussions (Chang and Chen, 2015), solve problems (Buzan, 2005), make decisions (Borchardt, 2011) and achieve learning (Mattos, Mateus Junior and Merino, 2012). Furthermore, mind maps present information and data in an organic and visual format that many of the proponents of the technique claim can increase the ability to retain information (Buzan, 1976, as cited in Meier, 2007; Buzan, 1993, as cited in Meier, 2007; Buzan, 2005).

When originally developing the technique, research attempted to gain an understanding of how people learn and remember (Mento, Mantinelli and Jones, 1999) resulting in gaining insights on how the brain operates. For instance, Zampetakis, Tsironis and Moustakis (2007) convey that the brain works by focusing on a central point from which outward ideas can be added and organised. Additional research uncovers the brain‟s division into two hemispheres which are connected together facilitating different intellectual functions (Buzan, 1991; Buzan and Buzan, 1995; Buzan and Buzan,

1996; Buzan and Buzan, 2006). By using both hemispheres, humans are able to think effectively and creatively (Mento, Mantinelli and Jones, 1999; Nast, 2006). Buzan and Buzan (1995) and Buzan and Buzan (2006) demonstrate this creativity by providing examples of the working notes of great thinkers such as Leonardo da Vinci and Picasso which reflect the use of the mental capabilities which exist in both hemispheres.

Examples of using the technique in academics, for educating students and for undertaking research do exist. For example, using mind mapping for academic purposes, Kokotovich (2008) demonstrates the value of the technique and use for educating first year industrial design undergraduates to think creatively and analyse problems during the early stages of a design process. Zampetakis, Tsironis and Moustakis (2007) also demonstrate the use of the technique, this time to educate engineering students who need to think critically and creatively. The study uncovered how it is possible to encourage students to use mind mapping which is advantageous due to the technique's ability of, making tasks interesting, improving the ability to concentrate and enhancing the ability to remember and think creatively. However, additional research that demonstrates the use of the technique by students from various university faculties is essential to generalise the findings about the preferences of students when it comes to using the technique (Zampetakis, Tsironis and Moustakis, 2007). The use of the technique by Kollock, Flage, Chazdon, Paine and Higgins (2012) on the other hand is during an investigation with a focus on understanding the impact on people's lives as a result of implementing an 18 month community program to strengthen leadership and reduce poverty. The authors collected the data during interviews by using mind maps before transferring the information from these maps onto an excel spreadsheet for coding and analysis (Kollock et al., 2012).

Research Methodology

This paper focuses on illustration of the case study of using mind map as a technique to educate third year engineering undergraduates in an Engineering Institution. This tool was employed as a part of teaching methodology for Materials and metallurgy course.

Transmission of knowledge present in the information by teachers does not guarantee an effective understanding of the student in a large class room which has been a greatest challenge [9]. Conventional teaching methods involve problem solving on boards as normal chalk and talk method it works only for a small group of students. In order to address the large class room visual techniques must be used as 65% of students are visual learners.

Conceptual mapping as implemented in this study has two major purposes. One is to help students gain and maintain an understanding of the overall conceptual structure of the course and, even more broadly, to see how and where the ideas in this course relate to other aspects of the engineering curriculum. The point is to help students avoid the sort of tunnel vision that can occur as students work on specific course tasks but never develop a meaningful conception of what the course is about. A second, more focused map is used to help students organize their thinking and understanding of specific technical concepts. This study reports on how the maps were developed, used, and received by both students and the instructor in an engineering course. The techniques used to develop the maps highlight collaboration between the engineering instructor and a cognitive scientist. We also solicited student feedback during the course and made adjustments in the map if these seemed warranted. The instructor referred frequently to the map, modeled its use in his own problem solving and thinking about the course ideas.

The approach has to be shifted to learning centric from teaching centric. The details of this activity are presented in this section. The activity involves the following

• **Concept analysis:** In this, students have to analyse the concepts dealt in the class and build a mind map based on their understanding of the topics covered in the class individually in every hour of the class on daily bases.

• **Group formation:** In this the students in a group of four have discussions on the individual mind maps, gather all the information from different mind maps exchange views and the group has to come up with a master mind map comprising of the view points of every individual in a team.

Fostering of creativity and ideas is addressed in this activity. Groups have been formed comprising of four students, they have to co-ordinate, organize and prepare a mind map in a team. Mind map is an interactive approach that forces the students to be attentive in a class as this approach provides much time for students to fi t in the topics and make revision not a boring issue. [4] Process of creating a mind map in this activity :

• Begin the Mind Map with a concept at the centre that symbolizes the main topic.

• With an open and creative attitude start with a brain dumping process that will stimulate new ideas and connections.

• Put down all the topics related to the central concept without evaluation and judgment. This will build the mind map having branches and sub branches moving outward the central topic.

• Keywords, symbols and pictures should be used for recording the ideas quickly.

• Topics related to the concept must be connected and organized in a better manner.

A questionnaire survey was conducted to administer the effect of introducing mind map as a part of teaching-learning. The entire class of 69 students was considered for this study. The questionnaire was conducted using 5 Likert scale. Question 1 reflects on the improvement on the memory in recalling, and in response 87% students agreed that relates to whether the students will use this

learning technique in future for interactive learning. In response students were very interested to use mind mapping technique for group concepts, project idea generation, planning of the project and for preparation of competitive exams. Question

The questions are as follows:

1. Mind mapping is an effective tool to recall the technical concepts.
2. Mind mapping helps me to remember and recollect information better than note-making.
3. The images, symbols and keywords, found in mind maps, helped me dynamically relate with concepts.
4. There is clear connectivity and categorization of topics when I mind map.
5. Mind map helped me to collaborate with peers in the process of active learning.
6. Mind map enabled me to think on a specific concept in a wide perspective.
7. There was an increase in the confidence level, when I presented ideas on paper, learnt from mind mapping.
8. Mind map stimulates visual thinking.
9. In future 'mind mapping' can be integrated in all classes as a part of teaching and learning.
10. Mind map helped me to revise the course at the time of examination/test

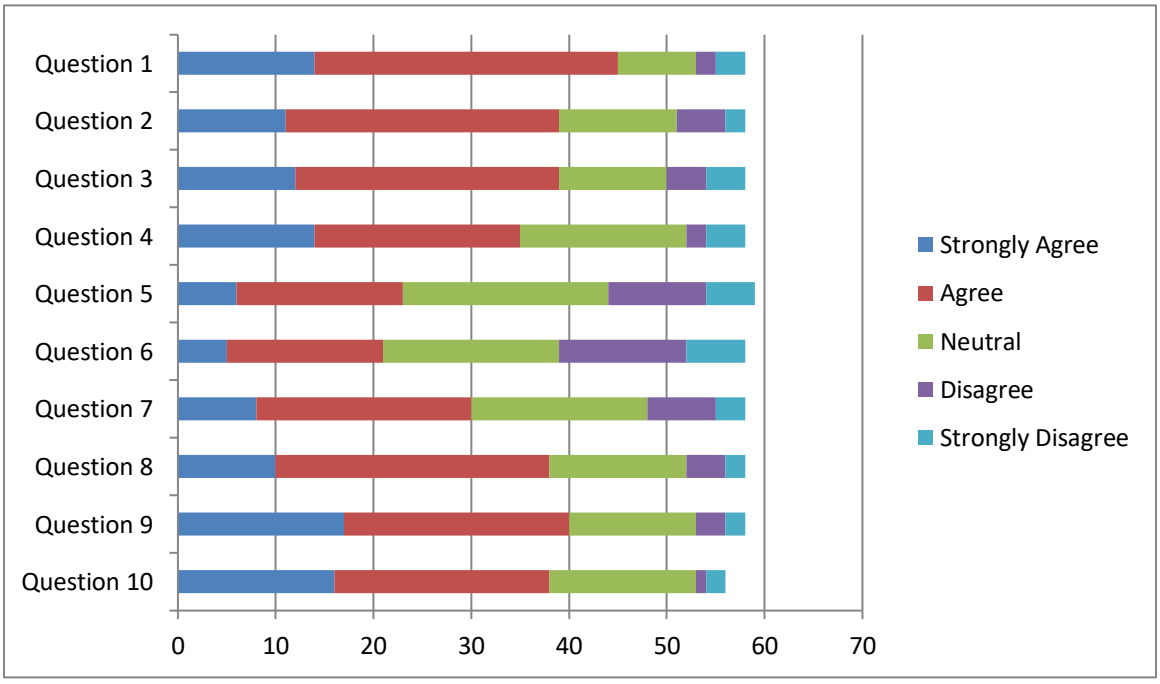

Figure.1 Response of students on using mind map

Discussion:

It was observed that the students were very responsive to the use of mind map in the class.

Many students find writing difficult, and they find getting started the most difficult part of writing. Mind mapping reduces the difficulty by giving students an organizing strategy to get them started. In mind mapping, ideas are freely associated and written out without pressure, thereby reducing tension and resistance often associated with writing. Although, it is one type of outlining methods, the product of the prewriting activity using mind mapping is notably different from the one using other type of outlining. Unlike conventional outlining, the product of prewriting activity using mind mapping does not follow a rigid fixed linear. In outlining, ideas must be arranged sequentially which is contradictory with the natural way of how brain works, because brain works in a non linear way. The elements of a given mind map are arranged intuitively according to the importance of the concepts, and are classified into groupings, branches, or areas, with the goal of representing semantic or other connections between portions of information. Mind mapping also aids recall of existing memories. Mind mapping may be used effectively with students beyond primary grades and in any class that requires writing. It is obviously appropriate for language classes. It is applicable for large groups. Teaching students how to use mind mapping takes about 10 minutes of demonstration time.

The procedure is as follows: the teacher begins by writing a nucleus word or phrase (topic/theme) at the centre of the chalkboard and circles it; then asks the students to concentrate on the topic; after two minutes, asks the students one by one to write any words or phrases related to the topic; teacher makes the point that other words and phrases are to be associated with the nucleus word/phrase, and with other words and phrases; teacher may demonstrates free association by saying aloud words and phrases that come to mind and jotting them down rapidly; these words and phrases are all circled and

connecting lines are drawn to show how they are associated. The procedure above is used to introduce the basic design of mindmapping and its application to the students. The steps are used to help the students analyze the ideas and represent them visually. The students will gradually be accustomed to use mindmapping to communicate their ideas. On the next meetings, the students are asked to use the diagram as a basis to construct a written product/text. As a matter of fact, mindmapping is not only useful to help students writing a complex composition of a certain type text. It can help with almost any types of texts. It even helps students to draw a grammatical schematic. It also does not merely have to use words and phrases but also pictures, charts, or anything as long as they representing what students have in mind.

This paper presents an effective learning technique in large classroom for the course Signals and Systems which is introduced in the curriculum of Materials and Metallurgy and in this study it is observed that the students who used interactive learning technique that is, mind mapping found it easier to learn and visualize the concepts. As this is a collaborative learning technique the students were motivated to learn the course. Students who were not good in mathematics found it easy after using this technique as they could analyze the connectivity between different concepts. The most prominent positive outcome of the experiment is that over 90% of the students have clearly indicated that this has given them a very good opportunity to evaluate, work on and improve their ability for interactive learning. This interactive learning approach adopted has great impact in significantly improving the overall teaching learning process, encouraging the faculty and the students to extend the same to the relevant courses in the curricula program.

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