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Engineering creativity by using computer aided Mindmap

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Abstract : Creativity is a high-level cognitive process which has given rise to research in various fields such as education. This paper shows a research on how Mind Mapping helps tertiary level students in Bangladesh to explore their creativity. It also focuses on use of Mind mapping in a learning environment which requires an enhanced way of thinking, learning and presenting. A research framework and a conceptual framework were developed to conduct this research. Based on the framework a case study will be followed by a qualitative and quantitative study on a group of students. The case study aims to compare student's performance before the use of mind map and the change after using it. Result of the research shows that use of Mind Mapping enhances the learning capacity in terms of number of ideas generated as well as improves presentation focus.. This research paper will facilitate the students, teachers and the researchers who seek ways to enhance the tertiary level educational experience.

Keywords: *-* *Creativity, Educational technology, Engineering education, Learning Method, Mind mapping*

I.   INTRODUCTION

What is creativity? It was discussed in [1] that there are two broad types of creativity, improbabilist and impossibilist. Improbabilist creativity involves novel combinations of familiar ideas. The deeper type of creativity involves METCS: the Mapping, Exploration, and Transformation of Conceptual Spaces. It is impossibilist, in that totally new ideas may be generated which – with respect to the particular conceptual space concerned – could not have been generated before. In the current research, the improbabilist type of creativity is looked at, in particular, whether students in a developing country university experience *increased* combination of their own ideas, both in terms of increased number of ideas generated and the resulting synthesis of ideas, before and after the use of a technique called Mind Mapping.

Developed by Tony Buzan in 1970, Mind Mapping is a revolutionary technique for capturing ideas on a horizontal surface. In [2] it was found the use of mind mapping for understanding case studies very useful among post graduate EMBA students. Mind mapping can be used in every activity where thought, planning, recall or creativity is involved (See [3]). A mind map allows a user to record a great deal of information in the form of linked ideas with keywords and images. Essentially, a user records or inscribes gathered information on a page while showing the relationships between the concepts involved. An example of a basic mind map drawn to organize this paper is shown in Fig.1.
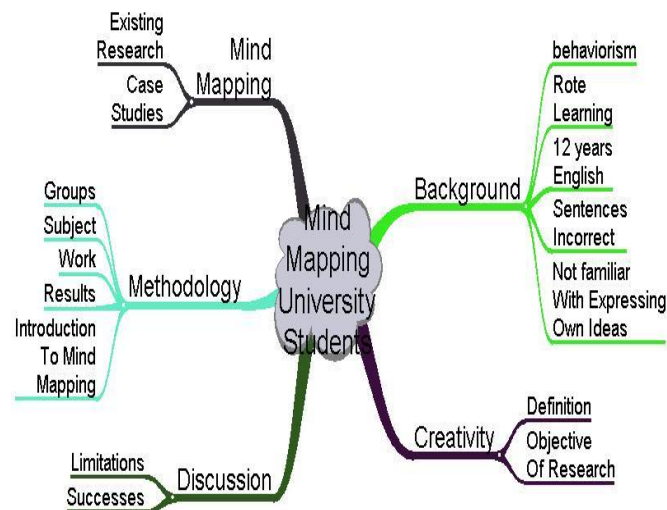
Fig.1 An example of a basic mind map

The mind map in Fig. 1 shows an attempt at organizing the paper currently being written. The branches only show two levels of linked ideas. There is no limit to the number of levels that can be added. In addition to keywords, visual images that represent key the key ideas can also be used.
"Using Mind Mapping as a study technique": (e.g. [4]) shows that retention and recall are better among students when mind maps were used as a study technique. However, they point out that the users must be motivated towards the use of mind maps, i.e. the students must enjoy using it and obviously be conversant in their use. It was studied whether mind mapping can be used as a pre-writing strategy to help explore and generate ideas for writing (see [5]). Author suggests that Mind Mapping tend to help students plan in the following ways:
- to find clearer focus;
- to have better organization of ideas;
- to have clearer ideas;
- to have better ordering of ideas;
- to include more relevant and appropriate ideas;
- to delineate more ideas;
- to have better paragraphing.

In [6] suggests a report which found similar improved results while using another type of mind tool, called Concept Mapping (See also [7]). Nurses used concept mapping to record and understand patient profiles. These nurses performed better than nurses that simply used the regular nursing plan guidelines. It appears therefore that use of tools that allow linking concepts help idea generation and focus.
For the present study, the students are from a developing country, Bangladesh. For both teaching and learning the behaviorism model is widely followed, i.e. student is given information that he/she is required to memorize and reproduce in quizzes and exams. The student is even required to memorize a variety of essays and reproduce one of these essays in the final exams. Essays given by the teacher often contain grammatical and spelling errors. The essays are memorized together with these errors and reproduced exactly. The result is that when students arrive at tertiary level they are not only unable to express independent thought, their sentence construction is random, i.e. mistakes in sentence making are not consistent. To understand the nature of mistakes, a batch of 18 students, studying in the first year first semester of a Computer Science degree were asked to write about a real incident in their lives that deeply affected them. To engage the students, the teacher first related a story in her own life and then got volunteer students to relate stories. Finally, students were paired and asked to verbally relate their stories to each other before finally writing their own story. All stories were collected, the total number of sentences counted and types of mistakes analyzed. It shows that 63.5% of the sentences written had a variety of errors. Further analysis revealed that those who write correct sentences use simple sentence structures, i.e. single verb sentences. When such students attempt to express more complex ideas, they run into trouble. Individual students were then collected and when asked to express the same ideas again the mistakes encountered were different. As the students do not have practice in independent sentence making, the mistakes made are random. It is with these types of students that the current research is designed. The test is to see whether mind mapping can help these students generate ideas for their presentations and assignments

II.   RESEARCH QUESTION AND OBJECTIVES

To answer this question we have several objectives to fill up
- Identify the level of improvements of after using mindmap?
- How does creativity express in mindmap?
- Was the mind map technique effective in enhancing students' creative thinking and problem solving skills?
- What impacts the students after using mind mapping?
- Impacts on student's knowledge compared to paper-based mind mapping and conventional teaching method?

III.   METHODOLOGY

Creativity assessment efforts might be qualitative, quantitative, or both. Analyzing qualitative data is a process which considers relevant contextual issues, possible biases, and values; it is concerned more with discerning the meaning of information rather than with formulating and testing statistical hypotheses, although there exists possibilities of statistical scores for creativity through mathematical means. A research process framework was developed by the researchers and that is shown on Fig 2
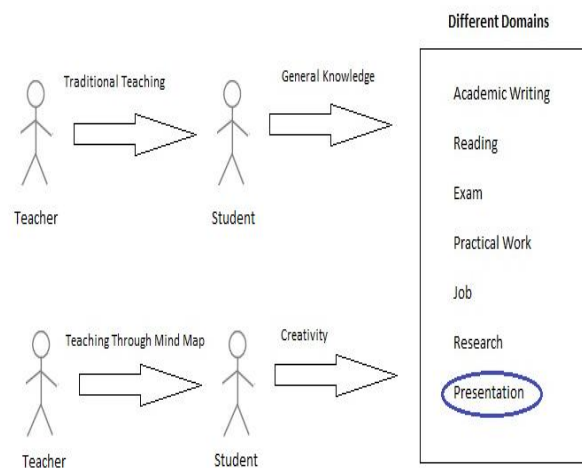
Fig 2: Research Frame work

IV.   EXPERIMENTAL DESIGN

1) Equipments
Some equipment like pen, pencil, marker, papers, and white board were introduced in this research study.

2) Procedure
In the research 11 students of Department of Agriculture from International University of Business Agriculture and Technology (IUBAT), Bangladesh were chosen and the research timeline was in between on January 2011 to April 2011.

First of all, lecturer discussed about importance of ICT in various sectors which is appropriate for this experiment using traditional teaching method with simple PowerPoint presentation. At that moment, students had no idea about any mapping techniques. After the lesson, teacher asked the students to make a presentation of uses of ICT tools in agricultural sector. When their writing is completed then teacher introduced different types of mapping techniques specially paper based mindmap. In the second part of this experiment, students worked for presentation using mind map with same topic.

V.   RESULT AND FINDINGS

After the experiment, the result is quite impressive; researchers found that without the knowledge of mindmap, students focused average of 7 point of interest (POI) or different sectors of using ICT in agriculture in their writing. But after having the concept of mindmap, no of sectors or point of interest(POI) increased as an average of 13 which is almost double than their previous writing.

TABLE 1 : Calculation of Experiment

	Mean	Standard Deviation
Total POI (Without Mindmap)	7	1.891810606
Total POI (With Mindmap)	13	9.052631579

In the chart, it was clearly visible that, standard deviation of students writing without help of mindmap they have covered relevance sectors is 1.81. That means most of the students covered relevant areas of 5.11—8.89 which is even less than the average of sector covered by students writing after using mindmap.

In our two sets of 20 measurements, both data sets gave a mean of consistently 7 and 13, but both groups size were small. How confident can we be that if we repeated the measurements thousands of times, both groups would continue to give a mean of 7 and 13

To estimate this, we calculated the standard error of the mean (S.E.M. or $S_{x\text{-bar}}$) using the equation

$$S_{\overline{x}} = \frac{S}{\sqrt{n}}$$

Where **S** was the standard deviation and **n** was the number of measurements.

- In our first data set, the student not using mind map S.E.M. was .42

$S_{x = s/\sqrt{n}}$

$S_{x =} 1.89/\sqrt{20} = 1.89/4.47 = .42$

- In the second group the student using mind map S.E.M. it was .67

$S_{x = s/\sqrt{n}}$

$S_{x = 3/\sqrt{20} = 3/4.47 = .67}$

95% confidence limits,

It turned out that there was a 68% probability that the "true" mean value of any effect being measured falls between +1 and −1 standard error (S.E.M.). Since this was not a very strong probability, most workers preferred to extend the range to limits within which they can be 95% confident that the "true" value lies. This range is roughly between −2 and +2 times the standard error.

So

- for our first group, .42 x 2 = .84
- for our second group, .67 x 2 = 1.34

So

- If our first group was representative of the entire population, we were 95% confident that the "true" mean lied somewhere between 6.16 and 7.84 ($7 \pm .84$ or $6.16 \le 7 \le 7.84$).
- For our second group, we were 95% confident that the "true" mean lied somewhere between 11.66 and 14.34 (13 ± 1.34 or $11.66 \le 13 \le 14.34$).

Put another way, when the mean was presented along with its 95% confidence limits, the workers were saying that there is only a 1 in 1.34 chance that the "true" mean value was outside those limits. Put still another way: the probability (**p**) that the mean value lied outside those limits is less than 1 in 1.34 (**p** = <0.05).

According to Chebyshev's theorem, the interval (7, 19) can be written as (13-2*3, 13+2*3) which is same as (Mean -k*SD, Mean +k*SD), where k =6/3=2.

According to Chebyshev's theorem, at least 1 - (1/k-squared) of the measurements will fall within (Mean - k*SD, Mean +k*SD)

But 1 - (1/k-squared) = 1 - (1/2^2) = 1 − 0.25= 0.75

Thus 75 percent of the values will fall between 7 and 19 for a data set with mean of 13 and standard deviation of 2.

That result said that the 75 percent possibility was that the average student using the mind map can generate more ides than the traditional system with 2 standard deviation.

According to Empirical rule, approximately 95% of the measurements (data) will fall within two standard deviation of the mean. Therefore (Mean -2*SD, Mean +2*SD) = (13-2*3, 13+2*3) = (7, 19) will contain 95 % of the observations.

Thus the two values are 7 and 19. That result said that the 95 percent possibility is that the average student using the mind map can generate more ides than the traditional system with 2 standard deviation.

As a result, researchers concluded the research with a positive view on Mindmap and from the experiments to

shows that it is really a powerful tool to improve academic tasks of students; in another word it increases the level of creativity of students. This research will help the researchers of the field of contemporary research, academic research, academic reading, academic writing, poster presentation, academic presentation, and innovative teaching and learning methodologies.

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