

A STUDY ON 3D CONCEPT MAPS MODEL

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Abstract. Up to now a very rich experience on Concept Maps design and ways to use them has been accumulated. Series of 3D maps were developed, where concepts were represented with balls and connectors by the bars. The distribution of the concepts on a 3D map has a geometrical structure and keeps the hierarchy. The experiment was developed following three steps: 1) Introduction session on Concept Maps construction; 2) Exercise on 2D concept maps; 3) 3D maps following some geometrical body shape. According to the first two steps, all participants designed 2D maps following Cmap Tools, beta version and then went to try them in a 3D body. After experience an opinion quest to contrast both types of maps was applied and student's comments were registered.

1 Introduction

Up to now a very rich experience on Concept Maps design and ways to use them has been accumulated. Developing of this learning tool has shown to be a very valuable instrument to help and support basic knowledge attainment at almost any field where it has been tried on.

Though there still are some problems to solve in order to have a correct use of concept maps as it was pointed out by Cañas and Novak (2006) like the characteristics of many constructions that tend to be more descriptive than explanatory or else the fact that, to be accessible to any observer, a limited number of concepts are to be included in each map so interconnections can be clearly established and easy to read. There are proposals to consider a balanced topology in regards to the distribution of elements in a map (Brenes & Valerio, 2006).

There has been many different ways to develop 3D structures out of a plane design like for example Gaudi's works for Güell Church which helped him to visualize the geometrical body and the whole 3D structure out of the 2D design as it can be appreciated in Fig. 1. (Giralt, 2002)

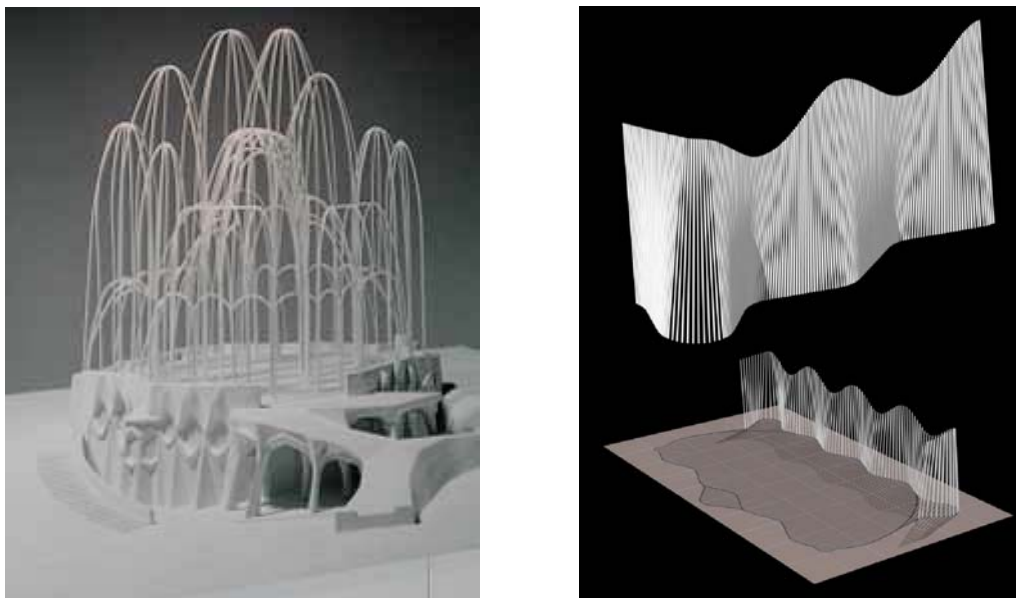


Fig. 1. a) 3D Gaudi's project to Güell Church

b) 2D plane design

So taking in consideration the mentioned facts as well as the main Novak's principles which point out that "concepts are constructed by humans as perceived regulations or patterns in events which are designated by a label, usually a word" (Cañas & Novak, 2006, p. 495) and knowing that two or more concepts can be linked to state a meaningful proposition which can be concretely represented on a map, we decided to explore three dimensional models as another possibility for concept maps usefulness.

2 Methodology

Taking in account the problems mentioned by Cañas and Novak (op. cit.) and trying to help Chemistry students basic knowledge development as well as their creativity, several experimental 3D maps were worked out to see if it is possible to overcome bidimensional planar difficulties like: inadequate connectors, many crossing lines, including too many concepts in a map. Considerations were made on the idea that perhaps 2D does not quite represent a 3D world in which we are and this study may explore other possible way to work with maps.

The exercise was made with a sample of 80 Chemistry students at the 1st level of Chemical Engineering programs offered by the School of Chemical Engineering of the National Polytechnic Institute (ESIQIE). Out of previous studies we detected some difficult concepts for them to comprehend and understand, like “solutions” and “mixtures” so they were chosen to be reviewed.

The way to introduce 3D concept maps followed these steps:

1. Introduction session on Concept Maps construction
2. Exercise on 2D concept maps design
3. 3D maps developing on geometrical bodies shape
4. Analysis and contrast of both 2D and 3D maps.

After the experience, an opinion quest was applied, so participants could comment on both types of maps and express about:

1. Advantages or disadvantages,
2. Main difficulties,
3. Recommendations and comments.

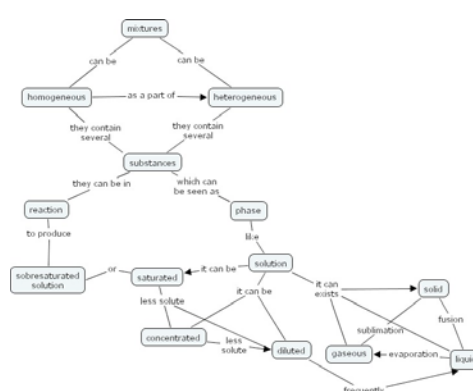
3 Results

- All participants designed 2D maps following CmapTools version beta which produced about 70 different maps.
- According to the quest answers, main difficult was: find out adequate connectors (60%) and going from 2D to 3D (45%).
- The main comment was that it is easier to follow up connections between concepts in a 3D model because there are not line crossings



Fig. 2.

a) 3D map about concepts related to “mixtures”



b) 2D original map

Figure 2 shows a 3D structure build up out of a 2D one with a set of concepts related to “mixtures”. A group of 14 concepts were represented with balls and connectors by the bars. The distribution of the concepts in a 3D body has a geometrical structure and keeps the hierarchy.

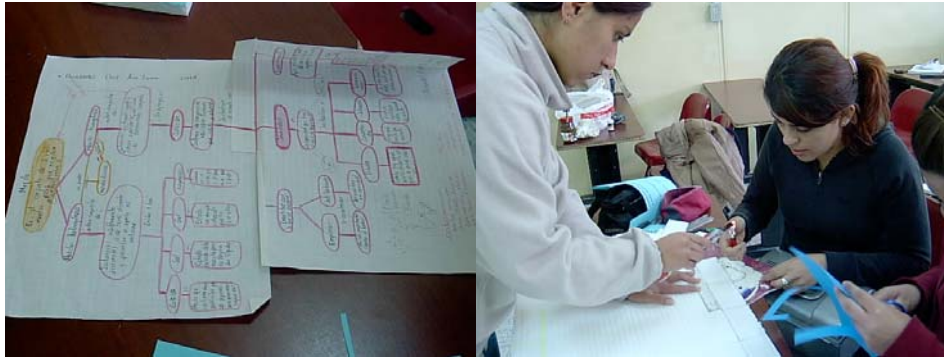


Fig. 3 a) 2D map b) Building the 3D map

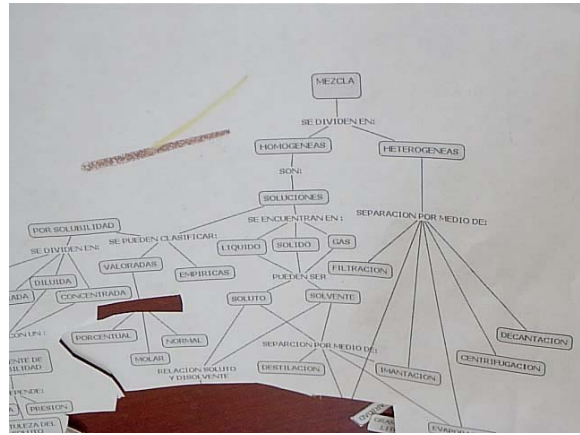


Fig. 4 Cmap of "Mixtures"

Figure 3a and 4 show 2D maps and figures 3b and 5 present 3D maps on "concentration units" and "colligative properties"

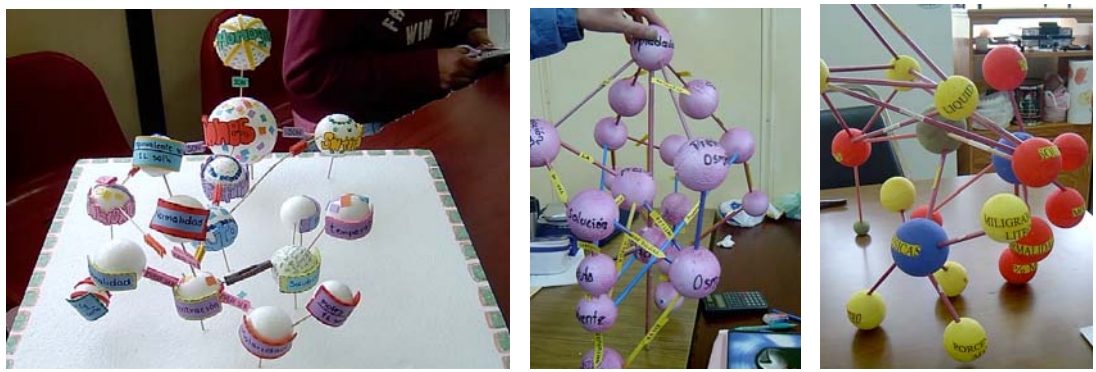


Fig. 5 some 3D maps about "Concentration units" and "Colligative properties"

- Another comment after the experience was that the geometrical body support has to be related with the number of concepts, they suggest that for a set of 5 concepts a tetrahedron could fit, as for a group of 7 concepts an square based bipyramid can be used or a cube for a group of nine and for 13 or more a cone can be suitable.

4 Comments

It seems that the main goals of the study were reached according to the student's opinion who said to like this new way to study and learn. Their creativity was promoted as they had to look for materials and representations to built up their models.

Teamwork and support were a valuable tool to convey their task and construct their basic knowledge on the chosen concepts.

This experience is a starting point that has to be worked out in a deeper way but it seems to be us help in exploring new ways to use Concept Maps.

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