"ELEMENTAL NORDIC CITIES"

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The periodic system is a fundamental knowledge in Chemistry at secondary school. The names and the chemical symbols of the periodic table elements are usually studied of a memoristic way by pupils because it is unusual present to them non chemical educational activities that allow their learning and the use of those symbols.

In this way, educational strategies to help pupils in this topic as an historical approach (Berg, 2003) o the use of games (Orlik, 2002; Franco, 2006a, 2006b, and 2007) have been designed by some authors.

According to Orlik (2002), educational games should be considered as active learning and teaching methods in science. These games make easy and funny learning, cause motivation in Chemistry and develop skills with a significant learning. So, classic educational games as puzzles with chemical symbols (Tubert, 1998; Helser, 2002) or other similar games (Hanson, 2002; Hernández, 2006) have been designed. A card game cross between the "Old Maid" game and "Go Fish" game has been developed and used by Granath and Russell (1999) to teach names and symbols of chemical elements. Franco (2006a) has presented an innovative and educational proposal about the World Cup Football in Germany in order to obtain chemical elements learning.

Tejada and Palacios (1995) have proposed the "Chemical Elements Bingo", a game to teach periodic classification while the "Lottery of atoms" (Franco, 2006b) has helped high school students to use chemical elements and to learn the atomic number and mass number. Finally, an educational strategy used with secondary pupils has been proposed by Franco (2007) too. Each student searches for the chemical elements in their immediate surroundings and then draws them.

In this theoretical framework, the aim of this paper is the presentation of an innovative educational activity that allows to the school students to practice and learn chemical elements and their symbols in a no chemical situation as the most important cities in three Nordic countries: Norway, Sweden and Denmark. The teaching/learning of the names and situation of those cities is considered as an aim from the point of view of Geography too.

A map of the Norway, Sweden and Denmark is presented in the figure in order to identify the name of each city from the series of chemical elements included as clues. To solve the educational game, students must find the symbols that correspond to the elemental names. Then, pupil should rearrange chemical symbols into the name of the cities and place them on underlined spaces. In order to help student one or more letters are included in some cities.

For example, the Nordic countries make up a region in Northern Europe consisting of _ **E** _ **M** _ _ _ (*deuterium, nitrogen, argon, potassium*), _ _ _ _ _ _ _ (*lanthanum, nitrogen, fluorine, iodine, deuterium*), _ _ _ _ _ _ _ (*cerium, neodymium, lanthanum, iodine*), _ _ **R** _ **A** _ (*yttrium, oxygen, nitrogen, tungsten*) and _ _ **E** _ **E** _ (*sulfur, deuterium, tungsten, nitrogen*) and their associated territories (in particular the Faroe Islands, Greenland and Åland). Then, the Nordic countries are **D**E**N**M**ArK**, **FINLaND, ICeLaNd, NO**R**W**A**Y** and **SW**E**D**E**N.**

REFERENCES

De Berg, K. C. (2003). Approaching a study of the periodic table from a nature of science perspective. *The Australian Journal of Education in Chemistry*, *61*, 9-13.

Franco Mariscal, A. J. (2006a). Con material, ¡nos vamos al Mundial!. *Aula de Innovación Educativa, 153-154*, 85-95.

Franco Mariscal, A. J. (2006b). La lotería de átomos. *Alambique, Didáctica de las Ciencias Experimentales, 50*, 116-122.

Franco Mariscal, A. J. (2007). La búsqueda de los elementos en Secundaria. *Alambique, Didáctica de las Ciencias Experimentales*, *51*, 98-105.

Granath, P. L., & Russell, J. V. (1999). Using games to teach chemistry. 1. The old Prof Card game. *Journal of Chemical Education*, *76*, 485, 1999.

Hanson, R. M. (2002). The chemical name game. *Journal of Chemical Education*, *79* (11), 1380.

Helser, T. L. (2003). Elemental zoo. *Journal of Chemical Education*, *80* (4), 409.

Hernández, G. (2006). Jugando con símbolos, *Educación Química*, *17* (2), 187-188.

Orlik, Y. (2002). *Química: métodos activos de enseñanza y aprendizaje*, Capítulo 10: Organización moderna de clases y trabajo extraclase en Química. México: Ed. Iberoamérica.

Tejada, S. & Palacios, J. (1995). The chemical elements Bingo. *Journal of Chemical Education*, *72*, 1115.
Tubert, I. (1998). Crucigrama elemental. *Educación Química*, *9* (6), 379.

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Joaquín Franco received a Bachelor of Sciences Degree in Chemistry in 1998 at the University of Cadiz (Spain). Since 2001, he has taught Chemistry in secondary education. He has received two Innovative Education Awards in Spain (regional in 2004, national in 2006). His investigation is about chemistry education, in particular about the teaching methods in this subject. He has published 15 papers (3 international and 12 national) since 2005.

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ELEMENTAL NORDIC CITIES – MAP

Resolve the puzzle and learn the geography of the Nordic countries!