



## **The water cycle in a bottle: simulation of a hydrogeological basin**

MR. Nebot Castelló (1) and S. Leiva Hevia (2)

(1) Spain (mrnebot@gmail.com), (2) Spain (sleiva3@gmail.com)

THE WATER CYCLE IN A BOTTLE: simulation of a hydrogeological basin

Author: M<sup>a</sup> Roser Nebot (Institut Manuel Blancafort, La Garriga, Barcelona, Spain)

Co-author: Sílvia Leiva Hevia (Institut Llicà d'Amunt, Lliça d'Amunt, Barcelona, Spain)

The activity can be implemented in a great range of ages, because it has many different levels of depth. It is based on the construction of an analogical model of a hydrogeological basin using a 5L or 8L empty bottle. There are also other hands-on experiences that can be done in relation to the central one, such as creating a fountain, making a cloud, fog, a breeze... The use of a model that the students have to build and interact with enhances the possibility of cooperative and dialogic learning.

The set of activities begins with an introduction to see what the students know about the water cycle and to focus on what they are going to work on. It also makes them think about underground water, which is frequently forgotten when drawing and studying the water cycle. Then, the building of the water cycle simulation from an empty bottle is presented, see [http://www.xtec.cat/cirel/pla\\_le/nottingham/roser\\_nebot/index.htm](http://www.xtec.cat/cirel/pla_le/nottingham/roser_nebot/index.htm) (Unit 5). You will also find other activities related to the water cycle at the site.

The students build the model, water the soil, and observe infiltration and the formation of a lake. Using a syringe they overexploit the well and dry the lake. By making the students label the underground water level and observe how water percolates through the holes in the aquifer we are making them aware that underground water doesn't circulate in rivers inside underground tunnels, but through the interconnected holes and crevices.

Inside the bottle there is a little plant to observe evapotranspiration but, because it is very difficult to see the water droplets in the small plant that is inside the set-up, it is advisable to do a parallel experiment using bigger plants in a pot, covering them with a plastic bag tied around the stem, with the soil exposed to air, leaving some of them in the shade and some in the sun. The origin of condensation is thoroughly discussed so that the students understand that evapotranspiration comes from the addition of transpiration (plants) to evaporation.

The students also add colouring to simulate contamination and salt to simulate marine intrusion. These activities, together with the overexploitation, help to understand how humans affect nature and how the effects are not the same in different parts of the world. To finish, there are different exercises to review, summarize and complement all that has been learnt through the lesson.

To acknowledge the fact that many times underground water is forgotten, as homework they have to surf the net to see the many water cycle drawings and animations that don't show the water in the aquifers, and sometimes when the water is seen, the rocks that contain it are not depicted. They are also encouraged to realize that in water cycle representations, it never rains over the sea and that to adjust to what really happens and that there should also be rain over the oceans and seas. To finish, the idea that within the water cycle model there are many interrelated processes is discussed