



PBL, Hands-On/ Digital resources in Geology, (Teaching/ Learning)

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The present study reports the elaboration, application and evaluation of a problem-based learning (PBL) program that aims to evaluate the effectiveness in students learning the Rock Cycle theme. Prior research on both PBL and Rock Cycle was conducted within the context of science education so as to elaborate and construct the intervention program. Findings from these studies indicated both the PBL methodology and Rock Cycle as helpful for teachers and students.

PBL methodology has been adopted in this study since it is logically incorporated in a constructivism philosophy application and it was expected that this approach would assist students towards achieving a specific set of competencies.

PBL is a student-centered method based on the principle of using problems as the starting point for the acquisition of new knowledge. Problems are based on complex real-world situations. All information needed to solve the problem is initially not given. Students will identify, find, and use appropriate resources to complete the exercise. They work permanently in small groups, developing self-directed activities and increasing participation in discussions. Teacher based guidance allows students to be fully engaged in knowledge building. That way, the learning process is active, integrated, cumulative, and connected.

Theme "Rock Cycle" was introduced using a problematic situation, which outlined the geological processes highlighted in "Foz do Douro" the next coastline of the school where the study was developed.

The questions proposed by the students were solved, using strategies that involved the use of hands-on activities and virtual labs in Geology.

The systematization of the selected theme was performed in a field excursion, implemented according to the organizational model of Nir Orion, to The "Foz do Douro" metamorphic complex.

In the evaluation of the learning process, data were obtained on students' development of knowledge and competencies through the application of several instruments such as small questionnaires (Hot Potatoes), Gowin V, scientific report, a grid to evaluate group work and a grid to evaluate the development of competencies.

This study intended to evaluate the success of a PBL intervention program when trying to improve students' outcomes. The positive impact obtained allowed us to advance some conclusions and instructional implications regarding teaching Rock Cycle through PBL and different digital and hands-on resources, obtained, especially in the students' questionnaires and Gowin V, allowed us to verify that students did learn about Rock Cycle and developed collaborative work skills.