

# **A distance learning web-based hands-on lab as a new method for teaching earth sciences**

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This research examined students' performances during the distance-learning and the factors that affected their level of understanding. The study was conducted according to the design research approach and included the following stages: (1) A pre-development study that included the following components: characterization of earth and environmental Sciences curriculum; survey of published models for Internet-based distance-learning and an analysis of students' attitudes regarding the integration of the Internet within their studies, (2) Implementing a Design: this stage included a modification of the module "Greenhouse Effect, Carbon Cycle and Earth Systems" for web-based distance-learning and was implemented within a group of 34 12<sup>th</sup> grades students. The outcome of this stage enabled us to define guidelines for the development of the learning environment, and (3) Modifying Designs as You Proceed: this stage included adaptation of activities from "The Rock Cycle" unit and its implementation within 2 groups of 10<sup>th</sup> grade students (38 students) during two cycles of implementation.

Data was collected before, during and after the implementation using a variety of qualitative and quantitative research tools including questionnaires, observations by an external observer, video, checking students' answers, analyzing the synchronic support the students receive, analyzing students' use of the web site and interviews that used the repertory-grid technique.

Research outcomes indicated that most of the students succeeded conducting the web-based lab activities correctly, but only 20-30% of them also understood the meaning of the lab activity. The current findings and the literature review indicate that the performance of students during a web-based distance-learning lab is very similar to their performance during a conventional, teacher-based lab.

The following recommendations were specified: (1) It is possible to conduct a distance-learning based course of the Earth Sciences program for high school. (2) A model to identify students who are capable of taking part in a distance-learning matriculation Earth Science program was suggested (3) It is suggested to adopt the computerized method for presenting lab activity instructions for a conventional teacher-based lab as well.