

The Influence of Learning Earth Systems studies on the Development of Systems' Thinking Skills in Junior High School Students

A dissertation Submitted for the Degree of Doctor of Philosophy

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Submitted to the Scientific Council of the Weizmann

Institute of Science, Rehovot, Israel

April, 2003

Abstract

The current study deals with the development of Systems thinking skills at the junior high school level. More specifically it deals with the study of the water cycle as part of a wider set of recycling systems, which include the geosphere, the biosphere, and the atmosphere. Thus, such an understanding, which can be described as “understanding the Earth as a system”, may serve as a basis for developing the environmental curriculum.

According to this approach, a multidisciplinary hydrological program (The Blue Planet) was developed. This program includes environmental topics about the relationships between the hydrosphere and the other components of the earth's systems. Moreover, the water cycle is discussed within the context of its influence on people's daily life, for example, river pollution, the quality of drinking water and contamination of groundwater supplies.

The main goal of the “Blue Planet” is to encourage students to develop the level of system-thinking as a basis for environmental literacy. Therefore, several different teaching approaches and learning strategies were incorporated, within the program in order to enable students to construct the dynamics of material transformation within the hydrological system. The learning process includes outdoor learning activities in order to assist students to connect and integrate the components of the hydrological cycle, as they appear in the real world, with the knowledge that is acquired in laboratories. It was suggested that the direct contact with real environments and processes in small scale scenarios will enable students to create a concrete local water cycle, which later on can be enlarged into large scale abstract global cycles.

The Blue Planet was tested in a sample population that included fifty 8th grade students from two different classes of an urban Israeli junior high-school. The study addressed two research questions: (a) Can junior high-

school students deal with complex systems? (b) What factors influence students' ability to develop system thinking skills? The research included a variety of research tools that were implemented in order to evaluate students' knowledge and understanding before, during, and following the learning process.

The study revealed that junior high-school students can: (a) recognize the inter-connections between parts of a system, (b) synthesize the data into a unified view of the whole, and (c) recognize patterns and interrelationships. Moreover, those students of the sample population that were involved in the learning process through knowledge integration activities, scientific inquiry, and with a concrete connection with the outdoor learning environment, achieved a meaningful improvement, in their systems-thinking skills.

Although system thinking abilities are commonly presented as high order thinking skills, not achievable at junior high-school levels, the results of this study show that they can be achieved with an appropriate supportive learning environment. The Blue Planet program is being implemented in many junior high school classes throughout Israel.