Geophysical Research Abstracts
Vol. 12, EGU2010-3160, 2010
EGU General Assembly 2010

How can we cope with the complexity of the environment? A "Learning by modelling" approach using qualitative reasoning for developing causal models and simulations with focus on Sustainable River Catchment Management

Michaela Poppe (1), Andreas Zitek (1), Paulo Salles (2), Bert Bredeweg (3), and Susanne Muhar (1)

(1) Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Applied Life Sciences, Vienna, Austria (michaela.poppe@boku.ac.at), (2) Institute of Biological Sciences, University of Brasilia, Brasilia, Brazil, (3) Informatics Institute, University of Amsterdam, Amsterdam, The Netherlands

The education system needs strategies to attract future scientists and practitioners. There is an alarming decline in the number of students choosing science subjects. Reasons for this include the perceived complexity and the lack of effective cognitive tools that enable learners to acquire the expertise in a way that fits its qualitative nature.

The DynaLearn project utilises a “Learning by modelling“ approach to deliver an individualised and engaging cognitive tool for acquiring conceptual knowledge. The modelling approach is based on qualitative reasoning, a research area within artificial intelligence, and allows for capturing and simulating qualitative systems knowledge. Educational activities within the DynaLearn software address topics at different levels of complexity, depending on the educational goals and settings. DynaLearn uses virtual characters in the learning environment as agents for engaging and motivating the students during their modelling exercise. The DynaLearn software represents an interactive learning environment in which learners are in control of their learning activities. The software is able to coach them individually based on their current progress, their knowledge needs and learning goals.

Within the project 70 expert models on different environmental issues covering seven core topics (Earth Systems and Resources, The Living World, Human population, Land and Water Use, Energy Resources and Consumption, Pollution, and Global Changes) will be delivered. In the context of the core topic “Land and Water Use” the Institute of Hydrobiology and Aquatic Ecosystem Management has developed a model on Sustainable River Catchment Management. River systems with their catchments have been tremendously altered due to human pressures with serious consequences for the ecological integrity of riverine landscapes. The operation of hydropower plants, the implementation of flood protection measures, the regulation of flow and sediment regime and intensive land use in the catchments have created ecological problems. A sustainable, catchment-wide management of riverine landscapes is needed and stated by water right acts, e.g. the European Water Framework and Floods Directive. This interdisciplinary approach needs the integration of natural riverine processes, flood protection, resource management, landscape planning, and social and political aspects to achieve a sustainable development. Therefore the model shows the effects of different management strategies concerning flood protection, restoration measures and land use. The model illustrates the wide range of ecosystem services of riverine landscapes that contribute to human well-being such as water supply, hydropower generation, flood regulation, and recreational opportunities. The effects of different land use strategies in the catchment are highlighted by means of the Driver-Pressure-State-Impact-Response (DPSIR) framework.

The model is used to support activities of students at the University as well as at High School within the DynaLearn Software to promote scientific culture in the secondary education system. Model fragments allow learners to re-use parts of the existing model at different levels of complexity. But learners can also construct their own conceptual system knowledge, either individually or in a collaborative setting, and using the model as a reference for comparisons of their own understanding. Of special interest for the DynaLearn project is

the intended development of interdisciplinary and social skills like cooperative working, cross-linked thinking, problem solving, decision-making, and the identification of the conflicts between environment, economy, legislation, science, technology, and society. A comprehensive evaluation of the DynaLearn software is part of the project.

To be effective, science education should focus on understanding scientific concepts and on application of scientific knowledge to everyday life. Conceptual knowledge of systems behaviour is crucial for society to understand and successfully interact with its environment. The transfer of environmental-scientific knowledge by means of the DynaLearn software to wide parts of the society can be regarded as an important contribution to that, and contributes to foster a life-long learning process.