**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.

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**INTRODUCTION**

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.

**INTERACTIVE QUALITATIVE KNOWLEDGE MODELS**

The DynaLearn project utilizes a "Learning by modelling" approach to deliver an individualized 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 (Forbus, 1984). Educational activities within the DynaLearn software address topics at different levels of complexity (Fig. 1), depending on the educational goals and settings (Bredeweg et al., 2009).

**MODEL ON SUSTAINABLE RIVER CATCHMENT MANAGEMENT**

Within the project 70 expert models on different environmental issues covering seven core topics will be delivered. Within the topic “Land and Water Use” the Institute of Hydrobiology and Aquatic Ecosystem Management has developed a model on Sustainable River Catchment Management.

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 (Zitek et al., 2009).

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.

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.

But learners can also construct their own conceptual system knowledge, either individually or as a collaborative approach, using the model as a reference for comparisons of their own understanding.

**Preliminary Evaluation Results**

Comparing pre- and post test results, students’ view of wind energy production and the effects on the environment became clearer, with increasing causality and conceptual understanding.

Both activities were highly engaged and motivated by the activities with DynaLearn to develop their own viewpoints and hypotheses. They also got very interested in different fields of studies available at BOKU, clearly proving that the activities in the software increased their interest in environmental science, which is one of the defined targets of the DynaLearn project - to attract more students towards environmental science. But the use of Dynalearn represents also a challenge for teachers. Teachers have to define clearly which content and learning goals are associated and deliver best by which use level of DynaLearn. They have to rethink the methodological approach to convey knowledge to students.

If concepts and teaching goals get defined more precisely the DynaLearn approach is likely to enable students to understand complex environmental systems better and faster.

**REFERENCES**


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