System understanding as a basis for sustainable decision-making. A science – school collaboration within the Sparkling Science project "Traisen w3"

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Equipping young people with the skills to participate successfully in increasingly complex environments and societies is a central issue of policy makers around the world. Only the understanding of complex socio-environmental systems establishes a basis for making decisions leading to sustainable development. However, OECD Pisa studies indicated, that only a low percentage of 15-year-old students was able to solve straightforward problems. Additionally, students get less interested in natural science education.

In Austria "Sparkling Science" projects funded by the Federal Ministry of Science, Research and Economy in Austria target at integrating science with school learning by involving young people into scientific research for the purpose of developing new and engaging forms of interactive, meaningful learning.

Within the Sparkling Science Project "Traisen.w3" scientists work together with 15 to 18-year-old students of an Austrian Secondary School over two years to identify and evaluate ecosystem services within the catchment of the river Traisen. One of the aims of the project is to foster system understanding of the youths by multi-modal school activities.

To support the development of causal systems thinking, students developed qualitative causal models on processes in the catchment of the river Traisen with an interactive, hierarchically structured learning environment that was developed within the EU-FP7 project "DynaLearn" (http://www.dynalearn.eu) based on qualitative reasoning. Students worked in small groups and were encouraged to interlink entities, processes and simulate the results of the proposed interactions of hydrological, biological, ecological, spatial and societal elements. Within this setting collaborative problem solving competency through sharing knowledge, understanding and different perspectives was developed.

Additionally, in several school workshops the ecosystem services concept was used as communication tool to show the multifunctionality of river catchments and to highlight the necessity of a sustainable use.

Furthermore a field mapping of a restored and an anthropogenically altered section of the river Traisen was performed by the students in collaboration with the scientists. It aimed on the surveying of specific parameters relevant for the identification of cultural and ecological ecosystem services.

To investigate the effects of the different forms of learning on youths' factual, regional and system knowledge, tests were conducted before and after the school activities.

The evaluation results of the pre- and post-tests proved that the multi-modal school activities lead to a significantly higher students' knowledge of environmental processes in river landscapes. The analyses of the students' model scenarios for the river catchment Traisen revealed a clear students' understanding of relationships of anthropogenic impacts, morphological and ecological river states and restoration measures. Students' feedback showed high enthusiasm for field work and the application of theoretical knowledge in their regional context.

Summarizing, the involvement of secondary school students in the research project "Traisen.w3" can be seen as a successful example of how students' system thinking and motivation for learning can be increased. Ensuring that young people are proficient in system knowledge and understanding also in relation to their own surrounding environment makes it more likely that sustainable considerations are soundly addressed in the future.