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DynaLearn in school: introduction to qualitative reasoning modeling for secondary school teachers

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Abstract

Learning by modeling has been seen as an advanced way to develop scientific inquiry capabilities and related reasoning skills. This is the main focus of DynaLearn (DL), an EU funded project aiming at the development of a modeling workbench that integrates three cutting the edge technologies: qualitative reasoning, virtual pedagogical agents and ontology mapping (www.dynalearn.eu). The software offers six modeling environments (Learning Spaces, LS), described as follows: Concept Map (LS1), Basic causal model (LS2), Causal model with state graph (LS3), Causal differentiation (LS4), Conditional knowledge (LS5), and Reusable knowledge (LS6).

Teachers are key partners in the learning by modeling enterprise, as they are the ones to offer the student curriculum opportunities for the development of models and to explore in all the possible ways the development of cognitive competences and abilities related to the model building process.

This paper describes the experience of 21 teachers of different disciplines (Biology, Chemistry, Physics, Mathematics, Portuguese, Philosophy, etc.) being introduced to DL and to modeling, in a 15h course held at a public secondary school in Sobradinho, a small town 35 km far from Brasília, Federal District, Brazil.

The main goals of the course were to present conceptual modeling using DynaLearn software and to investigate the teachers' opinion about the software. The methodology included an introductory lecture; after that, focus was given to modeling with DL, mainly in an evolving model-mode (the user develops a model guided by the researcher), or in a build-model mode (the user has full access to software and may create a model starting from the scratch. The collaborative modeling-mode will be used in all classes, with teachers working in pairs.

The teachers were involved in a broad set of modeling activities, exploring the lake as an ecosystem, conservation of natural resources, and other issues. Initially, the teachers were introduced to the concept map (LS1), both to inspect a map and to create their own representations at this level. Next, the teachers were exposed to LS2 by recreating models implemented by the researchers, changing models already done by the researchers, and by creating new models by starting from scratch, after consulting specific written texts. Some topics

(e.g. biomagnification) were further explored in LS3 and in LS4 (e.g. polluting and cleaning the lake). At the end of the activity, 8 teachers completed two questionnaires developed for collect their impressions on motivation and attitudes, and on the modeling activities, and wrote texts about how they foresee the use of conceptual modeling in the short term.
The answers to the questionnaires and texts were very positive and full of interesting ideas for further development of the software. Challenging is to create didactic materials that capture heuristic knowledge that may support learners and teachers while transforming vague ideas or fragmented knowledge into formal representations that may be used to simulate the system behaviour and to predict the future of the system under specific initial conditions.

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