A graphical modeling language for computer-based learning scenarios

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Abstract

A crucial challenge for improving EMLs is to provide an intuitive notation to support educational practitioners to not only understand, but also describe a large number of flexible scenarios themselves. We present here the general outline of a graphical modeling language based on the concept of Learning Activity Space (LAS) and its related editor so-called SCY-SE. The design stage of learning computer-supported scenarios can be facilitated by the use of LAS arrangements as improved in the context of an interdisciplinary European project named SCY (Science Created by You).

1. A Graphical Modeling Language based on Learning Activity Spaces

A Learning Activity Space (LAS) [1] is defined as *a coherent and intuitive set of activities supported with specific tools and scaffolds. The input and output of a LAS are described in terms of a set of artifacts created by students (further called Emerging Learning Objects: ELOs* [2]*).*

We use the LAS concept as the basis of a graphical scenario modeling language intelligible for non-computer scientists and aiming at realizing some necessary flexibility while providing expressiveness and pedagogical relevance.

The design of learning environments can be built on a specified selection of learning activities, which constitute the respective LASs. The general outline of scenarios is thus defined by an arrangement of LASs and the various learning paths between them. Sequencing of the selected activities provided by each LAS is not prescribed in a linear fashion but instead by the ELOs learners produce while performing these activities. (Figure 1 shows a specific LAS with its potential activities, tools and input/output ELOs).

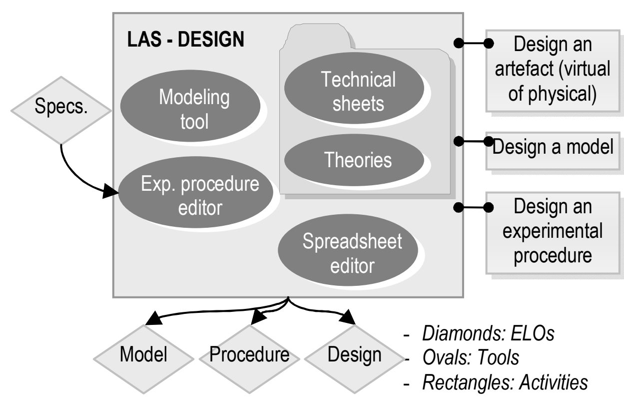

Figure 1: LAS Design.

Each activity requires an input ELO developed previously in another LAS by the learners or a given learning object pre-defined by the content developers. The activities in a LAS result in at least one output ELO, but in many cases there can be several of these. Additionally, the activities are supported by tools that may or may not have scaffolding characteristics, e.g., a simulation tool that – adapted to the learners' changing needs – provides clues for what variables to look for in the simulation.

For the SCY project (Science Created by You, FP7), thirteen LASs have been designed as the result of

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a large study focusing on science learning scenarios (i.e. *Analysis, Conceptualization, Construction, Debate, Design, Experiment, Evaluation, Information, Management, Orientation, Reflection, Regulation, and Reporting).*

In the specific outline of a scenario, a designer has to (1) choose a specific set of LAS from the 13 available LASs, and then (2) further specify each of them. In step (1), choosing the right set of LAS is guided by the identification of activities to be performed. In step (2), each LAS can be further specified with respect to its setting (learning arrangement, technology support, and location). Thus, each LAS can have different instantiations, i.e. single activities can be left out or added without changing the character of one LAS. The next step would be to adapt a so defined scenario to a concrete instance, adding specific content and a pedagogical plan.

2. Scenario and LAS editor: SCY-SE

Based on the conceptualization and the suggested graphical language for modelling educational scenario, the so-called SCY Scenario Editor (SCY-SE, figure 2) supports comfortable, graph-based and consistent creation of LASs and pedagogical scenarios, allowing practitioners and researchers to initially design exchange and compare new scenarios and LASs.

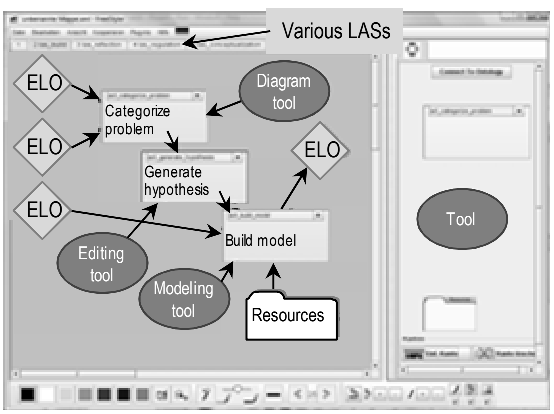

Figure 2: LAS View of the SCY-SE

SCY-SE is able to retrieve and infer information from an ontology that is being built in the context of the SCY project. In this ontology, a set of pre-defined template scenarios and LASs (as listed above) are stored along with their relations to activities, tools, ELO types, scaffolds, etc. Thus, SCY-SE assists the designer in adhering to constraints (e.g., an "interpret data" activity necessarily needs a tool to display data) and it is able to compare new or edited scenarios and LASs to existing ones. Similar scenarios or LASs may be joined or discussion between their authors may be initiated. SCY-SE provides two different views (with different objects and tools provided in a "palette") for LAS specification (shown in Figure 2) and for the combination of LASs into an integrated scenario.

This application has been built as an extension of the FreeStyler multi-purpose modelling tool [3]. Its architecture integrates the Freestyler environment with the SCY ontology using a blackboard-based agent architecture. The blackboard serves as a repository and a shared memory and is implemented in terms of several tuple spaces [4]. Specific agents provide consistency checks and similarity computation for LAS and scenario specifications.

3. Conclusion

The notion of LAS enables a structured and expressive description of learning scenarios and at the same time it allows for a high variability in interrelating activities within and between LASs. The focus of the graphical modeling language is on learners' expected productions while performing activities which are seen as keys for entering a specific LAS or for sequencing activities within it. By means of this graphical language and the SCY Scenario Editor (SCY SE) we seek to help non-computer-scientists to face the complexity of learning design.

4. References

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