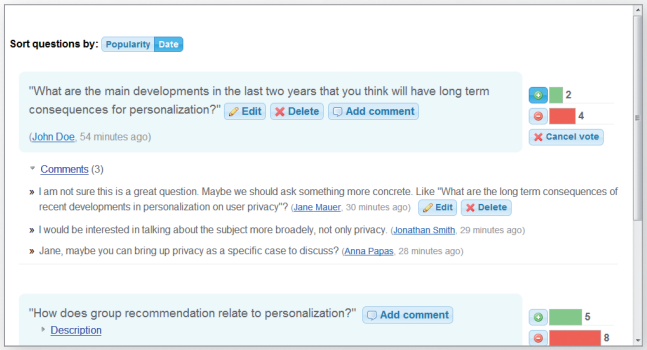
Results (cont.)



a group learning histories, making it possible, for instance, to identify persons that have solved similar problems to the one a learner is facing difficulties with, so that they can be consulted for learning assistance.

The automation dimension of group formation was addressed in another Sakai component, named **"Grouping"**. This tool supports the process of selecting individuals to assign to groups, on the basis of their characteristics, knowledge, etc., and following a predetermined pedagogical strategy. To achieve this, the tool utilises portions of the learner model (e.g., coverage of the course's leaning material, prior behaviour in collaborative settings, etc.), coupled with instructor selected apportioning strategies. The tool also facilitates the management of thusly created groups in Sakai, automating tasks such as the generation of workgroup sites to host the resources and activities of groups.

"Scripting" of collaborative activities

The project has proposed extensions to the IMS Learning Design specification (the only official specification for a collaboration scripting language in existence), to address the following main areas: better modelling of groups of learners and their activities; better modelling of collaboration tools, services, and artefacts; introduction of a work-flow model; introduction of a comprehensive run-time model; introduction of a set of adaptation actions that can be effected against the run-time model; etc. At the time of writing, the proposed extensions are under implementation in the form of an "activity coordinator" that will be integrated into the Sakai platform.

Team

The ASCOLLA project was carried out by the **Institute for Information Processing and Microprocessor Technology (FIM Institute)** of the Johannes Kepler University in Linz, Austria.

Both the FIM Institute and the ASCOLLA project are headed by **o. Univ. Prof. Dr. Jörg R. Mühlbacher**. The internal project leads of ASCOLLA were Dr. Alexandros Paramythis and Dr. Michael Sonntag.

The FIM Institute has participated in a multitude of R&D projects over the years, with e-Learning and Adaptive Systems being focal points of recent work. If you are interested in the theme and results of ASCOLLA, you may also find interesting its "precursor", the **Socrates-Minerva Adaptive Learning Spaces (ALS) project** (www.als-project.org).

Contact us

Please contact us if you are interested in more information on ASCOLLA and its outcomes, or would be interested in utilising (including for commercial purposes), or collaborating on the further development of, the project's results.

Assoz. Prof. Priv.-Doz. Mag. DI Dr. Michael Sonntag

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ASCOLLA

Adaptive **S**upport for
COLLaborative E-Le**A**rning

January 2008 – September 2010

Institute for Information Processing and Microprocessor Technology

JKU Johannes Kepler University Linz

FWF Der Wissenschaftsfonds.

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Project

Rationale

It is widely acknowledged that a large part of **success of the learning process** lies with the opportunities of learners to **interact with others**: groupwork, exchanging ideas, and helping each other (thereby learning themselves) are standard "classroom" practices. With **limited real-world contact**, learners have limited means for formulating personal mental models of other learners' capacities, skills, interests, strong and weak points, disposition towards teamwork, willingness to help, learning progress etc. Without such models, learners **cannot make informed decisions** about everyday learning tasks like: whom to direct a question to; which person(s) have the complementary skills required to put together a group that can effectively work on a given task; when to contact them; etc.

Project goals

Devise, facilitate and foster more **collaborative and group-oriented learning approaches** than are possible with today's technological means.

Scientific objectives

- widen the range of, as well as increase the amount of, **guidance and support** that Open and Distance Learning systems can provide to learners and instructors
- provide novel means to **support social cohesion** in groups of learners, as well as the **engagement** of their members in collaborative / team tasks and processes

Approach

The project's work can be generally classified along the following interconnected dimensions:

- → **analysis of user activities** towards the generation of better learner models
- → adaptive facilitation of **resource-based learning** activities and group work
- → adaptive support for the automatic **formation of groups** on the basis of the preceding, as well as an improvement of **ad-hoc collaboration opportunities**
- → adaptive support during the **collaboration process**

Results

Analysis of user activities

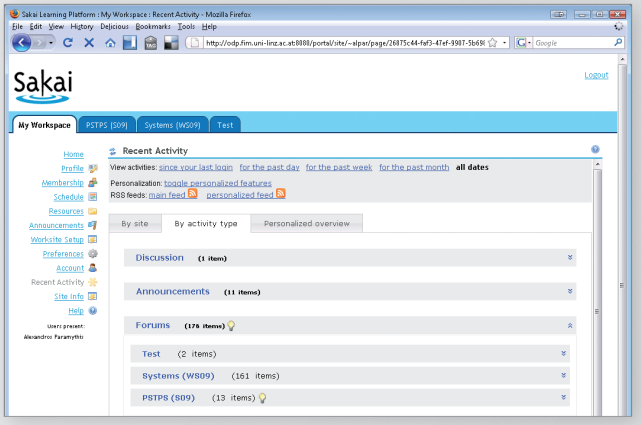
The **UDRP case generator** is a component for the Sakai Learning Management System. It adaptively generates exercise cases relating to the Uniform Domain-Name Dispute-Resolution Policy and exemplary solutions. It creates a learner model on the basis of individual user performance in the exercises, and also aggregates these into group models. The models are then also used as "feedback" into the algorithm that generates the exercise cases, and made available to the rest of the system, making it possible to base peer recommendations and grouping decisions on them.

At a level more independent from the knowledge domain, the project has worked towards the **automatic identification of users' reading behaviour**, based on their interactions within hypermedia pages containing learning materials. We have developed an algorithm and an accompanying software library that enables the monitoring and interpretation of mouse and keyboard actions of the learner, to derive a highly accurate estimate of the amount of attention learners have devoted to specific elements of the learning content in web pages.

Another major breakthrough of the project relates to the **automatic identification of patterns in semantic representations of learner activity**. Using a custom representation of sequences of user activities, we have developed a novel clustering-based approach to isolate patterns of user behaviour within these sequences. These patterns can be either known and predefined, or discovered by the system along known learning dimensions. Even more importantly, this approach has been shown to be able to discover learning dimensions themselves.

Resource- and peer activity- awareness

ASCOLLA has contributed to the completion of the **adaptive search engine core "Prospector"** that can be used in any structured search domain (including, for example, a repository of learning materials with an ontology describing the learning content therein), in order to: (a) provide personalized results to users on the basis of their user model (created and updated as users search and peruse results), and (b) allow users to apply categorical bias on search terms, with each category being directly affected by a group model built on the basis of the individual models of other users interested in the same category.



The project has improved the previously developed **"Recent Activity"** component for the Sakai platform (originally developed by the FIM Institute), which provides an adaptive, personalized view of the recent activity of peers within a course- or group work- setting. The updated version employs a sophisticated approach, based on machine learning techniques, for identifying resources and actions upon them that may be of interest to individuals as well as colleagues.

Facilitation of group formation and ad-hoc collaboration

The project developed the Sakai component **"Questions"**, which can support three complementary learning scenaria. Firstly, when used during online lectures it enables learners to pose questions to the instructor; their peers can vote and comment on these questions, making the most important ones more prominent and of higher answering priority. Secondly, the tool can be used in a similar fashion to prepare discussion topics to be addressed in online discussions. Thirdly, it can be used by instructors to pose questions to groups of learners, who then provide their collective responses as a group.

Another Sakai component developed in ASCOLLA provides learners access to their personal, but also to a whole group's **"Learning History"**. This tool automatically generates an account of the most important activities a learner has undertaken within the learning environment. At a second level, the tool can automatically combine the personal learning histories into