Panta Rhei Case Study: Fall 2007

Christine Müller,
Computer Science, Jacobs University Bremen, Germany
c.mueller@jacobs-university.de

1 Motivation

With the increasing globalization and internationalization of university education, such as the distance education offered by the Open University [OU07], eLearning becomes more and more important. In addition, enterprises are demanding and developing eLearning solutions which are used to train new employees as well as to allow learners to create and publish learning content themselves. For us, eLearning is not limited to educational scenarios where students or employees approach new material. It rather also applies to scientists who want to learn about related research fields while facing a rapidly increasing amount of international publications. In all three scenarios, the learners need to understand the meaning and importance of concepts, procedures, or skills that they are required or want to learn, respectively. They can be supported by relating the respective learning concept to their experiences, interests, and previously learned concepts. It is also helpful to link the material to practical settings such as the use of learning units in their daily work. For example, the E.ON Academy [E.O07] has integrated their learning management system with running IT systems to embed the learning into business processes. Any information that helps learners to characterize the learning material as well as their current learning situation defines the *context* of the learning experience. The process of supporting learners in capturing this notion of context is henceforth referred to as *contextualization of learning*.

In particular, mathematical learning can be contextualized by providing examples and counter-examples in order to teach a theory. Alternatively, the *(logical) context* of a mathematical concept can be clarified by providing its interrelation to other concepts: For example, learners can more easily identify and learn new symbols if they know about the respective theory, which defines these symbols. Moreover, a section in the learning material may be described by its relations to other sections, such as prerequisite or subsequent sections.

We believe that mathematical online material needs to be enriched by semantic markup to allow for the automatic extraction of its meaning and structure. Based on the extracted metadata, services need to be implemented that contextualize the learning experience of the user. Benefiting from our large corpus of semantically annotated course material of the Knowledge Adaptation and Reasoning for Content (KWARC) Group [KWA07] at the Jacobs University Bremen [Jac07], we are in the fortunate position of not having to produce content. With `panta rhei` [Mül07a, Mül07b, Mül07c] we have now implemented the first system, which displays the semantically enriched course content. The following sections present the current features of the system as well as a summary of the first case study.

2 *panta rhei* - description.

The first case study with `panta rhei` is based on our General Computer Science lecture, in which `panta rhei` offers the students an additional opportunity to discuss their assignments and exams next to the face-2-face lecture and the tutorials. Instead of setting up an ordinary forum, `panta rhei` facilitates the annotation of semantically enriched course content. The students' annotations are stored in a forum-like structure, allowing students to reply and link between annotation postings. Moreover, the system integrates a rating option, allowing students to indicate which lecture material they like or find to hard and/ or where they would like to receive additional examples and exercises.

Figure 1: *panta rhei*: Screenshot of an assignment.

Semantically Enriched Course Content The slides are generated from a LaTeX-like source, namely sTeX [Koh05]: During an XSLT transformation the sTeX sources are transformed into the OMDoc (Open Mathematical Document) format [Koh06] and further into XHTML, while preserving the meaning and structure of content, which will later allow us to contextualize the online material. The respective metadata, such as the type of document fragments (e.g. example, definition, theory) or the references between fragments (e.g. an example "exemplifies" a definition), is currently stored in the system's database. In the future, we will also integrate RDFa [AB06] to annotate the respective XHTML fragments, which will make our course material accessable to other semantic web implementation. In addition, the XHTML is enriched by code snippets that provide entry points for Javascript-based annotations and ratings as well as CSS-based adaptation (see Figure 2). Moreover, the encoded narrative structure in the sTeX source is extracted and is used to create a navigation menu for the online material.

Course Annotations Assignments and slides can be annotated. In contrast to other web annotation approaches, students are not able to insert an annotation everywhere in the web material. Instead, relevant learning artifacts are highlighted in the online material (see Figure 2, left). This allows to direct the attention of students to specific objects and in addition raises the attention of users towards objects they might otherwise have had overlooked. Annotation can be typed as *answer*, *advice*, *change*, *comment*, *example*, *explanation*, *question*, or *news* (see Figure 2, right). The annotation are displayed next to the respective slides/ assignments they point to as well as in the respective section of the course forum (see Figure 1, right).

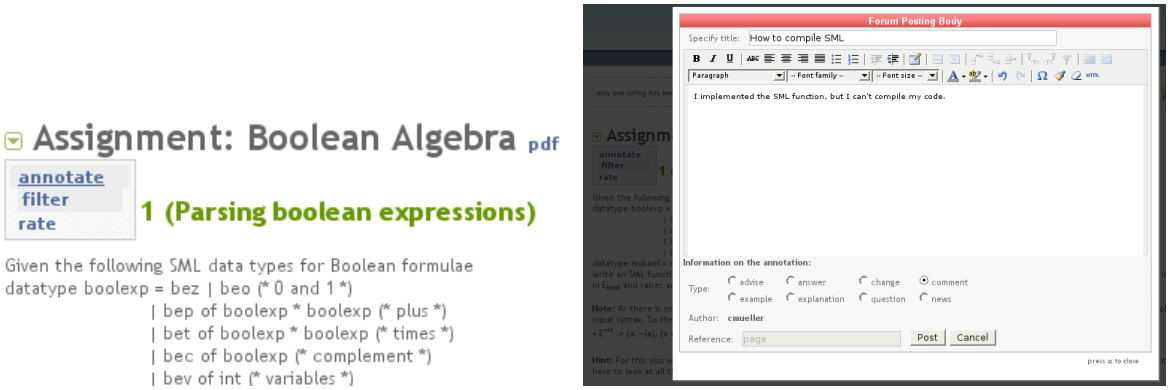

Figure 2: *panta rhei*'s annotations.

Course Forum In alternative to the moderated discussion of artifacts in the course, the forum enables students to freely post questions, comments, and news. The course forum is divided into *scopes* and *views*. Scopes refer to the type of material or object students post about. Currently, there are three scopes: slides, assignments, and news. Views are read-only and refer to the type of the postings. Currently there are 8 views which correspond to the annotation types above.

Figure 3: *panta rhei*: Screenshot of the forum.

Rating Users can rate artifacts in the course material. Depending on the type of the artifact (e.g. problem, example, definition), different rating dimension are displayed. The rating is currently only implemented for assignments, course modules, and sections.

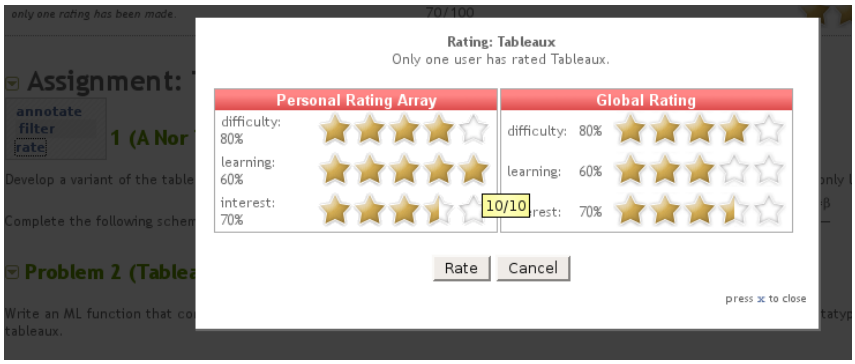

Figure 4: rating in *panta rhei*

3 Lessons Learned

The case study was carried out during the fall semester from September 1st 2007 to December 15th 2007:

By November 10th 2007, 70 students have been registered for the GenCS course: 68 students have signed up for the system, from which 27 posted in the forum. From 297 overall-postings, 136 have been created by the students and 158 by the 8 teaching assistants and the professor. Moreover, 30 postings were referencing slides and assignments, i.e. they have been created using *panta rhei*'s annotation feature. 46 postings were initialized in the *panta rhei* forum. 221 postings were replies. Students were also typing their postings with the available types: 13 advices, 51 answers, 14 changes, 34 comments, 1 example, 29 explanations, and 114 questions were posted. 5 threads were posted in the scope "slides", 45 threads in the scope "assignment" and 47 in the scope "news", where as the latter also subsumes postings from "slides" and "assignments" with the type: "news".

By the end of the case study, on December 15th 2007, 70 students have been registered for the GenCS course: All students have signed up for the system, from which 46 posted in the forum. From 508 overall-postings, 253 have been created by the students and 237 by the 8 teaching assistants and the professor. Moreover, 78 postings were referencing slides and assignments, i.e. they have been created using *panta rhei*'s annotation feature. 46 postings were initialized in the *panta rhei* forum. 384 postings were replies. Students were also typing their postings with the available types: 20 advices, 105 answers, 16 changes, 58 comments, 1 example, 36 explanations, and 212 questions were posted. 5 threads were posted in the scope "slides", 82 threads in the scope "assignment" and 69 in the scope "news", where as the latter also subsumes postings from "slides" and "assignments" with the type: "news".

The increase of postings at the end of the semester can be explained with the increasing difficulty of assignments as well as questions concerning the midterm and final exam. Moreover, the integration of the HTML editor TinyMCE [Tin07] as well as the eMail notification feature, tremendously increased the usability and acceptance of the system by our students. Looking at the statistics, students first primarily used the forum, but later also made us of the annotation feature. The rating feature of the slides was not used at all. Moreover, students mainly posted questions and answers, but also commented on the lecture material. Examples were not posted. The superior number of question is most likely a consequence of making "question" the default type. In particular, students were interested in discussing the assignments, only 5 forum threads were referencing the lecture notes. This can be explained by the rather poor quality of the automatically generated slides, which still needs to be improved. In consequence, although students prefer the online material (especially the menu and browsing), they are still referring to the PDFs to prepare for the exams. Currently the system is only tested for Firefox, however, a lot of first year students were using Internet Explorer which caused a lot of frustration in the first week. Moreover, the first javascript plugins were not running properly on all platforms.

4 Outlook

In the next semester, *panta rhei* will be extended with a sophisticated math editor, which facilitates students to enter math in a LaTeX like syntax. In addition, we are currently preparing the course material to be used in the mmlkit conversion [MMK07]. This will allow us to publish much more readable and consistent slides next semester and hopefully increase the students interaction with the online material. The latter will also be promoted by our work on an improved annotation and rating paradigm.

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6 References

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