ABSTRACT

We have developed courseware for UML/SysML modelling based on the needs of the European embedded/automotive industry. The courseware supports interactive modelling exercises. First evaluations show promising results.

Categories and Subject Descriptors
K.3.1 [Computers and Education]: Computer Uses in Education—Collaborative learning, Distance learning

General Terms
Design, Human Factors

1. NEEDS ANALYSIS

In the EC funded project embed4Auto (www.embed4auto.org), we are developing methods and tools to support lifelong learning for the embedded (automotive) industry. A survey on training needs and preferences showed that UML2, Requirements Engineering, and Software Architecture are the areas with the largest training needs [1]. The survey also showed preferences for blended self-directed learning with interactive feedback. Capabilities for collaborative learning were also ranked high.

Respondents expect that UML/SysML will be particularly useful to support the communication between engineers from different disciplines, the modelling requirements/use cases, and the modelling of software architectures. Little use is expected with respect to code generation and project management.

2. TOOLS

Based on the training needs and preferences described in the previous section, we have developed an integrated learning environment comprising three major components:

- **Content management.** Learning content is managed using a traditional Course Management System (Moodle, www.moodle.org).
- **Modelling tool.** UML diagrams can be interactively developed using StudentUML [3], which currently supports class diagrams, sequence diagrams and consistency checking of and between diagrams.
- **Collaboration platform.** PENCIL (Platform for Exercise sharing aNd Collaborative and Interactive Learning support) is used as integrative platform for sharing and discussing models developed using StudentUML.

3. EVALUATION

A first evaluation took place in all partner countries (Germany, Greece, Spain, Sweden, and Turkey) during the same two-week period with about 100 students and professionals. During the evaluation, we published several modelling problems that participants had to solve. The possibility to share and discuss solutions was well accepted. About half of the participants did actively participate in the discussions by sharing their solutions (class and sequence diagrams), commenting solutions by others, and by actually modifying and resubmitting shared solutions.

In a follow-up questionnaire with 42 participants, the learning environment was evaluated with respect to overall design, pedagogical design and user satisfaction [2], see Table 1 for a selection of results.

<table>
<thead>
<tr>
<th>Questionnaire item</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback from other users was helpful to my comprehension</td>
<td>39</td>
<td>3.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Feedback I wrote was helpful to my comprehension</td>
<td>34</td>
<td>4.0</td>
<td>0.7</td>
</tr>
<tr>
<td>I found the multiple choice questions more helpful to my comprehension</td>
<td>33</td>
<td>3.6</td>
<td>0.9</td>
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<tr>
<td>I found the problem solving exercises more helpful to my comprehension</td>
<td>36</td>
<td>4.1</td>
<td>0.8</td>
</tr>
</tbody>
</table>

4. ACKNOWLEDGEMENTS

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5. REFERENCES