An Approach for Detecting Learning Styles in Learning Management Systems

Sabine Graf
Vienna University of Technology
Austria
graf@wit.tuwien.ac.at

Kinshuk
Massey University
New Zealand
kinshuk@ieee.org
Motivation and Aim

- Learning Management Systems (LMS) are commonly used but they provide only little and in the most cases no adaptivity
- Learners have different needs
- Incorporating these needs increase the learning progress, leads to better performance, and makes learning easier
- Requirement for adaptivity: needs have to be known first
  - Comprehensive questionnaires
  - Identification from the behavior of students during a course

Aim:
Developed an approach that identifies learning styles according to the behavior of students in LMS
→ Identify patterns of behavior
→ Implemented a tool that extracts data from LMS database and calculates the learning styles
Felder-Silverman Learning Style Model

- Each learner has a preference on each of the four dimensions
- Dimensions:
  - Active – Reflective
    - learning by doing – learning by thinking things through
    - learning by discussing & group work – work alone
  - Sensing – Intuitive
    - concrete material – abstract material
    - more practical – more innovative and creative
    - patient / not patient with details
    - standard procedures – challenges
  - Visual – Verbal
    - learning from pictures – learning from words
  - Sequential – Global
    - learn in linear steps – learn in large leaps
    - good in using partial knowledge – need „big picture“
    - interested in details – interested in the overview
Patterns of Behavior

- Felder and Silverman describe how learners with specific preferences act in learning situations.
- Based on commonly used features in LMS such as content objects, forum, chat, self-assessment (SA), exercises, and examples.

<table>
<thead>
<tr>
<th>Active/Reflective</th>
<th>Sensing/Intuitive</th>
<th>Visual/Verbal</th>
<th>Sequential/Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visits_forum (act)</td>
<td>Correct_facts/concepts (sen)</td>
<td>Visits_forum (ver)</td>
<td>Correct_detail/overview (seq)</td>
</tr>
<tr>
<td>Postings_forum (act)</td>
<td>Revisions_marked tests (sen)</td>
<td>Postings_forum (ver)</td>
<td>Performance_marked tests (seq)</td>
</tr>
<tr>
<td>Visits_chat (act)</td>
<td>Revisions_SA tests (sen)</td>
<td>Visits_chat (ver)</td>
<td>Performance_SA tests (seq)</td>
</tr>
<tr>
<td>Postings_chat (act)</td>
<td>Duration_marked tests (sen)</td>
<td>Postings_chat (ver)</td>
<td>Visits_outline (glo)</td>
</tr>
<tr>
<td>Visits_exercise (act)</td>
<td>Duration_SA tests (sen)</td>
<td>Time_graphics (vis)</td>
<td>Time_outline (glo)</td>
</tr>
<tr>
<td>Time_exercises (act)</td>
<td>Visits_exercises (int)</td>
<td>Correct_graphics (vis)</td>
<td>Skips_learning objects (glo)</td>
</tr>
<tr>
<td>Time_examples (ref)</td>
<td>Time_exercises (int)</td>
<td></td>
<td>Visits_overview page (glo)</td>
</tr>
<tr>
<td>Time_content objects (ref)</td>
<td>Visits_SA tests (sen)</td>
<td></td>
<td>Time_overview page (glo)</td>
</tr>
<tr>
<td></td>
<td>Visits_examples (sen)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time_examples (sen)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tool Architecture

- Tool can be applied for LMS in general
  - Each LMS has a different database schema
  - Maybe not all features are used or data for patterns can be tracked

- Architecture:
Global schema

- Top-down approach: required information (patterns) act as basis
- Each table includes data representing one pattern
- Extraction should be as simple as possible
  → use event-based way in which data are stored in LMS
- Cumulation of data is done automatically
Calculation Component

- Calculate ordered data from raw data
  e.g. User 1: 94 % time spend → high → sensing → +1
  - determine thresholds based on values from literature
  - 3-item scale (+1, 0, -1)
  - provide recommendation and teachers can change thresholds

- Calculate learning styles from ordered data
  - Based on approach of questionnaire (ILS)
  - Summing up the values relevant for the dimension
  - Result is converted to 3-item scale (e.g. sensing – balanced – intuitive)
Conclusion and Future Work

- Developed an approach and implemented a tool for identifying learning style based on the behavior of students in LMS
  - Identified general patterns of behavior
  - Developed a tool that extracted required data from LMS database and calculated learning styles

- Future work
  - Evaluate the tool (comparing results of the tool with results of ILS)
  - Improve calculation approach (AI approach)