A Flexible Mechanism for Providing Adaptivity Based on Learning Styles in Learning Management Systems

Sabine Graf, Kinshuk, and Cindy Ives
Athabasca University
Canada
Why learning styles?

Why shall we consider learning styles in technology enhanced learning?

- Complex and partially inconsistent field
- Learners have different ways in which they prefer to learn
- If those preferences are not supported, learners can have difficulties in learning
- Previous studies showed that providing learners with course that fit their learning styles has potential to help learners in learning
Felder-Silverman Learning Style Model

Each learner has a preference on each of the dimensions

Dimensions:

- Active – Reflective
  - learning by doing – learning by thinking things through
  - 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“
Felder-Silverman Learning Style Model

- Scales of the dimensions:

  - Active: +11, +9, +7, +5, +3, +1, -1, -3, -5, -7, -9, -11
  - Reflective: +11, +9, +7, +5, +3, +1, -1, -3, -5, -7, -9, -11

  → Strong preference but no support → problems

- Differences to other learning style models:
  - Describes learning style in more detail
  - Represents also balanced preferences
  - Describes tendencies
  - Domain-independent
  - Flexible stable
Why learning management systems?

- Why shall we consider learning styles in learning management systems (LMSs)?
  - LMSs are commonly used
  - LMSs typically do not provide adaptivity for learners and deliver the same course for all learners
Aim of Research

- Extend LMSs so that they can automatically generate courses that fit students’ learning styles
- Make our approach applicable for LMSs in general
- Ask teachers for as little as possible additional effort
Previous Research

- Adaptive mechanism has been designed, implemented in Moodle and successfully evaluated with more than 500 students.

- Adaptive mechanism was based on predefined course structure and 6 types of learning objects (Content, Outlines, Conclusions, Self-assessment tests, Examples, Exercises).

→ Works well for courses with practical focus but does not work well for courses with theoretical focus.
How to make the mechanism more flexible?

- **Requirements**
  - Generic and work for different LMSs
  - Require from teachers as little as possible additional work
  - Restrict teachers as little as possible in their course design

- **Solutions**
  - Use only types of LOs that are available in most LMSs
  - Only ask teachers to annotate LO with the type once they create them
  - Use a course structure that allows many different types of LOs but does not require each type of LO to be available in each chapter/section
Considered types of learning objects

- Commentaries
- Content Objects
- Reflection Quizzes
- Self-Assessment Tests
- Discussion Forum Activities
- Additional Reading Material
- Animations
- Exercises
- Examples
- Real-Life Applications
- Conclusions
- Assignments

- Teachers can add many different types of LOs in their courses
- Teachers can add types of LOs wherever they feel they fit (as they usually do in LMSs)
- Teachers does not have to add types of LOs
- However, the more LOs are available in the course, the more adaptivity can be provided
How to provide adaptivity?

- **Adaptive Annotation**
  - Distinguishing between recommended and standard learning objects

- **Adaptive Sequencing**
  - Changing the sequence in which types of learning objects are presented
Structure of a course

Chapter 1:

Commentary

Few LOs that raise a student’s interest [0..2 types of LO]*
  Self-assessment tests, animations, exercises, examples, or real-life applications

Content

Conclusion [0..1]

Remaining LOs*
  Self-assessment tests, animations, exercises, examples, real-life applications, additional reading material, reflection quizzes, and forum activities

Conclusion [0..1]

Assignments

Chapter 2:

...

*Sequence of LOs is based on how well the types of LO fit to the student’s learning styles
Adaptivity in LMSs
Extensions of the LMS architecture

- Detecting students’ information (Extension 1)
- Presenting adaptive courses (Extension 3)
- Annotating learning objects (Extension 2)
Conclusions & Future Work

- Introduced an adaptive mechanism that enables LMSs to automatically generate courses that fit students’ learning styles
- Aimed at asking teachers for as little as possible additional effort
- Aimed at restricting teachers as little as possible in their course design
- Future work
  - Developing a tool that allows teachers to add additional types of LOs
  - Automatic and dynamic student modelling
  - Evaluation of our concept