

Providing Adaptive Courses in Learning Management Systems with Respect to Learning Styles

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Why shall we consider learning styles in LMS?

- Learning Management Systems (LMS) are commonly used in e-education but they provide the same course for all learners
- Learners have different needs
- According to literature, adaptivity has potential to facilitate learning

- Two different approaches to provide adaptivity
 - Provide courses that fit to the preferred learning styles
 - Aims at short term goal:
Makes learning easier and increases the progress
 - Provides courses that do not fit to the learners' preferred styles
 - Aims at long term goal:
challenging learners and encouraging them to train
learning according to their weak preferences provides
them with important life skills

- Adaptive systems aim at providing adaptivity
 - AHA!
 - TANGOW
 - INSPIRE
 - ...

- Limitations
 - are either developed for specific content (e.g. accounting) or for specific features (e.g. adaptive quizzes)
 - content cannot be reused
 - are not often used

- Learning Management Systems (e.g., Moodle, Blackboard, WebCT, ...) are developed to support authors/teachers to create courses
 - provide a lot of different features
 - domain-independent
 - content can be reused in other LMS
 - are often used in e-education
 - provide only little or in most cases no adaptivity

How to provide adaptivity with respect to learning style in LMS?

- Develop a concept that enables LMS to automatically generate course that fit to the students' learning styles
- Implement the concept as an add-on to Moodle
- Evaluate the concept by a study with 473 students

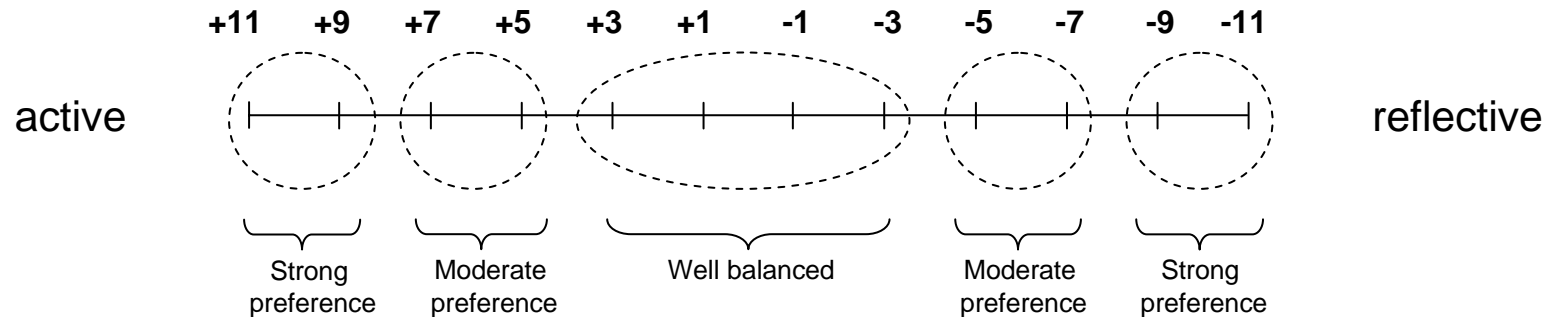
General aims:

- Combine the advantages of LMS with the ones from adaptive systems through enriching LMS with adaptivity
- Provide a concept for LMS in general
- Teachers should have as little as possible additional effort

- 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“
serial – holistic



■ Scales of the dimensions:



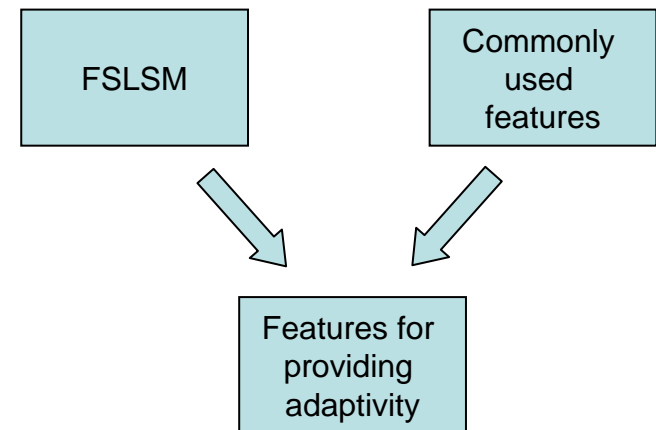
→ Strong preference but no support → problems

■ Differences to other learning style models:

- describes learning style in more detail
- represents also balanced preferences
- describes tendencies

How to provide adaptivity?

- Develop a concept which enables LMS to automatically generate adaptive courses
- Incorporates only common kinds of learning objects
 - Content
 - Outlines
 - Conclusions
 - Examples
 - Self-assessment tests
 - Exercises
- Requirements for teachers
 - Provide learning objects
 - Annotate learning objects (distinguish between the objects)



Chapter 1:

Examples

Self-assessment

Exercises

Outline

Content with/without outlines between subchapters

Conclusion

Examples

Self-assessment

Exercises

Conclusion

Chapter 2:

...

- Number of examples
- Number of exercises
- Sequence of examples (before or after content)
- Sequence of exercises (before or after content)
- Sequence of self-assessments (before or after content)
- Sequence of outlines (only once before content or between content)
- Sequence of conclusion (after content or at the end of the chapter)

■ Active learners

- Self-assessments before and after content
- High number of exercises
- Low number of examples
- Outline only at the begin of content
- Conclusions at the end of the chapter

■ Reflective learners

- Outlines between content
- Conclusion after content
- Avoid self-assessments before content
- Examples after content
- Exercises after content
- Low number of exercises

■ Sensing learners

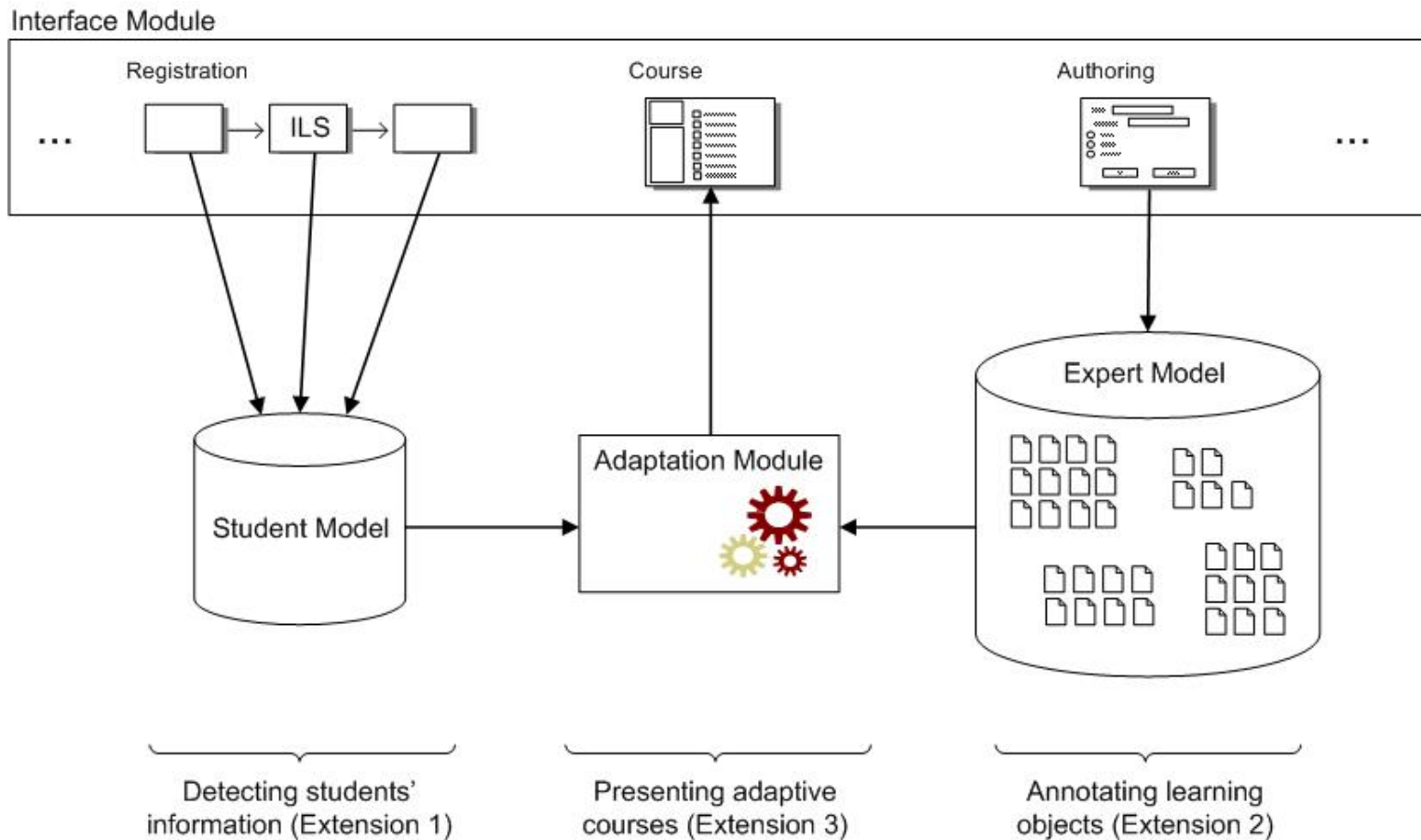
- High number of examples
- Examples before content
- Self-assessment after content
- High number of exercises
- Exercises after content

■ Intuitive learners

- Self-assessment before content
- Exercises before content
- Low number of exercises
- Low number of examples
- Examples after content
- Outlines only at the begin of content

- Sequential learners
 - Outlines only at the begin of content
 - Examples after content
 - Self-assessment after content
 - Exercises after content
- Global learners
 - Outlines between content
 - Conclusion after content
 - High number of examples
 - Avoid self-assessment before content
 - Avoid examples before content
 - Avoid exercises before content

General Concept for Providing Adaptivity in LMS



- Table which gives information about how the adaptation features can support each learning style preference
 - +1 ... supports the learning style
 - 0 ... does not have an effect on the learning style
 - -1 ... should be avoided in order to support the learning style
- Values are weighted with the strength of the learning style preference
 - 2 ... strong preference (values between +11 to +9 or -11 to -9)
 - 1 ... moderate preference (values between +7 to +5 or -7 to -5)
 - 0 ... balanced preference (values between +3 to -3)

- Values of all learning style preferences are summed up
- Results shows how the adaptation feature should be applied for each learner
- Advantage
 - Adaptive courses are constructed based on adaptation features
 - New adaptation features can be added easily
 - Considering ambiguous preferences

- Active/Reflective = +11 → strong active style
- Sensing/Intuitive = -11 → strong intuitive style
- Sequential/Global = -5 → moderate global style

- Number of Exercises
 - Active → high number ($+1 * 2 = 2$)
 - Intuitive → low number ($-1 * 2 = -2$)
 - Global → no preference ($0 * 1 = 0$)

→ Sum = 0

- Moderate number of exercises

- University course about object oriented modelling with 437 students
- Procedure:
 - Students filled out the ILS questionnaire
 - Individual course was automatically generated according to their learning styles
 - Moodle presented the adapted course (as recommendation) to each student
 - Students were nevertheless able to access all learning objects and take a different learning path

Does adaptivity have an effect on learning?

■ Research design

- Three groups:
 - Courses that fits to the students' learning styles (matched group)
 - Courses that do not fit to the students' learning styles (mismatched group)
 - Standard course which includes all learning objects (standard group)

- Requirements for data
 - Students have to take more than 5 minutes to fill out the ILS questionnaire
 - Students need to submit at least 3 assignments (which was a requirement for a positive mark)
- Applied group comparison (t-test and U-test) in order to find significant differences between the groups

■ Results:

- Average score on assignments & score on final exam
 - no significant difference
 - Time spent on learning activities
 - Standard (5h 34 min) > Matched (3h 47min)
 - Mismatched (5h 33min) > Matched (3h 47min)
 - Number of logins
 - Standard (32 logins) > Matched (28 logins)
 - Number of visited learning activities
 - no significant difference
 - Number of requests for additional LOs
 - Mismatched (36 requests) > Matched (24 requests)
- Students from the matched group spent significant less time in the course but achieved in average equal grades
- Demonstrates positive effect of adaptivity

- Developed, implemented, and evaluated a concept for enabling LMS to automatically generate adaptive courses that fit to the learning style of students
- Enhancing LMS with adaptivity allows teachers to continue holding their courses in LMS and provide students with adaptivity
- The conducted study shows that our add-on helped students to learn more effectively and therefore facilitates learning
- Future work deals with a more generic adaptation mechanism, allowing teachers to add also other types of learning objects

Questions



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