

An Approach for Dynamic Student Modelling of Learning Styles

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Why modelling students' learning styles?

- Benefits of knowing students' learning styles:
 - Make students aware of their learning styles
 - Make teachers aware of their students' learning styles
 - Basis for providing adaptivity based on learning styles

Types of Student Modelling

- Collaborative vs. Automatic
 - Collaborative: asking students directly for feedback
 - Automatic: inferring students' characteristics from their behaviour and actions
- Static vs. Dynamic
 - Static: once from a particular amount of data
 - Dynamic: frequently updating the student model based on new data

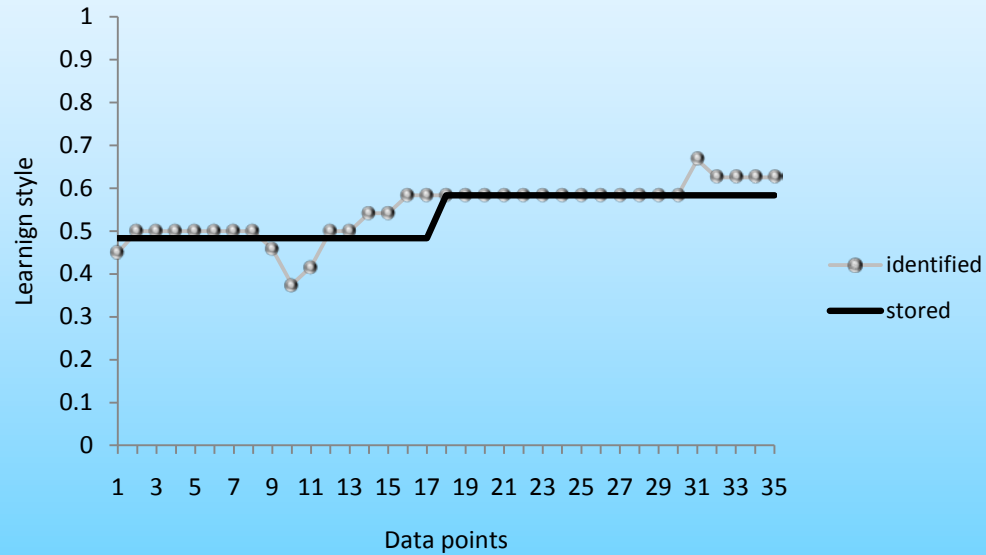
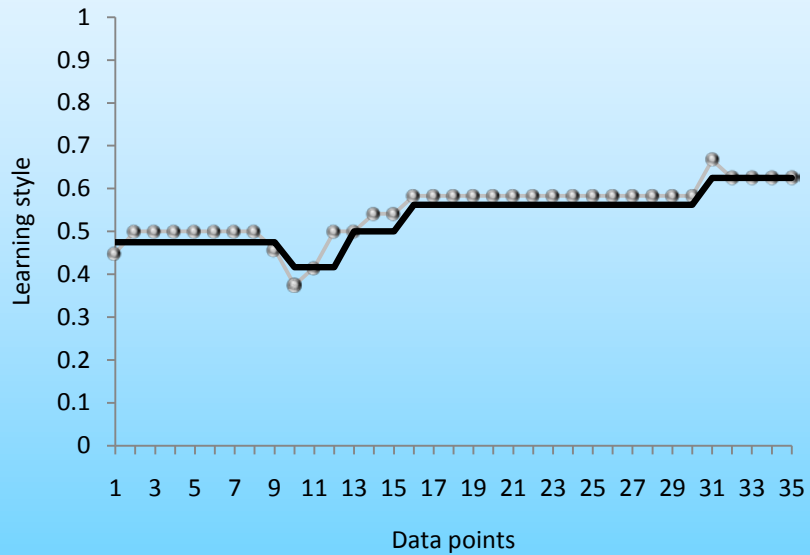
Aim of Research

- Recent research deals with automatic & static student modelling of learning styles (e.g., Cha et al. 2006, Garcia et al. 2007, Graf et al. 2008)
- Focus of this paper is on automatic & dynamic student modelling of learning styles
- Concept is based on the Felder-Silverman learning styles model but can also be applied for other learning style models with similar structure after few revisions

Concept for Dynamic Student Modelling

- We assume that certain amount of data is available (in the beginning very few) and that data are frequently added
- A main issue is to frequently check whether the new information about students' behaviour hints for revising the information stored in the student model
- Two objectives:
 - The currently stored learning style should reflect the current learning style of students as good as possible → updating as soon as a revision can be done
 - Considering deviations of students' behaviour and having as less as possible revisions which are then taken back shortly afterwards

More graphically ...



Concept for Dynamic Student Modelling

- Step 1: Learning styles (data points d_t) have to be calculated based on students' behaviour in the course at particular points of time t
- Step 2: In order to consider deviations in students' behaviour, the calculation of the current learning style is based on the means of the last A data points. However, one single data point should not have enough influence to force a revision

Concept for Dynamic Student Modelling

- Step 3: Make decision on whether the currently stored learning style should be revised
 - Difference between stored learning style and average learning style from current and past data
 - Difference between currently identified learning style (d_t) and previously identified learning style (d_{t-1})
 - Compare difference between previously identified learning style (d_{t-1}) and stored learning style as well as the difference between currently identified learning styles (d_t) and stored learning style

$$\text{If } \left| L_s - \frac{\sum_{i=t-A+1}^t d_i}{A} \right| \geq x \text{ AND } |d_t - d_{t-1}| < 2x \text{ AND NOT } \left[|d_{t-1} - L_s| - |d_t - L_s| > \frac{x}{2} \right] \text{ THEN } L_s = \frac{\sum_{i=t-A+1}^t d_i}{A}$$

Verification of the Approach

- Using data from 75 students from a course about object oriented modelling at a university in Austria
- 1. Experiment: What is the best parameter setting?

		Amount of data points included in the calculation process of learning styles (A)			
		2	3	4	5
Accepted difference bet. calculated and stored learning styles (x)	1/22	0.521	0.563	0.588	0.602
	1/11	0.640	0.656	0.645	0.617
	2/11	0.615	0.584	0.558	0.532

Verification of the Approach

2. Experiment: Verification of composition of the formula for deciding whether a revision is necessary (Are all three conditions necessary?)

	$x=1/11, A=3$
only first condition	0.646
first two conditions	0.642
all three conditions	0.656

Conclusions and Future Work

- Developed a concept for automatic & dynamic student modelling of learning styles that revises the learning styles stored in the student model frequently
- Revisions are necessary, when learning styles change and if dynamic student modelling is used for improving and fine-tuning the information in the student model
- Verified the concept with data from a course with 75 students
- Future work:
 - Implementing the concept in an adaptive learning system