Investigations about the Effects and Effectiveness of Adaptivity for Students with different Learning Styles

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Learning Styles

- Many learning style models exist in literature
- Considering learning styles in education has potential to make learning easier
  - Argued by educational theorists
  - Based on these arguments, several adaptive learning systems have been developed
  - Several evaluations of these systems has been conducted
  - Some results confirm that adaptivity can help students in learning, others do not

Aim of our Research

- Most evaluations check whether considering learning styles in online courses helps students in learning or not
- Our evaluation investigates the effects and effectiveness of adaptivity for students with different learning styles
  - Does students with different learning styles benefit from adaptivity in different ways?
    - → Effects of adaptivity for students with different learning styles
  - Which students can be supported more effectively by using adaptivity comparing their learning styles?
    - → Effectiveness of adaptivity comparing different learning styles

A Concept for Providing Adaptivity

- This study is based on and uses data from a project about adaptivity in learning management systems
- Moodle has been used as prototype for the developed adaptive mechanism
- Felder-Silverman learning styles model has been used to describe learning styles

Felder-Silverman learning style model

- Each learner has a preference on each of the dimensions
- Dimensions:
  - Active – Reflective
  - Sensing – Intuitive
  - Visual – Verbal
  - Sequential – Global

- Differences to other learning style models:
  - Combines major learning style models
  - New way of combining and describing learning styles
  - Describes tendencies
  - Describes learning style in more detail

Adaptive Mechanism

- Main aim was to keep the effort of authors/teachers as little as possible

  → excluded visual/verbal dimension
- Incorporates only common kinds of learning objects
  - Content
  - Outlines
  - Conclusions
  - Examples
  - Self-assessment tests
  - Exercises

Adaptive Mechanism

- Adaptivity is provided on a general basis
- Adaptive features include
  - Changing the number of types of LOs
  - Changing the sequence of types of LOs
- Adaptive courses were recommendations, students could access all LOs and go through them in whatever sequence they preferred

Study Design

- Course about object oriented modelling
- Lecture and practical part where students had to submit 5 assignments
- Randomly assigned to 2 groups:
  - Courses that fit to the students' learning styles (matched group) [75 students]
  - Courses that do not fit to the students' learning styles (mismatched group) [72 students]
- Procedure
  - Students filled out the ILS questionnaire
  - Adaptive course was automatically generated and presented

Effects of Adaptivity

- Comparing data from matched and mismatched course with respect to learning styles and behaviour/performance variables (using ANOVA)
- Learning Styles:
  - Two groups for each dimension (e.g., active and reflective)
- Performance
  - Scores of final exam
- Behaviour
  - Time spent on learning activities
  - Number of logins
  - Number of visited learning activities
  - Number of requests for additional LOs

Effects of Adaptivity - Results

		active	reflective	sensing	intuitive	sequential	global
final_exam	F	2.276	0.451	3.613	0.174	0.793	0.937
	p	0.136	0.504	0.06	0.678	0.376	0.336
time	F	**7.888 ***	3.856	1.754	0.339	**4.271 ***	0.038
	p	**0.006**	0.054	0.189	0.563	**0.043**	0.846
numlogin	F	3.937	0.11	1.28	0.012	1.356	0.014
	p	0.052	0.741	0.262	0.915	0.249	0.906
numLO	F	1.54	**4.639 ***	**4.084 ***	0.509	2.173	0.29
	p	0.219	**0.035**	**0.047**	0.479	0.145	0.592
numALO_p	F	1.486	**4.531 ***	**4.442 ***	1.668	0.867	**5.741 ***
	p	0.227	**0.037**	**0.038**	0.202	0.41	**0.019**

Means:
Matched: 4.45 h
Mism.: 6.29 h

Means:
Matched: 624.73
Mism.: 433.83

Means:
Matched: 413.33
Mism.: 545.17

Means:
Matched: 6.25%
Mism.: 8.99%

Means:
Matched: 3.81 h
Mism.: 6.00 h

Means:
Matched: 5.46%
Mism.: 7.91%

Means:
Matched: 6.07%
Mism.: 8.27%

Effectiveness of Adaptivity

- Which students can be supported more effectively by using adaptivity comparing their learning styles?

- Looking only at data from matched course and comparing the students‘ performance and behaviour with respect to their learning styles

Effectiveness of Adaptivity

		act/ref	sen/int	seq/glo
final_exam	F	**8.862 ***	**5.127 ***	0.490
	p	**0.004**	**0.027**	0.486
time	F	**8.063 ***	0.018	0.180
	p	**0.006**	0.893	0.672
numlogin	F	**4.586 ***	3.866	2.806
	p	**0.036**	0.054	0.099
numLO	F	**6.635 ***	1.370	0.003
	p	**0.012**	0.246	0.953
numALO_p	F	2.649	0.131	0.055
	p	0.108	0.718	0.816

Means:
Act.: 166.07 points
Ref.: 184.37 points

Means:
Sen.: 169.98 points
Int.: 185.43 points

Means:
Act.: 3.81 h
Ref.: 6.68 h

Means:
Act.: 27.24
Ref.: 31.08

Means:
Act.: 415.21
Ref.: 624.73

Conclusions

- Adaptivity based on learning styles can help students in learning
- Adaptivity has different effects for learners with different learning styles
- Findings give a deeper insight in the effects and effectiveness of adaptivity
- Findings show that for some learning styles adaptivity works better than for others, in terms of encouraging them to use the course more intensively and/or letting them achieve better scores.

Future Work

- Investigating interactions of the three learning style dimensions
- Investigating whether combinations of learning styles exists which have more impact on supporting learners
- How generic are our results
  - Do they show only possible benefits of adaptivity depending on the concept used for providing adaptivity?
  - Does results appear in general when adaptivity is provided?