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FACULTY OF SCIENCE & TECHNOLOGY
School of Computing & Information Systems

Enhanced Learning and Teaching Support through Adaptive and Intelligent Systems

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Adaptivity and Personalization in Learning Systems

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How can we make learning systems more adaptive, intelligent and personalized

- In different settings such as desktop-based, mobile and ubiquitous settings
- Based on a rich student model that combines learner information and context information
- Supporting learners as well as teachers
- Using techniques from artificial intelligence, data mining, visualization, etc.
- Develop approaches, add-ons and mechanisms that extend existing learning systems

Research Topics

- Adaptivity based on learning styles
  - Automatic and dynamic identification of learning styles based on students' behaviour [Charles Jason Bernard]
  - Adaptive course provision based on learning styles [Collaboration with Leibniz University Hannover, Alberta Distance Learning Centre; Ting-Wen Chang, Jeff Kurcz]
  - Adaptive recommendations for teachers to make their courses better support students with different learning styles [Moushir El-Bishouty]

Research Topics

- Adaptivity based on cognitive abilities
  - Automatic and dynamic identification of cognitive abilities based on students' behaviour in an online course [Charles Jason Bernard]
  - Providing teachers with recommendations about how to consider students' cognitive abilities [Ting-Wen Chang]
  - Adaptive course provision based on students' cognitive abilities [Ting-Wen Chang, Jeff Kurcz]

Research Topics

- Adaptivity based on motivation [Paul Maguire]
  - Integrating techniques for motivating students in learning systems
  - Investigating effectiveness of motivational techniques for students with different characteristics, situations and contexts
  - Providing adaptive functionality for motivating students

Research Topics

- Adaptivity based on students' context
  - Identification of students' context through sensor technology [Dan Jovicic, Richard Tortorella]
  - Identification of device functionalities and their usage [Renan Lima, Moushir El-Bishouty]
  - Providing adaptivity based on students' context [Dan Jovicic, Richard Tortorella]

Research Topics

- Combining adaptivity based on students' context with adaptivity based on students' characteristics
  - Providing adaptivity based on learning styles and context information for mobile devices [Richard Tortorella]
  - Combine students' characteristics, context, and learning behaviour [Hazra Imran, Mohammad Belghis-Zadeh]
  - Providing adaptive recommendations based on pedagogical rules, student's history, and collaborative filtering [Hazra Imran, Mohammad Belghis-Zadeh]
  - Provide visualization of identified data

Research Topics

- Learning Analytics
  - Identification of at-risk students
    - What features are relevant for at-risk student identification and how to use them for at-risk identification [Darin Hobbs, Júlia Marques Carvalho da Silva]
    - Learning styles vs. course content support [Moushir El-Bishouty]
  - Enhancing the Accessibility of Educational Log Data for Investigating Effective Course Design and Teaching Strategies [Jeremie Seanosky, Harza Imran]

Adaptive and Personalized Learning based on Students' Learning Styles

[Ting-Wen Chang, Jeff Kurcz]

Adaptive Course Provision based on Learning Styles

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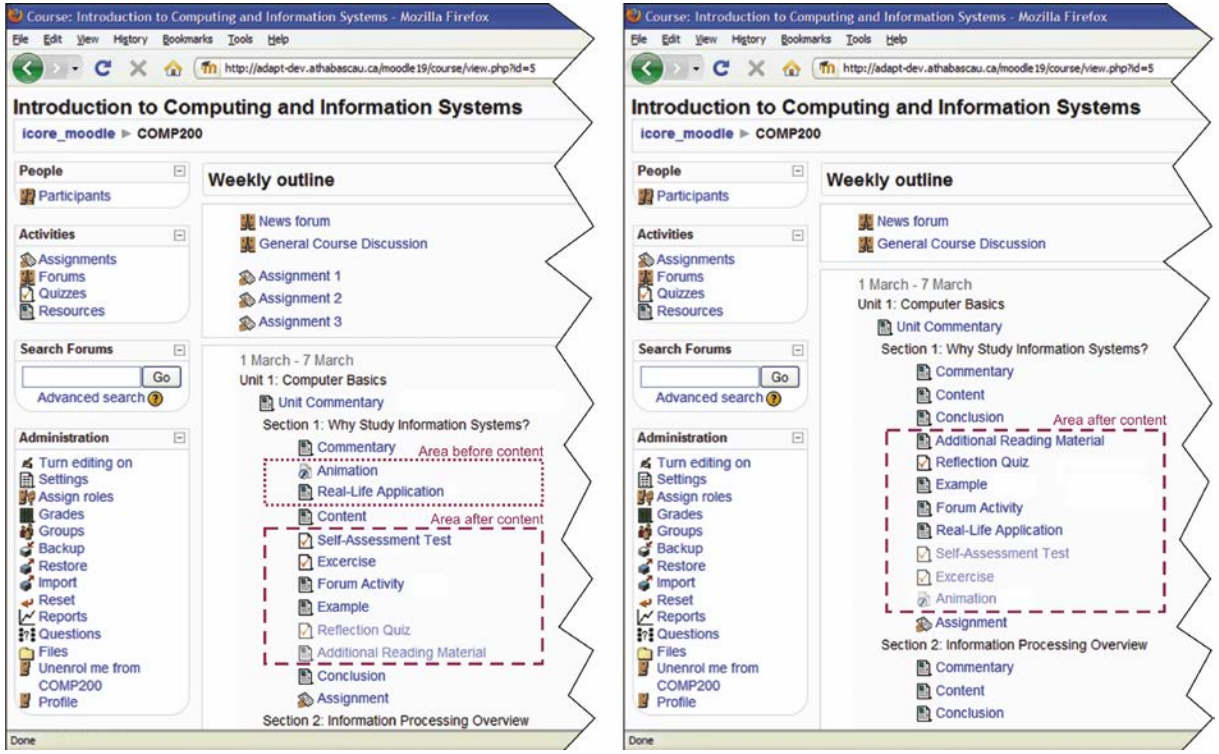
- Develop a mechanism that enables learning systems to automatically generate adaptive courses

- General goals:
  - Mechanism should be applicable for different learning systems
  - Mechanism should ask teachers for as little as possible additional effort

- Benefits:
  - Teachers can continue using their courses in existing learning systems
  - Students get personalized support with respect to their learning styles

Demo

Demo ...


Course: Introduction to Computing and Information Systems - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://adapt-dev.athabascau.ca/moodle19/course/view.php?id=5
Introduction to Computing and Information Systems
icore_moodle ▶ COMP200
People
Participants
Activities
Assignments
Forums
Quizzes
Resources
Search Forums
Go
Advanced search
Administration
Turn editing on
Settings
Assign roles
Grades
Groups
Backup
Restore
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Reset
Reports
Questions
Files
Unenrol me from COMP200
Profile
Weekly outline
News forum
General Course Discussion
Assignment 1
Assignment 2
Assignment 3
1 March - 7 March
Unit 1: Computer Basics
Unit Commentary
Section 1: Why Study Information Systems?
Commentary
Area before content
Animation
Real-Life Application
Content
Area after content
Self-Assessment Test
Excercise
Forum Activity
Example
Reflection Quiz
Additional Reading Material
Conclusion
Assignment
Section 2: Information Processing Overview
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Adaptive and Personalized Learning based on Students' Working Memory Capacity

[Ting-Wen Chang, Jeff Kurcz]

Why Working Memory Capacity?

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- There are several cognitive traits/abilities that are highly relevant for learning (e.g., working memory capacity, inductive reasoning ability, associate learning skills, information processing speed, etc.)
- Working memory capacity (WMC) is a very important trait for learning
- WMC enables humans to keep active a limited amount of information for a very brief period of time.
- Miller (1956) found that people can remember 7+/-2 chunks of information.
- Learners with high WMC can remember almost double the amount of information than learners with low WMC

Automatic Recommendations based on Students' Cognitive Abilities

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- However, typically learning systems do not consider this individual differences in WMC
- Research aim
  - Provide students with automatic recommendations to individually support their learning based on their WMC
- Adaptive mechanism
  - What recommendation shall the system show?
  - When shall the system provide a recommendation?
  - Which recommendation should be provided?
  - Do students follow recommendations?

What recommendations?

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No.	Asking the student to
R1	**take notes** when he/she learns a learning object
R2	**request help** if he/she have any question by posting or asking teachers about this learning object
R3	**post the ideas**, thought, or reflection about what he/she learnt in this learning object
R4	**summarize** what he/she learnt about this learning object
R5	**rehearsal by revisiting** the content of this learning object
R6	**use concept / mind maps** to easier remember content of this learning object

When to show a recommendation?

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- Show recommendation either before or after a learning object has been viewed
- Two methods for deciding on when to show a recommendation
  - Time-based (how much time has a student spent on a learning object)
  - Probability-based (based on students' WMC)

When to show a recommendation?

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No.	Asking the student to	When (before / after learning)	Method
R1	**take notes** when he/she learns a learning object	before	probability-based
R2	**request help** if he/she have any question by posting or asking teachers about this learning object	after	probability-based time-based
R3	**post the ideas**, thought, or reflection about what he/she learnt in this learning object	after	probability-based
R4	**summarize** what he/she learnt about this learning object	after	probability-based time-based
R5	**rehearsal by revisiting** the content of this learning object	after	time-based
R6	**use concept / mind maps** to easier remember content of this learning object	after	probability-based

When to present which recommendations?

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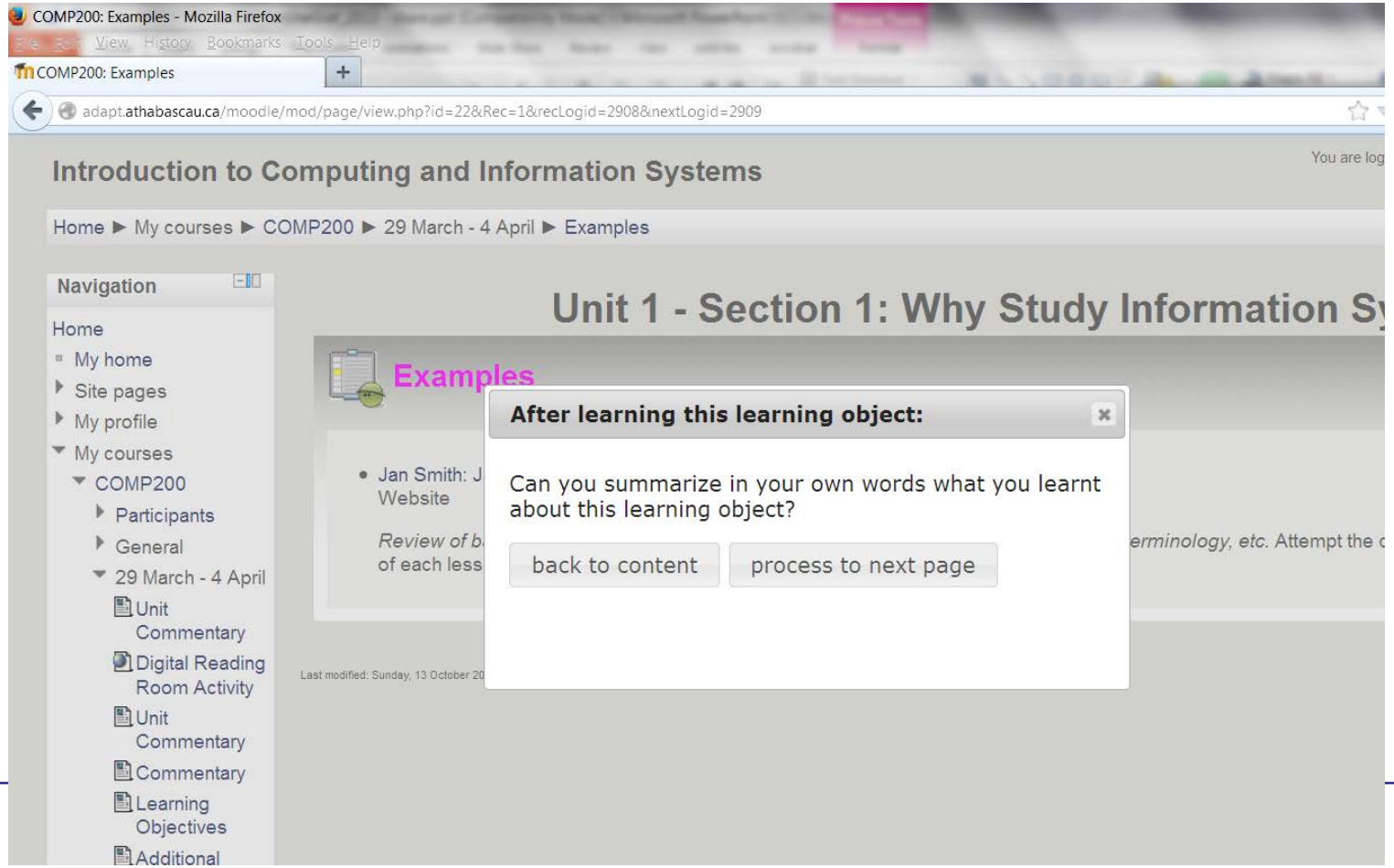
- For each type of learning object, it has been determined whether a recommendation makes sense or not
- For each type of learning object, recommendations are ranked based on how well they fit for a learning object
- Consider whether time-based or probability-based method is activated
- Consider whether a recommendation has been followed or not

Demo

Demo …


COMP200: Examples - Mozilla Firefox
COMP200: Examples
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Introduction to Computing and Information Systems
Home ► My courses ► COMP200 ► 29 March - 4 April ► Examples
Navigation
Home
My home
Site pages
My profile
My courses
COMP200
Participants
General
29 March - 4 April
Unit Commentary
Digital Reading Room Activity
Unit Commentary
Commentary
Learning Objectives
Additional
Unit 1 - Section 1: Why Study Information Sy
Examples
After learning this learning object:
Can you summarize in your own words what you learnt about this learning object?
back to content
process to next page

Academic Analytics

Enhancing the Accessibility of Educational Log Data

[Jeremie Seanosky, Harza Imran]

Academic Analytics

- What is academic analytics?
  - Analysis of data to support educational institutions, including faculty/teachers, learning designers, decision makers, etc.
  - Institution-wide and cross-course/cross-department analysis
  - Includes research related to
    - Effectiveness of teaching strategies
    - Effectiveness of course designs
    - Teacher Dashboards
    - Retention and at-risk identification
    - ...

Academic Analytics Tool (AAT)

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- In online education, educators and learning designers typically don't get much feedback on whether or not their teaching strategies and course designs are successful/helpful for students.
- Learning Management Systems (LMSs) generate a lot of data
- But learning designers and educators don't have skills to use these data (e.g.: SQL)

General Aim of Research

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How to provide support for users without computer science background to access complex LMS data?

General aim:

- Design, develop and evaluate a tool that provides users with easy access to complex educational log data
- Allow users to ask “questions” to the data
- Allow users to start with easy queries and then build upon them
- Work for different LMS
- Facilitate teachers’ learning about their teaching strategies and course designers’ learning about their learning designs

Procedure

Building a profile

- Select a learning system to connect to
- Create/Select a data set (courses)
- Create/Select a patterns (queries)

Demo

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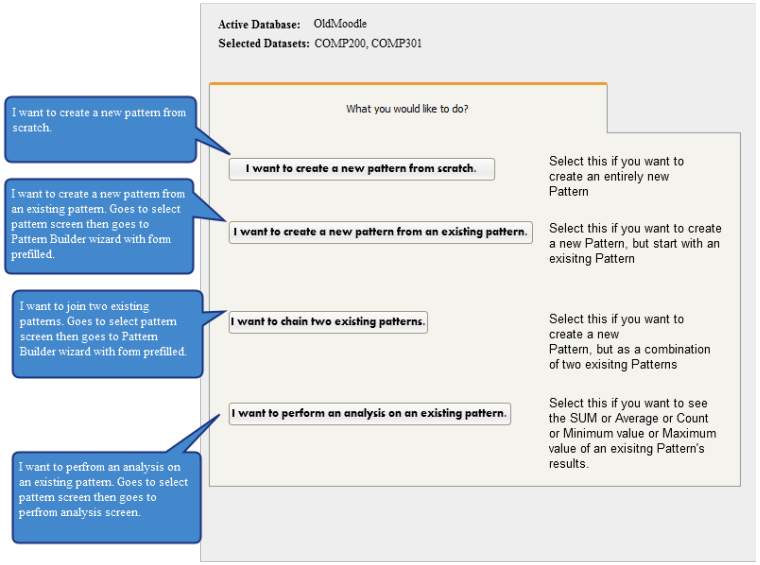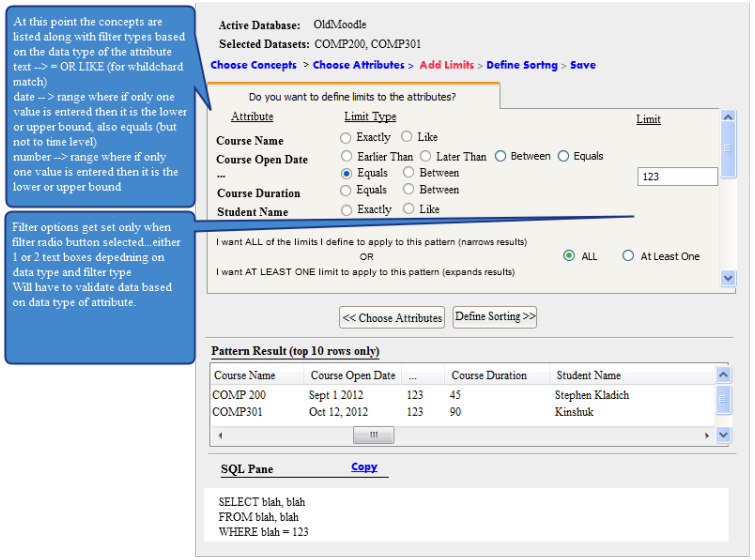
Demo ...