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Extending the AAT Tool with a user-friendly and powerful mechanism to retrieve complex information from educational log data

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Motivation

- 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

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

Our research is based on Academic Analytics Tool (AAT), a browser-based application that can access and report on the data generated by any LMS

AAT Overview

- Aim is to allow users (e.g., learning designers, teachers) to
  - **extract** detailed information about how students interact with and learn from online course in a learning system,
  - to **analyse** the extracted data, and
  - to **store** the results
- Allow users to decide and specify **what data they are interested in** (rather than choosing only from pre-defined information)
- Designed for **analytics in educational institutions** and therefore aims at flexibility with respect to the choice of course (rather than focussing only on one single course)
- Applicable for **different learning systems** and different versions of learning systems (not only one particular learning system)

Architecture of the Tool

- Five design elements
  - Concepts
    - Logical constructs of interest to the user (such as a course, discussion forum, quiz etc.).
  - Patterns
    - Based on concepts
    - Specify what data the user is interested in (and what data should be extracted)
  - Dataset
    - Courses that the user is interested in

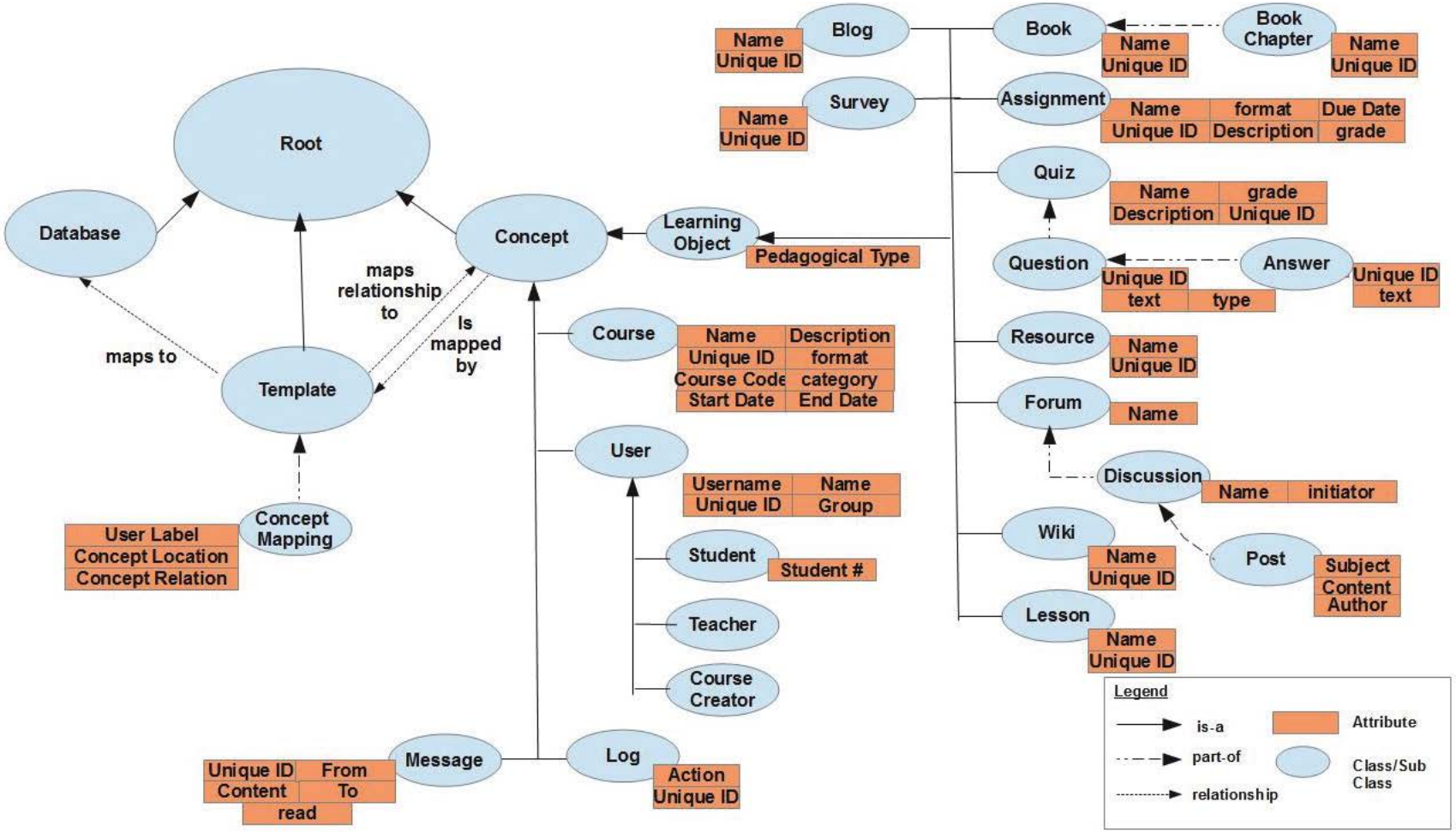
Architecture of the Tool

- Templates
  - make the tool applicable **for different learning systems**
  - specify **where the data resides** within the database of the learning system (i.e., what tables and columns)
  - templates can be created for different learning systems and different versions of learning systems and then used for extracting data from the respective (version of) learning system
- Profiles
  - Experiment for extracting and analysing particular data
  - User specifies:
    - **Which learning system** is used (through templates)
    - **How to connect** to the data (through selecting and setting up database connections)
    - **Which courses / learning objects** should be investigated (through selecting the data set)
    - **Which patterns** should be investigated
  - Once the profile is created, it can be used for extracting data

User-friendly and powerful mechanism for pattern creation

- Focus on pattern creation
- Create a user-friendly but powerful mechanism to allow users without computer science background to extract and analyse complex educational log data
- This mechanism is based on
  - Ontology → to store knowledge of the tool
  - Pattern Chaining → to build on simple pattern for creating complex ones
  - Pattern Creation Wizard → user-friendly interface

AAT Ontology



Pattern Chaining

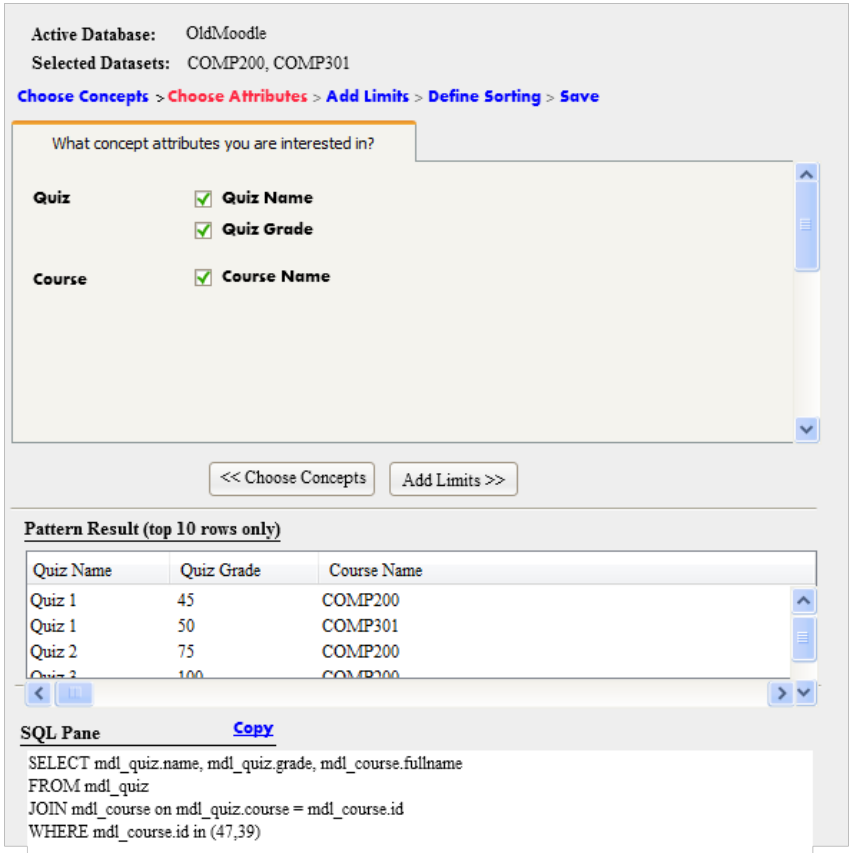
- Facilitates the creation of complex pattern through chaining simpler patterns together
- Two types
  - Using one pattern as input of another (→ restrict result set)
  - Merging two patterns (→ expand result set)
- Requires storage of additional data (e.g., identifiers of tables, etc.) and meta-data (e.g., from which location the respective data have been retrieved, etc.)

Pattern Creation Wizard

1. Create a patterns from scratch
2. Create a pattern by using en existing pattern as input
3. Create a patterns by chaining two existing patterns
4. Perform an analysis on an existing pattern

Pattern Creation Wizard

- Patterns are created via intuitive wizard interface
  - Users select Concepts
  - Users select Concept Attributes
  - Users select Limits (filtering)
  - Users save the Pattern
  - Users run the Pattern



Pattern Creation Wizard

- An analysis (or calculation) on an existing pattern
  - user selects the base pattern
  - the type of analysis (i.e., counting, calculating the sum or average, and presenting the minimum or maximum)
  - the concept attributes on which the respective analysis should be performed.
- Analyses can either be performed for one attribute, resulting in a single value (e.g., the number of forum postings in a course), or for one attribute per concept, resulting in an additional column of the result set of the base pattern (e.g., the average number of postings per student).

Conclusions and Future Work

- AAT is an innovative tool to allow users without computer science background to access and analyse LMS data
- We introduced a user-friendly and powerful mechanism for pattern creation, including an ontology, pattern chaining and a pattern creation wizard
- AAT facilitates course designers' learning about the effectiveness of their course designs as well as educators' learning about the effectiveness of their teaching strategies
- Future work:
  - advanced visualization of data
  - adding statistical functionality (e.g., regression, correlation)
  - conduct an evaluation with learning designers and educators