Innovative IT-supported Web-based learning environments

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Outline

• Aim of the research and research questions
• Objectives and methods
• Importance of the research
• Research progress
• Paper “Semantically enhanced decision support for LMS”
• References
Aim of the research and research questions

**Aim:** Applying intelligent tools for the design of innovative Web-based learning environment.

- What kind of intelligent and adaptive systems exist and their usage?
- What are the most useful types of intelligent tools for learning environments?
- How to apply intelligent tools for LMS and Learning games?
- Which approaches and methods could be applied for improving organization of Web-based learning environment?
Objectives and methods

• We are looking methods to build adaptive guidance system for learners.
• With the use of Semantic Web technologies and Data mining techniques there is a possibility to develop a set of intelligent tools for analysts and experts of LMS and digital LG.
• It is possible to create a toolkit which may include a variety of advanced technologies that make the content more relevant to learning environments with respect to a user, as well as to make learning more innovative.
• Future developing of feedback systems (Study Advisor), curriculum developing, career management developing, etc.
Objectives and methods

Learning programs

Web

Learning materials

Online courses

- Knowledge bases and knowledge management;
- Semantic matchmaking;
- Natural language processing tools;
- Data mining;
- Other.

LFS | Content-adaptation
---|----------------------
RS | Content creation and searching
Study Advisor | Career-management

learners

teachers
Importance of the research

• In Web-based learning environments it is necessary to monitor the student's knowledge level and automatically adjust the content for each student in order to improve the education process.

• Since Internet offers a vast amount of information, it is necessary to help the teacher create the materials most suitable for education; and as well help find the most relevant content and convert it to comprehensive information.

• It is necessary to help students with selecting courses and study programmes basing on their objectives, which will be beneficial in their further career.

• Adaptive presentation of educational materials provide individual attention to students, problem solving support and intelligent analysis of interactive feedback can significantly save teacher’s time, technology selection models can be trained to strengthen management and communication aspects of the learning process.
Research progress

Studies

• 2 Master Degree in Computer Science
  ▫ from Kharkiv National University of Radio and Electronics. Topic is “Research and development of intelligent assistant for virtual shops’ buyers”
  ▫ from University of Jyväskylä ”Semantically enhanced decision support for Learning Management Systems”
• 30 of 30 credits are done (accomplished PhD studies except of TIEJ601 Postgraduate seminar in Information Technology).
Research progress

Publications in KNURE

Research progress

Research reports

- Report on Learning Analytics
- Report on Learning games
- Report on Big data in education
- Report on improving Learning game “10monkeys”
- Report on distance education and learning games in Russian-speaking countries

In process:
- Report on Feedback systems and adaptive systems in education
- Report on existing adaptive games and learning platforms
Research progress

Publications

Finished:

• Manuscript “Semantically enhanced decision support for Learning Management System” which was sent to Ninth IEEE International Conference on Semantic Computing IEEE ICSC 2015.

Planned for 2015 year:

• “Analysis of automated feedback systems in Digital Learning Games”.
• “Ontology-based feedback system for supporting learning progress in Digital Learning Game”.

Planned for 2016 year:

• Paper related to intelligent tutor for career-managing.
• Paper related to learning analytics in learning games.
Semantically enhanced decision support for LMS

- The article focuses on proposed semantically enhanced model of decision support system for Learning Management System (LMS) according to survey of LMS’s functionality, and the use of various plugins for these systems to improve educational process.
Intelligent systems

Characterised by [1]:

- Solving different semi-structured tasks;
- Ability to make autonomous decisions;
- Ability to solve the problem, traditionally considered as a creative, belonging to a particular subject area;
- Structure: knowledge base, solver and intelligent interface.

Main types:

- Expert systems;
- Computer system with natural language processing;
- Computer systems with intelligent analysis of data;
- Learning systems;
- Decision support systems;
Semantic Web

- In modern RSs semantic technologies are often implemented.
- The Semantic Web is a technology that can describe things in a way that computers can understand.
- Is based on the fact that the semantics assumes a standard syntax of data (RDF) and the standard way to describe the properties of the data (RDF-schema), which have largely accelerated the algorithm of recommender system.
- Necessary when there is significant number of requests to the system.
- Use of Semantic technologies in the construction of intelligent systems because of their great potential to reflect the relationship between objects and concepts, the description is close to natural language.
Semantic Web

- Semantic web allows improving the metadata associated with e-learning materials as well as extension of the existing options for e-learning states.
- At the heart of all semantic Web applications lay ontologies, which play an important role among the various applications in knowledge representation, processing, sharing and reuse.
- Ontology (in computer science) – is an attempt to formalize a comprehensive and detailed knowledge of a domain by using the conceptual schema. Typically, such schema consists of a data structure containing all the relevant classes of objects, their relationships and rules (theorems, limits) taken in this area.
Learning Management System

• Learning Management System is a software application for administration, documentation, tracking, reporting and delivery of e-learning, education courses or training programs [2].
• Is a good example of automated learning;
• Meets the needs of modern society;
• Learning are individual, time and space independent;
• LMS “are software applications, which are used for the storage, administration and delivery of education courses or training programs”;
• LMS are used for developing, managing and distribution online learning materials to provide cooperative access.
Problem description

• A huge range of courses in LMS and users have the right to choose;
• Users need to spend a lot of time to see the entire courses descriptions in order to find the courses that will meet the needs of the user best;
• The potential user of LMS need to use decision support systems and intelligent applications for filtration rates in different conditions.
Solution description

- Create knowledge base that have students’ profiles, teachers’ profiles, courses, specializations that include list of courses;
- Using SWRL-rules divide students into groups with their potential specialization;
- Matching students’ background (already learned courses) with courses that include preferred specialization;
- Making recommendation as list of courses that students have to learn according to their preferences.
Proposed architecture of LMS with decision support tool
Diagram of the created Ontology for LMS
Example of SPARQL-query to the ontology
Example of SWRL-rule for the designed ontology

\[
\text{Student}(?s), \text{hasCourseBackground}(?s, \text{DatabaseAndKnowledgeManagement}), \text{hasCourseBackground}(?s, \text{SoftwareTestingAndQAEngineering}) \rightarrow \text{Student}(?s), \text{hasFutureSpecialization}(?s, \text{SoftwareTester})
\]
Schema of the LMS working process

**Registration and authorization**
- Regular registration;
- Using OAuth.

**Data extraction**
- Filling and editing personal profile;
- Using social network

**Data saving**
- Knowledge base;
- Data base.

**Data analyzing**
- Analyzing users’ profiles;
- Analyzing requirements for specialization.

**Choosing specialization or courses**
- Choosing from suggested list.

**Making profile**
- Students’ profiles;
- Teachers’ profiles;
- Courses;
- Specializations.

**Making recommendations**
- Using SWRL-rules for making new knowledge;
- Using SPARQL for data extraction from knowledge base;
- Recommendation of potential specialization;
- Recommendation of courses.
References

- Segaran T., Evans C., Taylor J. Programming the Semantic Web: Build Flexible Applications with Graph Data, - O’Reilly Media;
- Adaptive Sites: Automatically Learning from User Access Patterns. Mike Perkowitz and Oren Etzioni Department of Computer Science and Engineering, Box 352350 University of Washington, Seattle, WA 98195-2350.
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