ÄlyOppi

Älykkäät oppimisympäristöt ja niiden sisällöntuotanto

Smart learning environments and their content production

Aalto-yliopisto

UNIVERSITY OF EASTERN FINLAND

LUT University

Turun yliopisto
University of Turku

Aalto University

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

JYVÄSKYLÄN YLIOPISTO

Tampere University

Government key projects

- Special funding for advancing teaching, learning and studying in higher education institutes (HE), 2017 & 2018
- Two projects (2018-2020)
  - Älykkäät oppimisympäristöt ja niiden sisällöntuotanto (smart learning environments and their content production)
    - coordinated by Aalto (Lauri Malmi), 1,7M€
  - Digital Education for All (DEFA)
    - coordinated by UH (Kjell Lemström), 1,4M€

Note. Overhead is only 30%, implying correspondingly more real project money

Smart learning environment??

- In Finnish, ”älykäs järjestelmä” is often interpreted as an AI system.
- In our project, we use term *”Smart learning content”,* which refers to rich interactive content. Examples include:
  - Automatic assessment tools
  - Simulation tools
  - Interactive data or program visualization tools
  - AI can have a role here!
- Intelligent tutoring systems and adaptive learning systems are considered smart systems as well.

What does smart mean?

- **Interaction is *not* carried out only among humans (mediated by software).**
- **Instead, the learning software**
  - **understands the context of the assignment,**
  - **can analyze and check human generated solutions in advanced settings, and**
  - **generates tailored feedback for the student.**
- **E.g. checking MCQs is not smart in this sense as there is only a fixed set of solutions.**

Background

- Research and development work carried out on smart learning systems especially in U-level Computing Education in Finland including
  - Aalto, UH, JYU, TAU, UTU, LUT, UEF, ÅA
- ABACUS-network has produced smart learning content since 2015 on STEM education.
  - Based on STACK
  - 11 universities, and a number of UASs and foreign partners

Goals

- Improve access to smart content in HE institutions (and elsewhere)
- Build wider teacher networks for topical areas
- Integration and interoperability of systems and learning contents
- Immediate feedback for students
- Implementation by
  - sharing assignments (assignment bank)
  - adopting systems in new institutions
  - sharing open learning content modules
  - open online courses

Partners

Aalto University (coordinator)
University of Helsinki
University of Eastern Finland
University of Jyväskylä
Lappeenranta University of Technology
University of Oulu
Tampere University
University of Turku
University of Vaasa
Metropolia UAS
Tampere UAS
Yrkeshögskolan Arcada

Subprojects

Four topical areas

- **Computer science (chair: Ari Korhonen, Aalto)**
- **Mathematics (Simo Ali-Löytty, TAU)**
- **Physics (Petri Salo, Aalto)**
- **Electrical / mechanical engineering (Juho Alatalo, OY)**

CS subproject

Aalto, UH, UEF, JYU, LUT, TAU, UTU

A. Technology development, interoperability, usability

- **Open interfaces for information sharing**
- **Better tools for content production for teachers**
- **Configuring content for different formats and platforms**
- **Data logging and learning analytics**

CS subproject

B. Content development

- **Joint methods to describe current learning contents, learning methods and tools**
- **Increasing the number of open courses**
- **Support for multiple programming languages in learning content**
- **Support for versioning learning content**

Digital Education for All (DEFA)

- Opening first year studies in CS for all
- Partners: UH (coordinator), chair: Kjell Lemström
  - Aalto
  - University of Jyväskylä
  - University of Oulu
  - University of Turku
- Website (in Finnish)
  - https://www.helsinki.fi/fi/projektit/digital-education-for-all

Goals

- **Explore ways to admit students in HE without entrance examination**
  - **Reduce years between high school and HE (välivuosi)**
- **Encourage new people to study CS**
- **Compare study success of DEFA students and ”normal” students**
- ***Each university makes its own decisions on student admittance, as well as which courses are opened.***

Collaboration of the projects

- These projects have an overlap in open courses
- Joint project coordinator: Nea Pirttinen, UH
- Opening courses is coordinated in DEFA steering group

Implications for CS departments

- Clear support for tools/technology development
- Networking with other teachers
- Getting access to learning tools and content from other universities
- Building joint content or courses with other universities (sharing development effort)
- Students can take courses from partner institutes
- New entry paths for prospect CS students

CS subproject

- **Tentative courses**
  - **Introductory programming courses (1st year)**
  - **Data structures and algorithms**
  - **Introduction to databases**
  - **Computing tools for CS studies**
  - **Introduction to theoretical computer science**
  - **Web development / web technologies**

CS subproject

- **Goals**
  - **Networking with teachers, teaching assistants, developers, …**
  - **Introducing new teaching materials from other institutions**
  - **Sharing and improving materials with each other**
  - **Support for deployment of new technologies**

CS subproject

- **Five steps to cooperation**
  1. **Familiarizing yourself with courses and materials made by others**
  2. **Giving and receiving feedback from materials**
  3. **Introducing the best practices in seminars**
  4. **Sharing existing exercises**
  5. **Creating new exercises together**

CS subproject

- **Action plan**
  1. **Meeting with course-based subgroups**
  2. **Getting to know teaching materials and tools used in other universities**
  3. **Deciding who will be responsible of the course subgroup and who will be participating regularly**
  4. **Arranging a national seminar at the end of the spring**

Mathematics subproject

Aalto, UH, LUT, OY, TAU, VY, Arcada, Metropolia, TAMK

1. **Improving the search feature and organization of the ABACUS material bank**
2. **Electronic exams for mathematics**
3. **Testing and integrating of state variables in STACK**

Mathematics subproject

4. New open courses

- Calculus of several variables
- Introduction to probability and statistics
- Introduction to matrix analysis in multiple languages
- Introduction to computational methods and MATLAB
- Advanced course in matrix analysis
- Course in pharmaceutical arithmetics for health care students
- Core studies of mathematical modeling in English
- Introduction to graph theory

Physics subproject

Aalto, UH, JYU, Metropolia

- **Developing physics exercises for the ABACUS material bank**
- **Translating STACK exercises to English**
- **Electronic exams for physics**
- **Integrating UAS-level physics exercises to ABACUS material bank**

Collaborates with the mathematics subproject

Electrical and mechanical engineering subproject

OY, VY

1. **Developing electrical and mechanical engineering exercises for the ABACUS material bank**
2. **Developing exercises for these fields in general**

Other relevant key projects

Alternative path to university (Toinen reitti yliopistoon, coordinated by University of Jyväskylä)

Digital Education for All