Programming Exercises in LON-CAPA

Oliver Rod

Dipl.-Ing (FH) Oliver Rod
ol.rod@ostfalia.de

LON-CAPA Conference and Workshop 2017
Overview

- project
- motivation
- presentation
- proposed architecture
- implementation
- challenges
- results from testing
- further project plan
Ostfalia University of Applied Sciences

- 12 faculties
- ~ 12000 students
- 4 locations
Ostfalia University of Applied Sciences

Salzgitter
- Transport-Sports-Tourism-Media

Suderburg
- Civil and Environmental Engineering
- Trade and Social Work

Wolfsburg
- Automotive Engineering
- Public Health Services
- Business

Wolfenbüttel
- Electrical Engineering
- Computer Science/IT
- Mechanical Engineering
- Law
- Social Work
- Supply Engineering
About ZeLL

ZeLL: Zentrum für erfolgreiches Lehren und Lernen
● aim: improve teaching and learning in higher education
● consists of:
  – „Matheplus” – intensive math courses
  – “lerncoaching” – coaching for students
  – educational – coaching for lecturers to use clicker, JiTT, formative Assessment
  – eLearning – eCompetence and utilities for learners and teachers
    ○ task: improve formative assessment of programming exercises
    ○ partners: TU Clausthal, Hochschule Hannover, Uni Osnabrück, many more..
eLearning

- part of project:

- various German universities involved

- at Ostfalia University:
  - formative assessment of programming exercises
  - connect course management systems (CMS) and grading engines
Motivation
Write a program which prints "Hello World!" (without quotation marks). The program should contain a method that returns "Hello World!". The class should be named "HelloWorld" and the method should be named "greet".

Your submissions:

- Submission 1
- Submission 2
- Submission 3

Please enter your solution here:

```java
public class HelloWorld {
    public static String greet() {
        return "Hallo World!";
    }
    public static void main(String[] args) {
        System.out.println(greets());
    }
}
```

Proposed architecture
Proposed architecture

● extend possibilities of LMS with external grading engines
● combine advantages:
  – use management power of LMS
  – use grading power of external grading engine
  – students: single interface for class materials and exercises

● using the „XML exchange format for programming exercises“ (proforma-xml)
Implementation

- Using plain LON-CAPA with External Response
  - Adding three of our libraries
    + simpler
    + convenient
  - Improved Textfield with CodeMirror
    + syntax-highlighting
    + code folding
  - Improved answer display with JavaScript and Albertelli-EXT
Example: LON-CAPA and Praktomat

- **LON-CAPA** as CMS and repository
  - classlist
  - provide documents to students
  - access to programming exercises

- **Praktomat** as external grading engine
  - Java, Python, SetlX
  - test cases (JUnit, Checkstyle, etc.)

- **Editor** creating exercise Format and LC-Problem-File
Sequence diagram

- **I: LON-CAPA**
  - Textfield
  - Input
  - Feedback

- **p: ProFormA-Middleware**
  - StudentSubmission
  - + TaskPath
  - TransformGradingResult

- **g: Praktomat**
  - get_task_rep
  - TaskXML
  - createTask
  - TaskID
  - gradeTask
  - GradingResult

- **r: repository**

---

Programming Exercises in LON-CAPA

Oliver Rod ol.rod@ostfalia.de
Format editor

-> https://media.elan-ev.de/proforma/editor/editor.html
Challenges

security:
● data exchange must protect systems security and data security
● security standard for student submitted code

parameterised exercises:
● with parameterised exercises less plagiarism, but more effort required for creating exercises
● not easy implementation to make it exchangeable across LMS and grader tools
Challenges

detailed feedback and hints:

● more feedback than pass / fail
  – release different feedback at different times e.g.:
    ○ code submission time, hand-in deadline or after results are published
    ○ challenging to format the feedback (debug output and instructor-written comments) ->

● long-term support and benefits of sharing:
  – long-term availability of the tools
  – share the exercises among lecturers
Results from testing

- in operation since 2016
- small groups of students 12-16 students in two sessions in classes on introducing java
- another test with 65 students in linear algebra -> setIX

- most feedback required small changes
  - precision of the description of the exercises had to be increased
  - students had to get used to precise reading and verbatim implementation
Results from testing

- time requirements for creating the exercises
  - 4 hours per exercises
    - improving upload mechanism for LON-CAPA
      o with prefilled data fields
      o providing semi-automated tools for generating standard tests
Further Project Plans

● developing a response-xml -> https://github.com/ProFormA/responsexml
● connect more LMS and more grading engines
● feedback improvement
● exchange programming exercises
● resource pool for programming exercises
● testing subversion-submission with LON-CAPA
Links

ProFormA project in github (https://github.com/ProFormA)

- editor
  - https://github.com/ProFormA/formatEditor

- exchange format
  - https://github.com/ProFormA/taskxml

- examples
  - https://github.com/ProFormA/examples

- Publication about XML-based exchange format
  - https://eleed.campussource.de/archive/11/4138
Thanks for listening. Any questions?

Join the workshop ;)

Website: www.ostfalia.de/zell/elearning
Mail: Zell-ProFormA@ostfalia.de