

A study on how to classify exercises and student behavior profiles in introductory programming courses: a Moodle plugin contribution



2023-04-28
Thiago Gomes Veríssimo
Leonidas de Oliveira Brandao
Ewout ter Haar

Overview

- Context
- Research questions
- Data Analysis and Learning Analytics
- Data collected
- Metrics
- Code Structure
- Plugin Demonstration
- Plans

Context

- Introductory programming courses
- Moodle as Learning Management System (LMS)
- IAssign (interactive Assignment) to provide programming tasks
- Automatics evaluation - based on input/output matches
- IAssign provides a building programming blocks language

Research questions

- What metrics can be developed to effectively identify problematic exercises and measure their difficulty
- What is the feasibility of developing a tool to assist teachers in designing effective exercises, with the aim of reducing student difficulties?

Data Analysis and Learning Analytics

- The use of moodle as LMS generates large sets of data, representing the learning steps and users' interaction
- This exploration of educational data has been identified as Learning Analytics
- We created metrics using data and metadata from code submitted by students

Data collected

Submission data:

- time window for the submission
- diff code (Levenshtein or complexity)
- grade

Data transformation: Metrics

Data transformation, for each student:

- MTES: the highest time window between submissions
- MDES: the highest number of code modifications
- DEX : average submission grade

$$DEX = \frac{\textit{average grade}}{TMS + n}$$

$$TMS = \frac{\text{last timestamp} - \text{first timestamp}}{2}$$

Code Structure

- The plugin utilizes a command-line interface script to calculate TDES, MDES, and DEX, and then stores the results in a dedicated table within the plugin
- By extracting data from its dedicated table, the plugin is able to provide teachers with suggestions for both effective and ineffective exercises

Plugin Demonstration

Plans

- users profile behavior not implemented yet
- vpl support not implemented yet
- Can machine learning algorithms such as K-means clustering generate comparable results to MTES, MDES, and DEX for exercise difficulty assessment?