# Improving Individual Commitment and Assessment in the Module Compiler Construction

Dmitry Ivanov [1] Florian Meyer [2]

[1]Institute for Software Systems [2]Institute of Telematics

Hamburg University of Technology

## Initial Situation

| | |
|---|---|
| Participant count: | ∼45 |
| Course Level: | Bachelor |
| Course Period: | Summer Term, 2019 |
| Course Weighting: | 6 ECTS |
| Module Structure: | Lecture + Project Course (with 5 miniprojects) |
| Examination Method: | Graded project submissions and interviews |
| Student Projects: | 0. Installation<br>1. Grammars<br>2. Type Checker<br>3. Code Generation with LLVM<br>4. Free Choice |

## Problem Definition

1. Difficult individual assessment due to:
   - large project groups (up to 4 students in each)
   - time pressure of the interviews ( 18 min. per group, or 4 min. per student)
2. Difficulties with Project 3 (Code Generation with LLVM):
   - the LLVM API, the library used in the project, is complicated for beginners
   - the suggested starting point (Kaleidoscope tutorial) does not help every group according to the previous experience

## Objectives

1. Make sole commitment more **measurable**
2. **Promote** individual engagement in the project work
3. **Provide** a more gentle introduction to LLVM API

## Didactic Concept

### Promote and Assess Individual Commitment

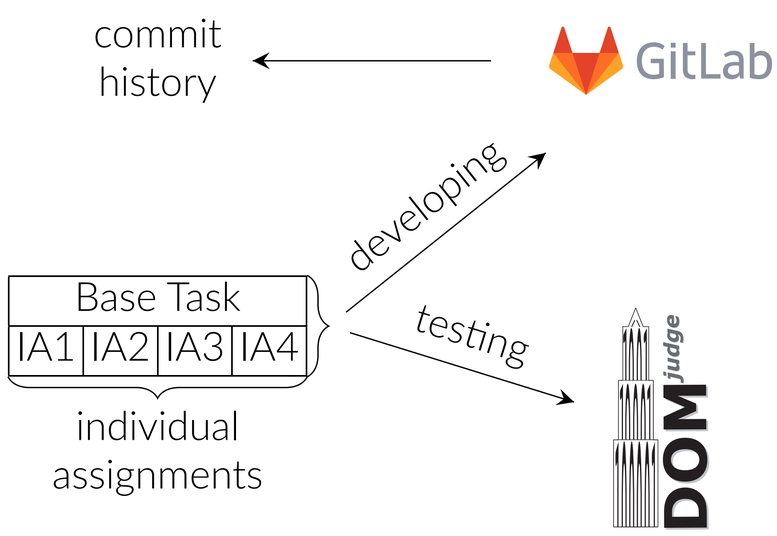


Figure 1. New workflow in Projects 2 and 3.

The new didactic concept suggests the following changes illustrated in Figure 1:

1. Projects 2 and 3 (Type Checker and Code Generator) are split into **base task** and four **individual assignments**, one per student in the group. Students work collaboratively on the base task and solely on the individual assignments.
2. Solutions for Projects 2 and 3 can be tested with the jury system **DOMjudge**.
3. Students are required to use the version control system **GitLab** throughout the whole course.

Table 1 shows how these changes fulfill Objectives 1 and 2.

| Instrument \ Purpose | Promotion | Assessment |
|---|---|---|
| Individual assignments | required minimum of independent work | required minimum of understanding |
| GitLab | convenient collaboration tool | commit history tracks activity |
| DOMjudge | fast & automatic feedback | — |

Table 1. How changes map onto objectives.

### Introduction to LLVM

Students will be introduced to the Kaleidoscope tutorial and will have to work on a small track involving LLVM during a **PBL** [1] session before Project 3. During this session students will get the initial knowledge of LLVM and make their first attempt of applying it under supervision, what allows them to identify the knowledge gaps and tackle common problems before the project starts.

## Evaluation Design

We plan to evaluate all aspects of our didactic concept, namely introducing individual assignments, using DOMjudge, working in GitLab, and the PBL session on LLVM.

### CheckING

The CheckING questionnaire will be used for assessing the usability of the technical part (DOMjudge and GitLab) and learning impact of the teaching novelties (individual assignments and PBL). The questions include both a series of "To what extent do you agree with the following statements?" questions and an open-ended questions for detailed feedback.

### Semi-Structured Interviews

We are also going to evaluate the effect of DOMjudge, GitLab, and the PBL session deeper through semistructured interviews [2] asking the following questions:

1. What were the difficulties in using DOMjudge as the testing tool?
2. How did GitLab help working on projects in a group?
3. How did the PBL session improve your knowledge and help working on Project 3?

## Conclusion

The present didactic concept can scale in two ways:

1. increasing the allowed group size
2. increasing the number of groups

The first approach may reduce the learning effect and requires more effort: one has to come up with new individual subtasks and tests for them. On the other hand, for the second approach one needs to reserve additional time for the assessment interviews and adjust the number of DOMjudge judge hosts. Therefore, we recommend increasing the number of student groups for a larger number of course participants.

## References

[1] David Boud and Grahame Feletti. *The challenge of problem-based learning*. Routledge, 2013.

[2] Rosalind Edwards and Janet Holland. *What is qualitative interviewing?* A&C Black, 2013.