

## Final report for miniproject " GameLab for learning Software Engineering with Excitement " financed by Excited

### Quick factual info

- **Mini-project leader:** Girts Strazdins, associate professor, IIR, IE, NTNU.
- **Other participants:** student assistants Thomas Mjåland, Ole-Martin Hagen Steinnes, both from "Automatiseringsteknikk" bachelor study program in Ålesund, 3<sup>rd</sup> year. Robin Isfold Munkvold, NORU University. Pupils and teachers from Aalesund International School.
- **Start and end date** of mini-project: 01.01.2018 – 30.09.2018
- **Related project(s)** in Excited: P3 Learning through Construction.
- **Funds given** from Excited: 50'000Kr
- **How funds were spent** (specified list):
  - Game-programming tutorial development:
    - Student assistants: ~21'000Kr
    - Course teacher Girts Strazdins: ~12'000Kr
  - Travel costs for poster presentation in UDIT conference: ~17'000Kr
- **Own effort:** 55 hours of work (programming tutorial development, poster preparation and presentation) for course teacher Girts Strazdins.
- **Related course(s)** ID202712 Systemutvikling og modellering
- Ethical rules have been followed during data collection in the project:
  - Only anonymous data collected in the survey at semester end, no personally identifiable information.
  - For all published pictures involving Aalesund International School children, consent from parents is collected.
  - Student games are published with the author permission.

### Objective

Project objective: to motivate students for applied study of software engineering disciplines, through construction: practical game programming projects with external customers.

The following activities related to the project were performed (some of the activities were outside the scope of this mini-project in terms of funding; nevertheless, these are included here because the real project is bigger than the scope of this mini-project and no additional external projects were used to cover any of these activities):

- Course teacher contacted colleagues at Nord University and learned about their experience with GameLab concept in teaching.
- Existing game engines were researched.
- Game programming tutorials for course students were developed by course teacher and student assistants.
- Contact with Aalesund International School was established: their pupils participated in the project teams as idea generators and customers.
- Students worked for 13 weeks. Resulting games were gathered and published on a website.
- A poster was prepared and experience of the project was shared at UDIT conference (NIKT) in September 2018, Svalbard.

## Results

The main achievement of the course: all the course students worked hard on the course project, using tools and techniques accepted in the industry: Agile development sprints, Jira issue management tool with story point estimation, GIT version control system, among others. With very few exceptions, the teamwork was functioning very well, and all teams produced a playable game at the end of the course. This is a considerable achievement, in comparison to previous year, when students worked on an imaginary logistics system and only one of seven teams produced good results. In course teacher's opinion, there has not been a significant difference in programming skills for the 2018 and 2017 students. The different results are mainly explained by motivation and work efficiency.

One important part of the project was choice of game engine(s) to use in the project. Game development is a complex topic. Students should not start from scratch. This choice was a difficult one. The idea of course teacher was to suggest a Java-based game engine, because students at NTNU Ålesund are using Java programming language throughout the whole study. Colleagues from Nord University (Robin Isfold Munkvold) suggested using Unity 3D game engine, due to its easy-to-use interface and rich asset base. As a result, a very short introduction to Unity was given in the lecture, and an extensive game programming tutorial in LibGDX engine (for Java) was provided to the students. As the results show, many more teams chose Unity engine in contrast to Java-based engines.

## Deliverables

The main deliverable of the project: an online tutorial with examples and explanation of concepts and techniques used in different game programming engines: <https://github.com/strazdinsg/gamelab/wiki>

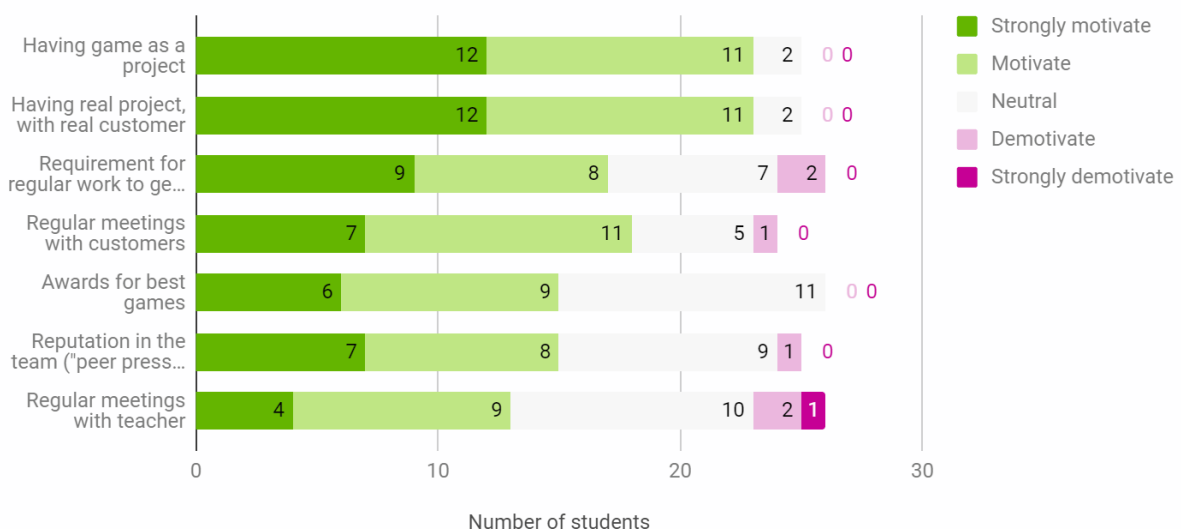
In addition, the games and their short descriptions are available here: <https://www.ntnu.no/studier/004da/studentoppgaver> (the link leads to a website outside the NTNU network: <https://sites.google.com/view/ntnu-aais-games-2018/home> )

## Evaluation

Feedback in the course was collected in two ways. First, a questionnaire was sent to all students. Response rate: 79% (26 of 33 students). In addition, an open discussion with all students was performed after the last lecture of the course. Results shows that:

1. Students are able to develop unexpectedly rich games in the short period of time and with the limited previous experience.
2. Despite teacher's suggestion to use Java-based game engines such as LibGDX or jMonkey, most students (4 of 9 teams involving 15 of 33 students) chose Unity 3D game engine. Even those who did not, at the end of the course reflected that next time they would choose Unity due to its rich and intuitive graphical user interface. Unity allows building most of game components without writing code.
3. It is difficult to develop a unified tutorial for all students. It is perhaps better to simply let the students explore existing online tutorials.
4. Choice of groups is essential. Forming groups based on student skill in programming and Jung's personality type has been a success (with few exceptions).
5. During the process, students get confident that they can participate in software development projects with best practices and common tools (such as GIT and Jira).
6. Games as projects and external customers is the strongest motivation behind efficient work: 89% of students get motivated. In comparison, mandatory weekly meetings with teacher is a bad motivator: only 50% of students see it as motivating (See Figure 1).
7. While students put extra effort in the game projects, they sometimes don't see clearly the connection between the project and theoretical lectures and books. It should be expected that in the fight "Game projects versus book reading" the former would win. Involving enough theory in the projects is challenging for course teachers.

### How much did the following motivate you to work efficiently?



*Figure 1 - Results from student semester-end survey showing motivating factors for efficient work.*

## Future and reuse

The [game development tutorial](#) created during the project contains both textual explanation and source code examples. The repository is open, and can be used by all students of NTNU and beyond. Although the tutorial is using libGDX library, the concepts would be the same in many other game engines, including Unity. Therefore, the programming examples may have limited use, while the textual descriptions are generic.

Concerning the future of the course – it is clear, that real projects motivate students to work much more efficiently. Therefore, the approach of small application development for external customers with regular meetings will be continued next year. One idea for future exploration is to have different customers with different types of projects: some of them could be games; some could be simple web-applications, etc. Course teacher has already begun discussion with several potential customers for next year, including Newton Rooms and security researchers at Sintef.

## Quick popular description

Software engineering best practices and principles is an important part of every computer engineering university curriculum. However, information in software engineering related courses is typically very theoretical. Practical activities are needed to let students experience the development processes instead of simply memorize the theory. Software development projects can play the role of practical experience. The objective of this project – to involve students in game programming projects with external customers.

During this course, 33 Computer Engineering bachelor students at NTNU in Aalesund were working in groups and developed a games as part of their software projects. They have previously had introductory programming courses and small module on user interface but no game programming experience. To help students familiarize with game programming concepts and game engine principles, a tutorial with code examples and documentation was developed by course teacher and two student assistants. Projects had pupils from Aalesund International School Years 3 and 4 as customers who came with ideas and requirements for the games. Teams worked for 13 weeks and had a final presentation of the games in a form of a workshop with demonstrations and voting.

Results show that students are able to develop unexpectedly rich games in the short period of time and with the limited previous experience. Games as projects and external customers have been the strongest motivators for efficient work: 89% of students get motivated. In comparison, mandatory weekly meetings with teacher was a bad motivator: only 50% of students see it as motivating.

## Links and attachments

- **Pictures** – consent must be clarified with Aalesund International School, pictures will be sent to Ida Sortland.
- **Products:**
  - Game development tutorial: <https://github.com/strazdinsg/gamelab/wiki>
  - Student-made games: <https://www.ntnu.no/studier/004da/studentoppgaver>
- **Longer reports or papers (if any):** poster abstract attached.