

INTERNATIONAL COOPERATION BETWEEN TWO PROJECT LEARNING ENVIRONMENTS - A CASE STUDY

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ABSTRACT

The CDIO Standards (www.cdio.org) set to focus on learning environments that support and encourage hands-on learning activities. Thus, workspaces ought to inspire students both in disciplinary and social learning. Students can learn from each other and interact with several groups in the same environment. The learning experiences focus on leading the acquisition of disciplinary knowledge simultaneously with personal and interpersonal skills, and product, process, and system building skills. In order to achieve this, active learning methods are needed to engage students in problem-solving activities. International connections and activities are typical in project-oriented organizations in many engineering domains. Especially in larger ICT companies, it is typical that projects are implemented as multi-site assignments, and different activities are running 24/7. Thus, it is important to create possibilities for students to experience this type of environment already during their engineering studies. Project office "theFIRMA" operates in the ICT unit at Turku University of Applied Sciences (TUAS), Finland. The project office provides ICT-focused development projects to small and medium-sized companies and third sector organizations. Multicultural and multidisciplinary teams work together in challenging assignments to meet the goals of the projects. Students attain relevant disciplinary and interdisciplinary skills by participating in the projects in different roles. The cooperation discussions between TUAS and Singapore Polytechnic (SP) started in 2016, and after the decision to establish a similar learning environment to SP, planning of the cooperation model between the two learning environments was initiated. The new project office AGILE@SoC was established at SP in 2019. The activities were started with four project teams assigned to work on two industry paid projects, one being an international collaboration with TUAS. Students were organized in teams of five and were supervised by one lecturer per project. This first run of the program aims to evaluate the SP students' and supervisors' experience in the interaction with customers and overseas project teams. To identify operation gaps for future improvement for the operations of the AGILE@SoC office and to further improve the project-based teaching model.

KEYWORDS

Keywords: International Cooperation, ICT, Learning Environment, Project Office, Standards 6, 7, 8

INTRODUCTION

One of the key challenges for educators is to find the best ways to develop programs to equip their graduates for the transition from student to the industrialist. Cooperation projects with the industry is one approach, which can be used to support the transition (Thomson, Prince, McLening & Evans, 2012.) The CDIO 2.0 Standards 6, 7, and 8 focus also on developing the program in this context. The CDIO Standard 6 (Engineering workspaces) sets the focus on workspaces and laboratories that support and encourage hands-on learning. Thus, workspaces ought to inspire students both disciplinary and social learning. Students can learn from each other and interact with several groups in the same environment. The CDIO Standard 7 (Integrated Learning Experiences) focuses on leading the acquisition of disciplinary knowledge simultaneously with personal and interpersonal skills, and product, process, and system building skills. The CDIO Standard 8 (Active Learning) adduces the importance of learning methods that engage students in problem-solving activities. The focus is on engaging students in manipulating, applying, analyzing, and evaluating ideas. (CDIO Standards 2.0.; www.cdio.org)

Topics in globalization, new technologies, migration, international competition, changing markets, transnational environmental, and political challenges are all addressed as drivers for the need for new learning methods (Scott, 2015). The different fields of education are facing disruption with the uncertainty of not knowing the jobs they need to prepare their students for since they are also unsure about the types of jobs that will be available in the future. Hence, deep cooperation with the industry is needed throughout the education to make sure that the skills taught in school meet the ever-changing needs of the industry. Much higher education institutions have set a priority to prepare a student for the world of work and employability (Magnell & Geschwind, 2013).

Project offices (POs) offer students the possibility to develop their skills in an authentic environment while doing cooperation with industry. Students will be able to pick up technical skills and competencies through working on real-world industry projects, instead of the traditional classroom learning environment. At the same time, POs offer a wide range of services for companies and, thus, answer to the demand for applied education as a regional developer. International connections and activities are typical in project-oriented organizations in many engineering domains. Especially in larger ICT companies, it is typical that projects are implemented as multi-site assignments, and different activities are running 24/7. Thus, it is important to create possibilities for students to experience this type of environment already during their engineering studies.

In addition to industrial cooperation, cooperation between educational institutions is important, since it enables the development of innovative international partnerships, student mobility, the establishment of networks, experience and knowledge exchange, and generation of ideas (Laaziri, Khouliji, Benmoussa & Larbi, 2018). Fostering a global mindset in students by raising their awareness of economic and social developments around the world. Students will also be appreciative and immerse in a new culture.

In this paper, the focus is set on describing the international cooperation model between two POs, establishing the new project office to Singapore as well as analyzing the outcomes and experiences from the first two customer projects that were implemented in collaboration. First, the core functions of theFIRMA are described. Second, setting up AGILE@SoC is being described. Third, creating a cooperation model between the two project offices is being presented. Thereafter, the outcomes of the first two cooperation projects are being analyzed and presented. Finally, the current activities are being discussed, and future development thoughts are presented.

THEFIRMA – PROJECT OFFICE

Project office "theFIRMA" has been working in its current form from 2015, when the earlier project learning environments of TUAS School of ICT were merged. The project learning environment provides ICT-focused development projects to small and medium-sized companies and third sector organizations. Typical assignments include web development, small-scale game prototypes, graphic design, and end-user training (Säisä, Määttä & Roslöf, 2017). Students in theFIRMA usually start as project members in real projects where more experienced students mentor them. While students' skills and professional self-confidence grow, they start assisting new junior-level students, or they might even become student project managers. In addition, it is also possible to apply for more responsible roles, such as student marketing manager, head of system administration, or student CEO. Since autumn 2016, it has also been possible to study a whole competence track (curricular structure equivalent to a major subject) in theFIRMA. In other words, this means that the students who are in theFIRMA competence track, do a major part of their third- and fourth-year studies in these projects. Personal learning goals are set for each student to ensure that their skills fulfill the overall learning goals of the degree program. On a yearly basis, about 50 customer projects are done, with 150 students mentored by teachers and other staff members of TUAS. (Määttä, Säisä & Roslöf, 2017)

Multicultural and multidisciplinary teams work together in challenging assignments to meet the goals of the projects. Students attain relevant disciplinary and interdisciplinary skills by participating in the projects in different roles. Based on the results of the alumni survey done in 2018-2019, communication, teamwork, problem-solving, interpersonal skills and motivation and enthusiasm have had the most impact on being employed (Säisä, Määttä & Roslöf, 2019).

SETTING UP AGILE@SOC – PROJECT OFFICE

The new project office AGILE@SoC (aka Authentic Group-based Industry Learning Experience/Environment) was established at SP in 2019. The activities were started with four project teams assigned to work on two industry paid projects, one being an international collaboration with TUAS. Students were organized in teams of five and were supervised by one lecturer per project. This first run of the program aims to evaluate the SP students' and supervisors' experience in the interaction with customers and overseas project teams. To identify operation gaps for future improvement for the operations of the AGILE@SoC office and to further improve the project-based teaching model. Students who participated in this run of the programme will have the opportunity to continue as the first management team for the AGILE@SoC office next semester of their study.

CREATION OF INTERNATIONAL COOPERATION

The cooperation discussions between TUAS and Singapore Polytechnic (SP) started in 2016, and after the decision to establish a similar learning environment to SP, planning of the cooperation model between the two learning environments was initiated. During the PO planning phase, staff members from SP visited TUAS a few times to discuss the concept in more detail. The discussions consisted of the project process, acquiring customers, and evaluation of credits for students, among other things.

During the planning phase, TUAS created a minimum viable product (MVP) description of the FIRMA concept as well as the next steps on how to broaden the concept after it being created and tested. This MVP was shaped as the FIRMA platform that describes the required organization and roles, premises, processes, digital environments, and security. In addition, the platform describes four development phases: current state of activities, near-future improvements (expanding services), branch office in Finland, and international project office phases. The international cooperation between two project offices began at the beginning of 2019. The first round of cooperation is divided into three sections, which are presented in Figure 1.

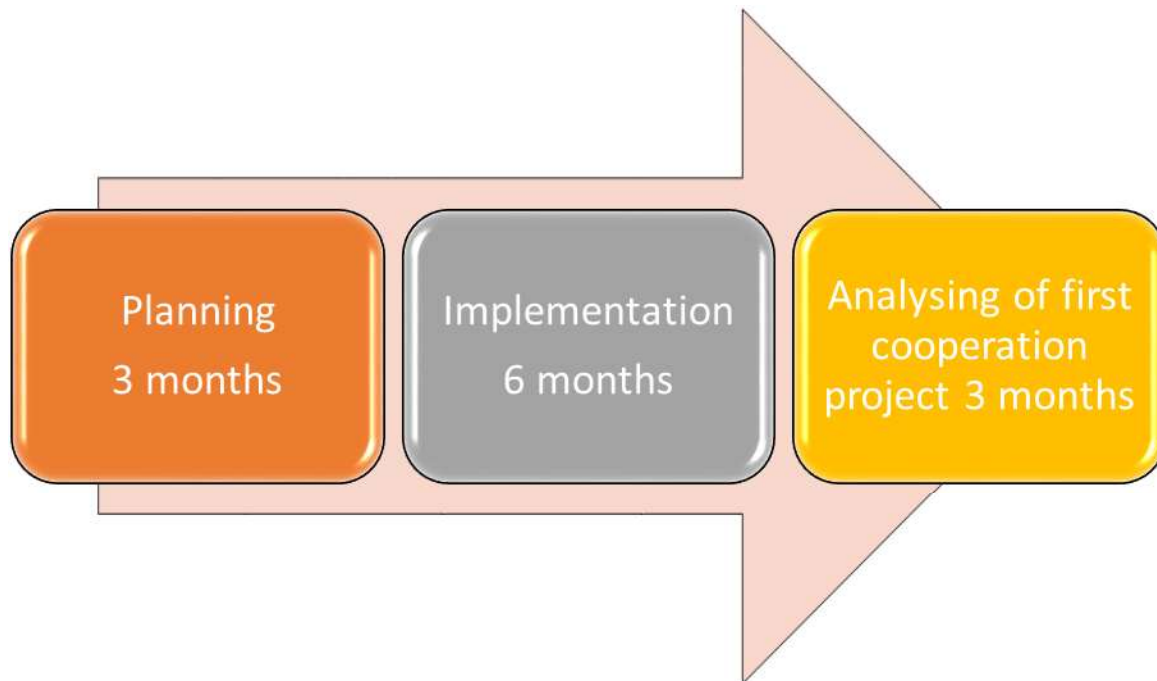


Figure 1. Phases of the cooperation

Initiation of The Cooperation Projects

The planning phase lasted three months, from January to March 2019. At the beginning of the planning phase, it was agreed that international cooperation would start with two customer projects, one from each organization. First, both project offices ought to find two suitable customer projects for cooperation and write a one-page description of each potential project. Thereafter, an online meeting between the POs was held, and one project for each learning environment was chosen. After the decisions, both project offices made a contract with the chosen customer from their home country. For the first round, it was agreed that each project

office would invoice the customer project from their home country. For future cooperation projects, the invoice will be split between the organizations. The contract was made between schools and companies from the same country. After the contracts with the customers were made, I started the recruitment of students for the teams.

Implementation of The First Projects

The implementation phase lasted six months, from April to September 2019. Project from Finland was implemented for a startup company that is creating a model for people to move a little more during their lunch breaks. The idea is to choose a restaurant a bit farther than the restaurant downstairs in the company building. Users collect the (kilo)meters while walking or jogging to a restaurant and back to an app. When users have collected several kilometers to an app, they get awards, such as free coffee or discounts on lunch.

Project from Singapore was for the client "Kidzania, Rakan Riang Pte Ltd." Kidzania Singapore is located on Sentosa, an island resort off Singapore's southern coast. In order to reach out to more customers and provide more collaboration opportunities with various Hotels within Sentosa, Kidzania wishes to develop a web application that allows users to upload their photographs were taken at places of interest; for example, the Zoo, Night Safari or Kidzania. Customers will then be able to choose from a variety of products from Kidzania to have the photographs printed on. The finished product will be delivered to either the customers' hotel room or for self-collection at Kidzania.

For each project, there were two competing teams: one from Finland and another from Singapore. The teams designed their own versions for the customer who got to choose which version they prefer. In addition, there were mentors from both institutions that were responsible for mentoring the local team. The teams did the work independently, but there were organized online meetings between mentors and teams working with the same project on a monthly basis. Progress of the project, technical solutions, and potential difficulties we discussed in these meetings.

In the project done to a customer located in Finland, teams chose different approaches to address the assignment. TUAS team first chose to do the project as a native application. There were some technical difficulties during the project. In short: measuring the distance between point A to point B appeared to be difficult when the user is not keeping the phone open during the walk. Reason for this is related to information security regulation (GDPR): it is forbidden to follow the movement of a user while the phone and the application are not active. Both teams struggled with the same problem, but they were able to find a working solution for the prototype within the given timeframe.

In the Singapore project, the project was divided into two phases. During phase one, the project teams conduct regular meetings with the client to gather system requirements and feasibility studies. The teams then developed a prototype for the client to seek confirmation on how the user interface design should look like. The system requirements and prototype screenshots were shared with the Finnish team, and clarifications between the teams were communicated via emails. During phase two, the team concentrated on system development and user guide documentation. Upon completion, the client was invited to a final presentation/demo of the system by the teams to provide their final feedback and adjustments required before the handing over of the project.

Analyzing of Cooperation

After these first projects between the FIRMA and AGILE@SoC were completed, the project results and experiences on the international cooperation between the POs were analyzed. This phase lasted three months, from October to December 2019.

Both customer projects ended up well, even though the implementation phase was a challenging time to time. For the Singapore project, the difficulties faced by the students are mainly the change in requirements during the first project phase as the client was unsure of how their customers interact with the web application. The teams were about to overcome this by seeking regular clarifications and confirmations with the client. After the client had seen and approved the prototype, the challenges were mainly connected to the technical development issues. To overcome any knowledge gaps required, the teams acquired knowledge via online resources and conducted regular meetups with their mentors. The teams were able to resolve all issues smoothly. For the project in Finland, the main difficulties were related to technical solutions in measuring the movement of the user. However, both teams were able to provide a working solution for the challenge. After the international cooperation phase, TUAS continued the work with the customer by testing the prototype with potential users and developing a monetization model for the concept.

Overall, both projects went well, mentors helped students with the projects, and the teams performed well within the project. Another takeaway includes that the processes were developed for the handling of contracts with companies; it seemed that the students did not feel added pressure due to the fact the projects had a price tag. Instead, students enjoyed the friendly competition among the teams working on the same project, and they were able to learn from each other's approach to the project. It was a great experience working on an overseas project.

For the international cooperation between the POs, the process of acquiring suitable customer projects for the cooperation, negotiating the contracts with customers, implementing the agreed projects, and analyzing the results was rather straightforward. However, there were some unexpected events, too. For example, after the decision of a suitable customer project for international cooperation, the already confirmed customer from Finland decided not to participate. Hence, TUAS had to find new potential customer pilots for cooperation with a rapid schedule. Luckily, a new appropriate pilot case was found, and the cooperation was able to continue within the agreed time frame.

OUTCOMES OF THE COOPERATION

For TUAS, one of the main reasons for starting international cooperation was to offer students a great learning opportunity to work in multi-site assignments. This learning goal achieved during the cooperation with AGILE@SoC. Scheduling the meetings with another team that is working only a couple of "office hours" at the same time needs a lot of planning. Not to forget, all the students still had their other courses, and thus, they were able to work with the project approximately 10-25 hours on a weekly basis. Yet, communicating the needs of the customer for the team abroad in a way that they really understand the needs and can provide technical solutions to meet the needs of the customer was a great learning experience.

For SP, Students who participated in this run of the programme will have the opportunity to continue as the first management team for the AGILE@SoC office next semester of their study.

Outcomes of the cooperation between the two POs have been so far smooth, and thus, deeper cooperation is being planned between the offices. The future cooperation of the POs has been divided into three fields, as shown in Figure 2.

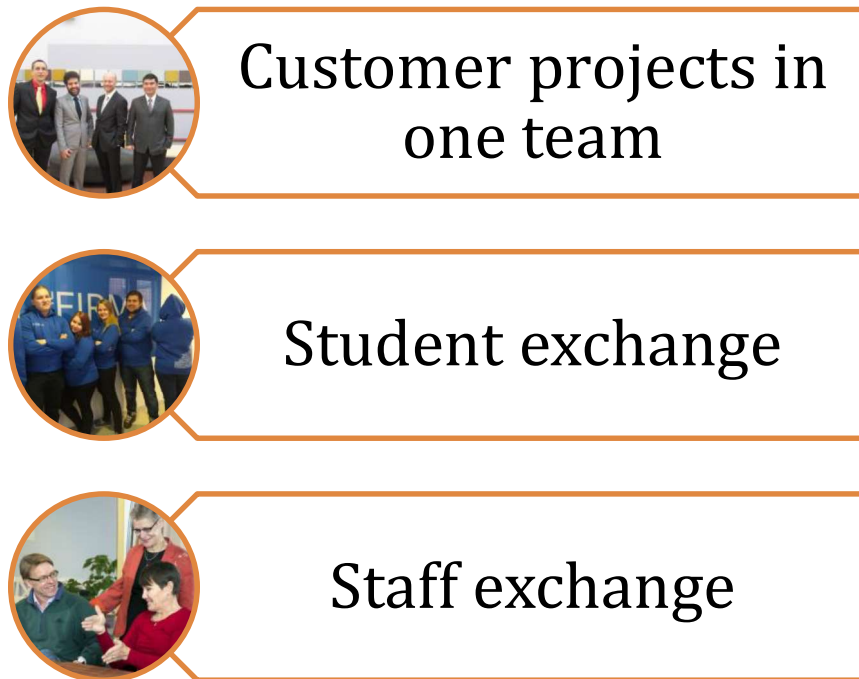


Figure 2. Future fields of cooperation

The next phase of the cooperation is to combine teams from the POs. Hence, there will be one project from Singapore and another project from Finland, but only one team working for each customer project. The team is constructed of the students from both TUAS and SP. The student project manager is responsible for customer communication and for leading the daily activities of team members. As always, teachers mentor teams and make sure that the project results meet the quality requirements of the project.

Another field of cooperation is to start student exchange between the POs. The idea is that students come for a fixed period of 4-6 months to work in the PO abroad. By working in the other PO, students gain both technical and soft skills that are needed in working life. In TUAS, students can focus on front-end and back-end development, system administrators, or project management using both waterfalls as well as agile methodologies.

The third field of cooperation is to start staff exchange between the POs. The main aim of the staff exchange is to share best practices from home PO and, at the same time, learn new technologies and methodologies in the PO abroad. Even though some of the best practices are shared already in different meetings between the POs, a more effective way of sharing and gathering is to participate in daily operations. The staff exchange broadens the CDIO perspective to standards 9 and 10, which requires institutions within the initiative to work toward supporting and developing the teaching and more general competencies of the faculty (Thomson & Gommer, 2018).

DISCUSSION AND CONCLUSIONS

In this paper, the focus was set on describing the international cooperation model between two project offices, establishing the new project office to Singapore as well as analyzing the outcomes and experiences from the first two customer projects that were implemented in collaboration between Finland and Singapore.

The first two customer projects met the goals set for the projects. Some challenges occurred while finding suitable customer cases as well as in the implementation phase when the needs of the customer changed during the project. In addition, some technical difficulties were encountered, but the teams were able to provide solutions for them. All these events are very typical for real-life projects, and they were significant learning experiences for the students.

The goals of the CDIO Standards 6,7 and 8 became a reality during the process. The outlines of Standard 6 Engineering workspaces were used when planning the new PO to Singapore. Integrated Learning Experiences from CDIO Standard 7 were highly valued in designing of the international cooperation where students can join an authentic multi-site experience while working in the projects. The CDIO Standard 8 Active Learning was particularly present when students were applying theory to problem-solving activities to find suitable solutions for the challenges that they met during the implementation phase.

The next phase for AGILE@SoC is to increase the number of paid industry projects. The first run involved students from the third year of their study, AGILE@SoC will be working on increasing involvement from students at various stages of their study to provide more interaction opportunities among seniors and their juniors.

Currently, the cooperation between the FIRMA and AGILE@SoC is heading towards the next phase: doing a cooperation project with one team that consists of students and mentors from both Finland and Singapore. In addition, student and staff exchange between the POs are being planned to broaden to cooperation and to deepen the authentic experience of international cooperation for students. For future operations, the communication tools, mentoring processes are taken into a closer plan in order to make sure that the geographically spread team can do their best while working for the common goal.

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Sanna Määttä works as a Senior Lecturer at the School of ICT of Turku University of Applied Sciences. She has D.Sc. (Tech.) and M.Sc. degrees in Digital and Computer Systems from Tampere University of Technology (Tampere, Finland). She is one of the responsible teachers in the FIRMA, mainly concentrating on developing and improving the quality and learning processes. Her primary areas of interest include embedded software, the Internet of Things, and the software project process.

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