Retrospective Review for Students' Experiences Regarding University-Industry project: Case Panoste

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Abstract

This paper presents a retrospective study on students' experience about the project and learning process during a university-industry project. A project called Panoste was coordinated by The Turku University of Applied Sciences (TUAS) and it started in May 2008 and was finished in December 2010. A semi-structured interview was carried out to gather information about students' point of view 2013, three years after finishing the project. The Panoste project had two priorities: to develop a new robotized, cost-effective and flexible manufacturing cell for machining industry and to disseminate information and knowledge related to new technologies and applications as well as project results. In total 28 engineering students and 14 industry partners took part on the project. The students worked in the project for more than 300 ECTS-credits in total.

Most of the students have graduated since the project completion and we discuss here how the project helped them to learn, gain experience and to get a job. The students for interview were contacted using LinkedIn at Internet. Every student who could be reached with LinkedIn network was contacted. We argue that working on an industry-related project gives important skills and self-confidence to the students and contributes to their employment possibilities.

Keywords: *University-industry collaboration, Innovation pedagogy, Project-based learning.*

1. Introduction

Panoste is an acronym derived from the Finnish name of a project which means *deploying new methods in loading machined blanks.* The project was a part of a technology programme called SISU 2010, funded by Finnish Funding Agency for Technology and Innovation (TEKES, www. tekes.fi). The aim of a programme was to develop innovative practices for the manufacturing industry by developing new production methods and manufacturing technologies for industry. The programme had a total volume of 93 million euros and it was implemented during 2005-2009.

Panoste project was coordinated by the Turku University of Applied Sciences (hereafter TUAS). It had 14 partner companies covering South-Western and Western Finland. The budget of a project was 434 697 € and it was carried out between May 2008 and December 2010. The project had two priorities; the first one was to develop a new robotized, cost-effective and flexible manufacturing cell for a machine industry, and the second one was to disseminate information and knowledge relating to new technologies and applications as well as project results. The primary target group for the developed cell was small and medium-sized companies having a wide variety of products.

According to these above mentioned guidelines, the technological targets for the research and development within the Panoste project became:

1) zero point clamping system applications and robotized loading,

2) robotized deburring applications,

3) robotized marking applications,

4) robotized optical and mechanical based measuring applications.

The primary location for the studies and for the building of the cell itself was the facilities of Machine Technology Centre Turku Ltd (hereafter MTC) which is a joint education and development centre utilised by the educational institutes and enterprises within the mechanical engineering in the Turku area.

The project personnel consisted of TUAS teachers, R&D personnel and TUAS students as well as personnel from partner companies. The work was distributed so that the teachers acted as specialists and guides for students, the students themselves made the main work force and the personnel of companies acted as observers, keeping the challenges and problems of the project as realistic as possible. Students involved participated in the project in numerous ways and all together 28 students carried out some of their studies in the project. Although students participating in Panoste were engineering students, the degree programmes themselves were various. The students writing their thesis for the project were simultaneously working as paid project assistants. [1]

In practical industry-driven projects the students can learn important skills. Not only technical engineering substance (like CAD, product development, control systems, etc.) but also teamwork and networking, with both the fellow students and the industrial partners of the project, are trained. The aim of the project was to provide new applications and technologies for the industry, so it was natural to use the principles of PBL (problem-based learning) and CDIO (conceive - design - implement- operate) when working with students. The primary working and teaching methods utilised here were problem-based learning [2] [3], teamwork, peer learning and peer teaching [4] , and self-guidance [5]. The main idea was to see the teaching as tutor-mentor cooperation between students and experts. Teacher-student relationship was similar to a relationship between two colleagues – the only real difference between a teacher and a student was the fact that the former had more professional competence.

Methods of innovation pedagogy were utilised in Panoste, as the project and its subprojects were executed in close cooperation with working life companies similarly to activities TUAS carries out in general [6]. The possibility of utilising a flexible curriculum was also exploited. And finally, a basic infrastructure was not neglected; a comprehensive platform for an innovative product development can be best created and maintained by approaching the topic from the evolutionary perspective where a strategy of an organization and strategic resources are simultaneously adapted and synchronized with external and internal requirements and where a human system is taken account as one of the most elementary factor for an innovative outcome. [7]

The Panoste project was divided into four subprojects, all of which were led by a member of the TUAS staff. The main idea was to divide the workload in a way that staff members would have enough time for all students. The subprojects were divided further into separate tasks, for the completion of which the students were responsible. The tasks varied a lot which was taken account when students were divided into teams of different sizes. Only the thesis writers worked more independently. Students were kept in the zone of proximal development in parallel with the principles of JIT (just in time) – the students were helped only when the completion of the task was in jeopardy. This was the ideal way to get the students to constantly challenge and develop themselves, and to help the project as much as they could. The students learned very much from each other and the cumulative knowledge of the teams sometimes surpassed the knowledge the teachers possessed.

2. Evaluation of the learning outcomes during and soon after the project participation

The basic surveillance of the students was done by weekly reports. The report was an A4-template with five parts for the students to fill out:

1) progression after the last report
2) occurred problems and how they are going to be (or are being) solved
3) plans for the next period
4) uncategorised issues and ideas
5) tracking of working hours.

Throughout the project, there was a weekly meeting, to which every student group and individually working students were asked to participate. During these weekly meetings, typically held at the end of the week, current affairs and problems were discussed together with other project personnel. After these meetings, the project manager and other responsible persons could be sure that every announcement and instruction was disseminated. Memos kept in the meetings were uploaded into an internet-based working platform. Students were instructed to use electric memos, sketch plans and other similar aids, but to use only a single paper notepad. The goal was to ensure that everything would be documented, preserved and easily disseminated. [1]

During the project, the students made many appearances in front of various audiences. E.g, they gave spoken reports at weekly meetings and presented their work to the steering group and visitors. Students also created demos and example cases from the project to be presented to other students and staff on the R&D theme days at TUAS. In addition, the students working in the project took part in company visits. According to the spoken feedback from company representatives and the project's steering group, students were outstanding and convincing performers, and they could well answer most of the questions [1]. The students were also responsible for communicating with most of the suppliers. This responsibility was not limited to simply finding the cheapest components, but students have to compare the total cost of different options, including working time, possible alterations, different working principles, the life cycle of accessories and so on.

The workshop days were also organized where every team and student presented the tasks they had been working on, their working methods and their results. These workshops were carried out by utilising the idea of peer learning and teaching. No limits for the style, location or method of the presentation were given, but each team used a combination of lectures, showcases and hands-on presentation methods. Most students used their breaks discussing their tasks and results with other teams and students. Feedback was described as very enlightening and the concept was seen as an extremely useful one.

Although feedback was collected throughout the project, special interview sessions with the students were organised at the end of the project. Every student was called to have a dialogue with a project manager. Each session lasted from 15 to 30 minutes depending on the student. The sessions were divided into two parts. The first and more essential part concerned the way the project was executed, focusing on methods, facilities, schedules, and so on. Here, the emphasis was on the issues that had to be enhanced or changed regarding to a project executed with students, opinions on the effectiveness of this kind of work and ideas to develop the overall coordination of future projects. Overall opinions about the project based on these discussions are shown in the Appendix 1 at the end of this article. The second part of the feedback interview concerned the personnel, and the student's task was to evaluate the project manager and the people responsible for the subprojects.

3. Later survey of students' experiences

The survey was carried out in the beginning of 2014, three years after the completion of the Panoste project. The students for survey were contacted by using social media (LinkedIn and Facebook). Out of 28 students who worked on the project, we managed to reach 15. The actual survey was carried out using Google Forms and link to the survey form was sent to all 15 students that we were able to reach.

The goal of the interviews was to find out whether the skills learnt during the Panoste project have been beneficial for the students. We assumed that most of the students have graduated and started their work life (questions 1 and 2). That is why we wanted to ask if the students feel the project has helped them to get employed (question 3). Our assumption was that the self-confidence, experience, specific skills and contacts gained during the project have made it easier to get a job. In addition to that, we asked whether the skills learnt during the project have been helpful in their job (questions 4 and 5). We separated the question in two parts: the cooperation skills and the specific engineering skills. The specific engineering skills include, for example, mechanical engineering, modelling with Solid Works, programming industrial robots, pneumatics, measuring technology, deburring and technologies related to zero point fixturing.

For questions 3, 4 and 5 we used a Likert scale from *very negative effect* to *very positive effect*. We wanted to give the students a chance to express if they feel they have learnt some wrong ways of working or something else that has had a negative effect on their work after project.

We also asked if the students would be willing to recommend project studies to other students (question 6). In addition to that, we asked them to explain their opinion in an open question (question 7). We also wanted to hear their opinion about how to improve project based learning. Instead of asking generic improvement ideas, we used a more provocative way by asking *what did go wrong with the project* (question 8).

Survey results

The survey consists of eight questions which are presented in the Appendix 2 here in this article. Out of 28 students we managed to reach 15. Out of 15 students 11 answered the survey.

1. ***Have you graduated?***
All of the 11 students have already graduated from Turku University of Applied Sciences.

2. ***Are you currently employed?***
9 are currently employed (82 %)
1 is currently unemployed (9 %)
1 is currently in further studies (9 %)

3. ***Did the project studies (the experience and gained contacts) have a positive effect on your employment?***
The distribution of results is presented in figure 1a. 3 students (27 %) told that the project has had a neutral effect on their employment. 2 students (18 %) saw the effects as slightly positive and 6 students (55 %) as very positive. The mean of answers is 4,27, between *slightly positive effect* and *very positive effect*.

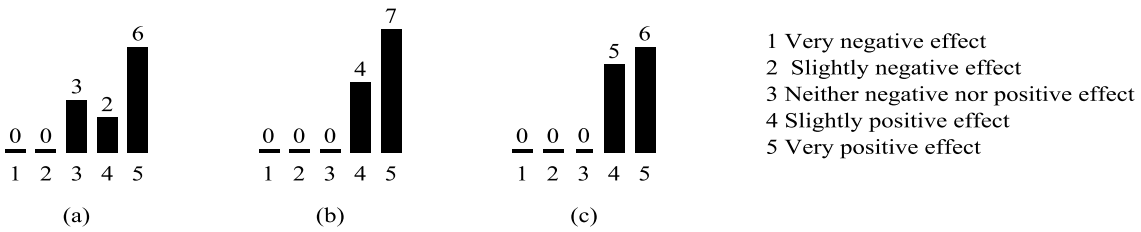

Figure1. The survey results as bar graphs for questions 3-5.

4. ***Have the cooperation skills learnt in the project been helpful in your job?***
The distribution of results is presented in figure 1b. 4 students (36 %) told that the cooperation skills learnt in the project have had slightly positive effect in their job. 7 students (64 %) saw the effect as very positive. The mean of answers is 4.64, between *slightly positive effect* and *very positive effect*.

5. ***Have the specific engineering skills learn in the project been helpful in your job?***
The distribution of results is presented in figure 1c. 5 students (45 %) told that the specific engineering skills learnt in the project have had slightly positive effect in their job. 6 students (55 %) saw the effect as very positive. The mean of answers is 4.55, between *slightly positive effect* and *very positive effect*.

6. ***Would you recommend project studies to other students?***
All of the 11 students were willing to recommend project studies to other students.

7. ***Why do you/do not want to recommend project studies to other students?***
10 out of 11 students (91 %) answered this optional open question. The translated answers are below:

- "The project work in school is very similar to the projects in working life. "
- "Project work is a great way to practice the needed communication and organizing skills that are needed in working life. In addition to that, the students get a picture of their own skills and how they can improve their own know-how."
- "You get both responsibility and freedom to work in things that you find interesting. At the same time you gain experience of team work and managing your own work; it's crucial for the team and the whole project to handle your own schedule well. It is project work that has absolutely given me the most concrete experience and knowledge for working life."
- "Project based training is as close to real life work as possible."
- "Interesting and useful work/research to get ECTS credits. Not just theory."
- "Panoste project gave very good picture of project based work. You learn team work and get to apply your knowledge in a creative way. It's also possible to study even more and deepen your skills while working with the project."
- "You get contacts and collaboration with real industrial companies, because the project was more like actual work, not just practice for the university."
- "There's a lot good to be said about practical, project-based studying. I had an opportunity to work on challenging tasks and be my own boss with scheduling. It was interesting to work with industrial partners and some of the students got valuable contacts from the industry. I got to know nice people and got new friends, since the project team had students from different groups and classes. After I graduated, I got employed pretty much because of the project."
- "The best part of project was that it was very practical and everyone got to choose their own "specialization area". Also, the Machine Technology Center was very good as learning environment and provided us a great place to work in."
- "Gives good balance to normal studies. Practical working and "real life problems" – you can see how the results of your work affect in practice."

8. ***What did go wrong in the project – how can project learning be improved?***
6 out of 11 students (55 %) answered this optional open question. The translated answers are below:

- "We started to take a bit too big steps and did not think through all the details."
- "The involvement and engagement of the personnel varied quite much – some were very engaged, some were less."
- "Communication failed sometimes: there were times when we were waiting for someone, who was not ever aware he was supposed to be present."
- "Nothing at all, I think."
- "Scheduling was a bit difficult and not predictable: sometimes we were suddenly super busy with the schedule. The goals were not always clearly enough set."

- "Nothing in particular. In future it would be good to have even more companies involved and work with them. The contacts are helpful when looking for a job."

4. Discussion

The survey results were very positive, but not all students could be reached for the survey. For next projects it is important to systematically collect the contact information of every student and keep in touch with them after the project, so that this kind of survey would be easier to carry out. Some students told that it is a little bit difficult to remember all the details about the project, because it has already been three years since the project ended. This might be one reason why some students did not fill in the survey even we were able to get in touch with them.

Based on the evaluation during and immediately after the project, the pedagogical results can be seen very positive ones. The methods implemented during the project proved to be quite effective and motivating. Also the students involved felt that learning in this kind of environment was both challenging and rewarding. The students' collective opinion is clear: this kind of university-industry projects are a great way to learn real problem solving and team working skills. All the students told that the project has provided them with skills that have either slightly positive or very positive effect on their current working life.

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APPENDIX 1. Student feedback collected at the interview sessions soon after the project.

Positive aspect / Number of student opinions		Negative aspects / Number of student opinions	
Very motivating way to learn	8	Accessory shortages	10
Motivating and different way to learn	6	Communication problems	8
Practical way to learn	5	Too open tasks, more limits needed	6
Spontaneous, free problem.solving	5	Little cooperation with companies	6
Free schedule	4	Slow project starting	5
Weekly meetings	3	Schedule problems with components	5
Challenging workload	3	Unclear responsibilities and rights	4
Concretises learned theories	2	TUAS staff schedules	4
Atmosphere in project group	2	Need of intensive theory part	3
Real-world problems	2	Need of clear instructions	3
		Need of more peer learning/teaching	3
		Faster component purchasing	2

APPENDIX 2. Interview made three years after the project completion. Questions with answering options.

1. *Have you graduated?*
   - Yes, I have graduated from TUAS
   - No, I am still studying
2. *Are you currently employed?*
   - Yes, I am employed
   - No, I am currently unemployed
   - Other, please describe
3. *Did the project studies (the experience and gained contacts) have a positive effect on your employment?*
   1 Very negative effect
   2 Slightly negative effect
   3 Neither negative nor positive effect
   4 Slightly positive effect
   5 Very positive effect
   6 I have not been employed after the project, not applicable
4. *Have the cooperation skills learnt in the project been helpful in your job?*
   1 Very negative effect
   2 Slightly negative effect
   3 Neither negative nor positive effect
   4 Slightly positive effect
   5 Very positive effect
   6 I have not been employed after the project, not applicable
5. *Have the specific engineering skills learn in the project been helpful in your job?*
   1 Very negative effect
   2 Slightly negative effect
   3 Neither negative nor positive effect
   4 Slightly positive effect
   5 Very positive effect
   6 I have not been employed after the project, not applicable
6. *Would you recommend project studies to other students?*
   - Yes
   - No
7. *Why do you/do not want to recommend project studies to other students?*
   Open question
8. *What did go wrong in the project – how can project learning be improved?*
   Open question