INTERNATIONAL INTENSIVE PROJECTS IN ENGINEERING EDUCATION

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ABSTRACT

European universities organized numerous international Intensive Projects (IP) during Erasmus Lifelong Learning Program 2007-2013. The main principle of international IP was to gather students and teachers from partner institutes together for 2-3 weeks long intensive, project-based learning experience. Students were divided into multicultural teams, which solved a topical engineering problem in CDIO Context.

Subject was selected to be multidisciplinary and comprehensive. Students participating on the IP reported that it was an eye-opening experience. This was due to the multi-disciplinary approach where students were forced out of their comfort zones and were required to collaborate with team members. The class schedule was designed such that student groups were required to do conceive phase, design phase, and implementation phase.

For teachers, the IP was deepening long lasting relationships and was providing an opportunity where teachers could freely open discussions on various topics. The IP strengthened the partnership between the universities. In many cases the IP gave a conceiving ideas for curricula or course content enhancements. In the academic world there are rarely, hardly ever, an opportunity to develop new course content with 10 - 20 colleagues in an international context.

This paper introduces the concept, summarizes the results, and proposes how IP's can be revitalized without external funding.

KEYWORDS

Intensive project, multicultural projects, Project-Based Learning
Standards: 2, 3, 5, 6, 7, 8, 9, 10

INTRODUCTION

Metropolia University of Applied Sciences has experience on participating or coordinating Intensive Projects (IP) with European partner universities. Although the IP's were very successful and they had undoubted benefits for academic co-operation between European universities, the start of new Erasmus+ program in 2014 also same time discontinued Erasmus IP funding. The IP's ended, since without short term mobility support the students

are not willing to pay extra for 2-3 weeks long study period abroad.

The main principle of international IP was to gather students and teachers from partner institutes together - each year in different location - for 2-3 weeks long intensive, project-based learning experiment (Piironen, 2012). Students were divided into 3-5 student multicultural teams, which solved a topical engineering problem as a Design-Implement Experience (CDIO Standard 5). At the end of the IP, student's projects were evaluated, and received credits were acknowledged as a part of degree studies at their home institute. Same partner networks organized typically three rounds of similar intensive projects with different topics. Also it is important to notice that many of the students had not participated in team work using a foreign language before (Kitsnik et al., 2003).

Self-evaluation was an integrated part of the IP. All students and teachers had to participate at least the end evaluation. Some IP's used also intermediate checkpoints to ensure proper workflow during the IP. The analysis results of evaluations were used to improve the concept for the next round of the IP.

Overall, the results from the IP's were exceptional. The aims and objectives were well achieved. International multicultural teams were created and formed European student networks, which some of them are nowadays engineering professional networks. Students learned to develop engineering solutions also for nontechnical, multidisciplinary problems.

This paper summarizes the advantages and challenges of running IP's, and proposes how the IP's could be revitalized without external funds.

POSITIVE RESULTS

The teacher's role in IP differed from the traditional one. They could observe the professional development of the team members when supervising the design and implementation work. All IP partners had similar technical field. However, emphasis was quite different in each curriculum. Orientations concerning system analysis and design are also different. As the topic was chosen to be a real world multidisciplinary solution problem, different kinds of approaches were needed. The IP provided the possibility to apply the approaches developed at each partner institution to a practical application problem.

The project topic or task was multidisciplinary. In this case, the students had to focus on the solution and they were given proper tools, which they had to adapt quickly. Multidisciplinary top down engineering thinking along with Active Learning methods (CDIO Standard 8) was to be used and some technical details were taught 'just on time' basis. Similar approaches are spreading through in engineering education. Running IP's help co-designing new pedagogical approaches, which each partner institute may freely adopt. This way the IP serves also as an international training session to enhance faculty competence and faculty teaching competence (CDIO Standards 9 &10).

Planning of the project was done by a group formed of representatives of all the partners, chaired by the coordinator. That work group made all the needed decisions and definitions. All partner universities were responsible for the tasks that were organized and divided on the meetings prior the IP. Supervision of students during the project was shared by all the partners' representatives. Lectures were provided by teaching staff appointed according to

the special subjects. The main supervision in the Engineering Workspaces (CDIO Standard 6) for the students' group work was provided by specially appointed staff members of the local organizer.

As there have been multiple IPs with the same partner universities, the transnational cooperation works without any problems or special concerns. The effectiveness of the approach where each partner university brings its special knowledge to the IP and actively participates on the student group work was highly effective. Each of the partner universities selected the students from their own organization based on their local criteria. Students were required to have genuine interest and proper fundamental knowledge on the topic. Applicants were ranked by their overall study performance.

Transparent distribution of the funds was ensured by sharing the budgetary information with all the partners, and agreeing on the use of the funds. Typically a round of an IP was funded by Erasmus with 50 000 - 75 000 € depending on the number of participant students and teachers, the duration of the intensive weeks and distance between their home - host locations. Accommodation was organized centrally and paid from the funds by the coordinating institute. Travel costs were collected by each institute, and then the coordinating institute was invoiced for these expenses according to the IP funding rules (75%). The project organization rate was used to miscellaneous expenses resulting from the physical implementation of the IP.

Students participating on the IP reported that the IP was an eye-opening experience (Piironen et al., 2014). This was due to the multi-disciplinary approach where students were forced out of their comfort zones and were required to collaborate with team members. For teachers, the IP was deepening long lasting relationships and was providing an opportunity where teachers could freely open discussions on various topics. A few international joint projects were initiated. The IP strengthened the partnership between the universities. In many cases the IP gave a conceiving ideas for curricula or course content enhancements. In the academic world there are rarely, hardly ever, an opportunity to develop new course content with 10 - 20 colleagues in an international context. Often the subjects were focused on emerging technologies that were not yet a part of regular curricula. Subject was selected to be multidisciplinary and comprehensive. It can be seen new trends concerning both in content and pedagogical approach. International aspects, comparison of teaching methods and benchmarking should be mentioned as objectives of IPs, as well.

The results of most evaluations were very favorable. Commonly there was only a little room to improvement except on the matters related to the facilities, equipment, and tools available. However, from the learning point of view, this forced the students to be innovative and use alternative solutions.

The School of Information and Communication Technology at Metropolia University of Applied Sciences participated in 17 different IP programmes counting altogether 41 rounds. Each round gave an opportunity to 10 students from each partner university to participate. Roughly 400 Metropolia students had a chance to gain an international learning experience in these IP's. Counting all European mobile students and teachers would total to 2500 students and 400 teachers participating in these IP's as listed in Table 1.
Table 1. List of Erasmus IP programmes where Metropolia School of ICT participated.

IP abbreviation	Full name of IP	Years	Venues	Mobile students/ staff
DaSBuG	Data Science for Business and Government	2014	Riga (LV)	50/18
HESUDI	HEalthcare Support Using Domotics and IT	2014	Helsinki (FI)	60/12
Active Games[7]	Active Games	2013 - 2014	Frankfurt (DE), Vilnius (LT)	60/12
Big Data	Big Data	2013 - 2014	Vilnius (LT), Frankfurt (DE)	50/18
ViOpe[7]	Learning Computer Programming in Virtual Environment	2013 - 2014	Espoo (FI), Leiria (PT)	60/14
LBS	Local Based Services	2012 - 2014	Sundsvall (SE), Amsterdam (NL), Istanbul (TR)	60/14
SaSeRoS	Safe and Secure Robots based on Open Source Software	2012 - 2014	Valencia (ES), Espoo (FI)	50/12
SWEB	Secure WEB Applications: Best Practices for Protection and Development	2012 - 2014	Munich (DE), Glamorgan (UK), Cantabria (ES)	60/12
DOSSEE[7]	Developing Open Source System Expertise in Europe	2011 - 2013	Espoo (FI), Alcala (ES), Kapfenberg (AT)	60/15
EPSIAE	European Project for Sustainable ICT in Academic Education	2011 - 2013	Amsterdam (NL), Amsterdam (NL), Birmingham (UK)	60/12
WISDOM	Web Information System Data Organisation Modelling	2011 - 2013	Vilnius (LT), Porto (PL), Helsinki (FI)	50/18
eDSP[7]	Embedded Digital Signal Processing IP	2010 - 2012	Espoo (FI), Vilnius (LT), Coventry (UK)	40/12
Miss Logo	Management Information Systems Supporting LOcal GOvernment	2008 - 2010	Mechelen (BE), Eindhoven (NL), Vilnius (LT)	50/18
Outsourcing	Nearshoring: the Next Step in Offshoring	2008 - 2010	Cracow (PL), Ostrava (CZ), Sundsvall (SE)	60/14
DeSeRTS	Design of Safe and Reliable Technical Systems - Exploring technologies dark sides	2007 - 2009	Bonn (DE), Espoo (FI), Amsterdam (NL)	60/12
Security[7]	Improving the Security Knowledge in ICT - Advanced Technologies	2007 - 2009	Espoo (FI), Amsterdam (NL), Paris (FR)	60/15
QA-ICT	Improving the success of the ICT projects, Quality Assurance	2005	Amsterdam (NL)	60/10

CHALLENGES

One common challenge of multinational educational projects is to match the intensive project such that it does not disturb student's regular studies or traineeship period. This challenge was overcome by agreeing on the timing of the IP as one of the first co-operative planning efforts.

The main challenge is to find sufficient funds. Although Erasmus IP program enabled these intensive projects, there was not enough momentum to continue activities after funding was over. With the grant we could support 75% of the travel costs, 100% of student's accommodation, and subsidize partly student's meals. The grant could not be used for wages, which was one of the major expenses. On the other hand the IP produced credit points for students, which is the main purpose for operating a university.

Surprisingly also recognition of IP credits as a part of student's curriculum in degree programme required sometimes extra persuasion. Typical excuses were "full curriculum with no room for optional studies at all" and "IP was not on the curriculum during the last accreditation time". Although the professors of degree programmes were involved on the development of the IP, it seemed that there was some kind of communication gap in between the department and student affairs office.

CONCLUSIONS

The benefits of organizing multinational intensive projects is evident. However, some issues must be solved first before we can realistically start intensive projects in large scale again. The intensive project should be made a part of regular curriculum. However, since we cannot realistically organize massive intensive periods abroad, it should be an optional part of the studies. Modern communication and social networking tools offer an interesting opportunity to virtualize the mobility part of the IP. Nowadays anyone with decent connection to internet can do video conference calls, live video broadcasting, co-editing documents, transfer files, send quick messages, co-scribble whiteboards, and do almost anything which required a physical working area just a decade ago.

We are looking for few brave partners to start developing the IP concept to a new level. All challenges are solvable if we just find the common desire to start doing instead of just continuing the discussions.

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BIOGRAPHICAL INFORMATION

Antti K. Piironen, Ph.D. is a Principal Lecturer of Smart Systems Engineering in the School of ICT at Metropolia University of Applied Sciences. He collaborates regularly with universities in Europe on topics related to joint courses, teacher exchange, and curriculum design. His current scholarly activities focus on the providing professional ICT engineering education using mixture of modern and traditional teaching tools and methods.

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