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An International Blended Learning Experience based on Real-World Problems

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Colibri: An International Blended Learning Experience based on Real-World Problems

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Abstract

Colibri is a European project funded by Erasmus+, where seven universities, a governmental organisation and two enterprises work together and explore new and innovative approaches to teaching. As part of the project we offer a joint course during the spring semester which was followed by 30 students in 2015. It contains both course and project activities. In this paper we describe our experiences from the project work, from the initial formulation of the project problems by the companies, over the organisation of the seminars and virtual collaboration phase to the final exams.

The whole course was organised as follows: First there was a virtual kick-off meeting for all students and teachers. This was followed by a phase where students studied different modules online. Each student chooses an individual combination of modules that fits his/her background while also supporting the later project work. After the online modules, the students and teachers all meet physically for a week in Istanbul to finalize the modules and begin working on the real life projects provided by the enterprises. Then there was a period of virtual collaboration in the groups followed by the final seminar in Riga where everyone (students, teachers, and company representatives) met to finalize the projects, prepare for presentations/exams, and conduct examinations.

Overall, the project was successful and received positive evaluations from the students, particularly regarding the international and interdisciplinary dimensions. On the other hand, we also learned how important it is to facilitate the collaboration, group work, and project planning during the first physical seminar. We found that it is both challenging and important to be very explicit about what exactly is expected from the students, as both students and supervisors have differing understandings of what a project is. Discussing the learning objectives with the students to obtain a common understanding can be a useful tool.

Keywords: Project work; Problem Based Learning; Blended Learning.

1 Introduction

The Colibri project (Colibri, 2016), (Lopez et.al, 2015) is Strategic Partnership funded by Erasmus+, which aims at tackling some of the main challenges the European educational system is facing (European Commission, 2011) including:

- The need for enhancing the quality and relevance of the learning offer in education by developing new and innovative approaches, and by supporting the dissemination of best practices.
- Increase labour market relevance of learning provision and qualifications.
- Promote the take-up of innovative practices in education by supporting personalised learning approaches and collaborative learning, by making use of ICT and Open Educational Resources, and by exploring the use of blended and virtual mobility.

As part of the project, a joint course based on blended learning has been developed between all the participating organisations: 7 universities from different countries, 1 governmental organisation, and 2 private companies. There is a Colibri course during the spring semester in three consecutive years and each year it is adjusted according to comments from the previous year in order to improve and try out new methodologies. The course is entitled "Future Internet Opportunities", and focus on exploring business, technical and social aspects of Future Internet Opportunities. The course consists of both course modules, where each student

follows his individual track/combination, and project work where students with different profiles work together on solving a real-life problem proposed by the involved companies.

The course is being followed by students from all 7 universities, and consist of the following phases:

- A development phase (October - February), where the content of the course is developed in collaboration between staff from all organisations. This includes a one-week teacher training seminar with focus on development of teaching methods and exchange of knowledge on best-practices.
- A virtual kick-off meeting in February, where the students are introduced to the course and each other.
- A First virtual phase, running from February through April, where the students follow a number of modules based on blended learning. We offer 10 different modules, where each can be taken at introductory, basic or advanced levels. All students follow all modules at introductory level, and then chooses a set of modules to be taken at basic and advanced levels. The topics include more technical topics such as wireless networks and future Internet architecture, more usability focused topics such as Information systems and Services and applications, and more business oriented topics such as Enterprise architecture and Entrepreneurship. The modules are mainly based on online learning materials, but some also make use of virtual peer learning.
- A midway seminar in April, where the modules are finalised and the students introduced to the groups and project work. The seminar is physical, so all students and teachers/supervisors are gathered for five days. The first days focus on finishing the modules, along with training in group work, whereas the last days focus more on the problem based project work in groups.
- A second virtual phase, running from April through July, where the students work on the projects virtually.
- A project seminar in July (5 days), where all students, supervisors and company representatives would meet to finalise the projects and conduct the exams.
- The period from August to September is reserved for evaluation, documentation and dissemination.

The course counts as a 5 ECTS course, and thus the workload for the students is expected to be 140 hours, including preparation, self-study activities, seminars, project work and examination. In order to help align expectations with the students, we provided a suggestion of how the workload would be distributed with 4 hours for the virtual kick-off seminar, 41 hours for the modules, 35 hours for the midway seminar, 25 hours for the virtual project work, and 35 hours for the project seminar.

Colibri runs for three years, and so the cycle is repeated three times. Every year new tools and methods are used, and the course is adjusted according to the previous experiences. Both development of course material and blended learning activities is funded by Erasmus+ (Strategic Partnership framework). There is funding for a total of 4 students per country per year, so 28 students in total, but the first year two additional students participated from other funding sources.

In this paper, we will focus on describing the approaches with the projects, our learning points from the first year, and our ideas for adjustment in the second year. The paper is organised as follows: After the general introduction to Colibri in Section 1, we introduce the project approach in Section 2. Section 3 summarizes the feedback from students, teachers and companies, and Section 4 describes our learning points and suggestions for adjustments. Section 5 concludes the paper and summarizes our contributions.

2   The project approach

The basic idea has been to let students work together on real-world problems posed by real-world companies in groups with students of different nationalities and with different cultural and scientific backgrounds. The approach is inspired by how Problem Based Learning is carried out in Aalborg University (Kolmos et al., 2004) as well as the CDIO initiative (Crawley et al., 2007) implemented in UPC and experiences from RTU with self-organized student groups working on real-life problems (Kapenieks et al., 2002). Problem Based Learning in online settings is described and discussed in e.g. (Lajoie et al., 2014) and (Savin-Baden and Wilkie, 2006).

In Problem Based Learning, the problem formulation is the "driver" of the project, and based on this the students are responsible for choosing appropriate methods and tools in order to solve it. This requires the students to work rather independently. In Colibri this, including the process of understanding and narrowing down the problem formulation, is done in close collaboration with the academic and company supervisors each group is assigned. While the purpose of the project is to facilitate the learning of the students, it is important that the problems are highly relevant for the involved companies as this ensures a higher commitment, and the fact that the companies can get useful inputs/ideas/solution proposals is a key motivational factor for their participation in this kind of learning processes.

Compared to existing work, our main contribution lies in the international and blended approach where students work together across universities and disciplines through a combination of physical and virtual collaboration. In the following, the process from formulation of project proposals to exam and feedback received at the end of the course, is described.

2.1 Developing the project proposals

Within the project consortium there are two companies (Talaia Networks and Atene KOM) as well as a Greek governmental organisation (The National Hellenic Research Foundation, NHRF). Well ahead of the midway seminar, these organisations come up with 2-4 proposals each based on their own real problems/challenges/opportunities while at the same time respecting the learning objectives of the project. In this regard, NHRF acts as a collaboration partner with different smaller companies, and formulates problems together with these - in this way we were able to obtain problems from also smaller companies and start-ups. The project proposals were then reviewed, revised if needed, and finally accepted by the project coordinator together with the local organiser of the midway seminar. While the formal reason for this was to align the proposals with learning objectives and student backgrounds, it also allowed for a good dialogue and thus improved project proposals. One of the challenges we were facing in the process was to find the best trade-off between "real" problems and at the same time ensuring that all students would be able to contribute with their specific knowledge.

The problems to work on should not only be "real-life", but also fit into the learning objectives of the course, and thus the students would need to take into account technical, business and social aspects of Future Internet. In order to succeed, the students would need to work together and all contribute with their backgrounds including the modules they selected during the first virtual phase as well as the competences they had before starting with Colibri. Given the time frame of the project, it is not possible for the students to implement or build a solution, so at the end they are expected to develop and qualify concepts/ideas rather than final solutions. One example of a problem is from Talaia Networks, who is making network monitoring and visualisation solutions. They would like to design a strategy for extending their market from academic institutions to the private market, including e.g. identifying potential costumers, understanding their needs and which new features/functionality is needed, and develop a business model canvas.

2.2 Project selection process

Since the first part of the course (kick-off meeting and completing the modules) was entirely virtual, the students would meet each other for the first time at the midway seminar. We therefore chose to use the midway seminar to start off the project period including presentation of projects, forming of groups, and assignment of supervisors. In this way we could also properly introduce the students to problem based project work in groups, including project management, time planning, conflict resolution etc.

Presenting the projects in a physical meeting also made it possible to better clarify the requirements and expectations from the students. Doing so was actually more challenging than initially expected, since both students and supervisors from different traditions have different ideas of what a project is and what the students are expected to deliver; in particular, some universities are quite focused on problem analysis and the problem solution process, whereas others are more focused on task solving and implementation. In our experience, neither students nor staff are used to be explicit about these expectations, but build upon either an implicit understanding of what a good project is or by looking at previous project examples. We used the learning objectives to explain and discuss our expectations with the students.

There is an important process in forming groups and distributing or selecting the projects. In Aalborg University most often the students are responsible for forming groups and for selecting a project they would like to work on (there can be practical constraints and limitations). However, in this setting we need to keep in mind that the students don't know each other very well, that the students have different levels of experience with problem based project organised learning (some have formed groups before, some have not) and that the students only have limited time together to sort out disagreements and conflicts. Regarding the group formation, we also wanted each group to consist of students with different backgrounds and nationalities. Therefore, it was decided to create the groups administratively, and to announce the groups at an early stage of the midway seminar. This made it possible to also base some of the initial team-building exercises on the groups.

Regarding the group formation, a total of 8 groups were made, thus with 3-4 students per group. Each group would consist of people of all different nationalities, and with a diversity in technical and cultural backgrounds.

Regarding the project selection, we chose to do this randomly through a public draw. While this made the selection fair and transparent, it did not make it possible to assign projects based on interest or special knowledge/background available in the groups. But it did ensure that the students could start working on their projects straight away instead of first going through a project selection process, which could potentially lead to disagreements and conflicts, and where it might not be possible to assign all groups their favourite choice. The supervisor distribution was agreed upon between the supervisors just after the project distributed, based on supervisor knowledge/interest, and in a way so that supervisors would only supervise students not from their own university (i.e. a supervisor from UPC would supervise a group with only non-UPC students).

2.3 The project work in groups

The groups were announced on the second day of the midway seminar. In this way, the groups were working together during the second teambuilding exercise, and thus started to get to know each other. The third day included several elements related to the project work: The students had a workshop with introduction to group work including project management, time planning, group collaboration, intercultural communication and conflict resolution. While this was introduced through a short lecture, the main focus was on students reflecting and discussing together, role plays, and personality tests followed by discussions in the groups. It was an intense workshop, but very important since the students would have only little time together before starting the virtual collaboration. On the last two days of the seminar, the students were working on the project in groups with the main focus on problem analysis and on planning the virtual collaboration phase. At the end of each day, each group would make a pitch presentation of their progress (based on a list of requirements provided by the supervisors). During this time, the supervisors would be around to support the students. The time was also used for having supervisor seminars to discuss topics related to good supervision practices. We encouraged the students to also make use of other supervisors than their own, in order to benefit from the expertise knowledge available.

From previous Intensive programmes, e.g. (Pedersen et al., 2015) it was our experience that the exam form with presentations in front of all other students would be challenging for some of the students: For some it would be their first project based exam, their first presentation in front of an audience, and their first presentation in English. Therefore, we organised already in the midway seminar workshops with training of presentation techniques including video recordings and individual feedback. This was very well received by the students.

After the midway seminar, the students were expected to spend approximately 25 hours each on the virtual group work. While we could have chosen to let the process of finalising the project be completely student driven, we found it was important to help the students get at least a common view on what should be the outcome of the virtual phase. We therefore asked each group to prepare and upload a 20-minute presentation (PowerPoint or similar) at least one week before the project seminar. This presentation should be self-explanatory and contain:

- An analysis of the problem at hand
- The expected outcome
- A preliminary suggestion for design of a solution
- A plan for what work to carry out during the project seminar

- At least three critical questions that the students would like to receive feedback on

Apart from this, the students were organising their own work, and they could ask their supervisors for support as needed. Each group had the opportunity to hold at least three virtual meetings with their supervisor. Both groups and supervisors approached the tasks differently; In some groups the process was well organised from the beginning and went very smooth. For others it was a more difficult process, and it turned out challenging to agree on tasks and meeting times. However, all groups managed to prepare the required presentations before the project seminar.

The project seminar was started by providing feedback to the groups from supervisors, company representatives, and other students. The groups were divided into pairs, and then each group would present their project (based on the uploaded presentation) and receive feedback both from students, supervisors and company representatives. In the next days, the students were working on the projects with support from supervisors and company representatives. They were again encouraged to benefit from the presence of experts in different fields, and they did so more than in the midway seminar. They also provided feedback on each others work, e.g. through daily progress presentations.

The training of presentation techniques from the midway seminar continued, now with more focus on the final presentation. We had cameras and tripods that the students could borrow for practicing their presentations. We experienced that the students appreciated this, and that they became both much better and much more confident with their presentations. It was also one of the aspects that received consistently positive comments in the evaluations.

2.4   Project documentation, examination and feedback

The requirements for the project were defined from the very beginning of the course to help everyone get a common understanding of the requirements. Basically, the students were asked to for each group:

- Upload what corresponds to a 30-minute presentation in PowerPoint or similar (one presentation per group). This format was chosen in order to let the students focus on the problem solving part which requires collaboration and discussions, rather than spending time on preparing and writing a nice looking report.
- Prepare a 2-page document describing the learning process of the project. This document could contain (but was not limited to) aspects such as: Group work organization, remote interaction and experience, main challenges, valuable learnings and outcome of the course. The idea behind this reflection report was among other things to ensure that the students would reflect on what they have learned during the course.

We also used the learning objectives to discuss these requirements with the students. It was done in different ways, but in the most elaborate case the students had to specify exactly how they would meet each of the learning objectives.

The examination was done one group at a time, and contained the following elements:

- A 30-minute presentation, where all students in the group should actively contribute.
- A session with questions from supervisors, where all students should actively participate in discussions. The questions would take the starting point in the project, but cover all modules the students had participated in.
- An individual assessment of each student by examiner and censor (pass/fail)

The students also received feedback and questions from the involved companies, either directly or through video link. The seminar was co-located with a project meeting on the first two days, which made it possible for all to receive feedback on their initial presentations, and most also received additional feedback afterwards e.g. through email.

One challenge when conducting a joint course is to ensure rules and procedures for every possible case (i.e. students failing, students being ill or exam complaints). In order to be able to handle such cases in unified and unambiguous ways, it was chosen to follow the rules by Aalborg University in all such cases.

3 Evaluations from students, teachers and companies

In this section, we will present a summary of both quantitative and qualitative feedback received from students, teachers and company representatives. It is based partly on evaluation forms and partly on the reflection reports the students had to hand in together with the project presentations. Moreover, both company representatives and supervisors have delivered written, qualitative feedback as well.

3.1 Feedback from students

Figures 1-5 show the qualitative feedback from the students, specifically related to the projects. The evaluations are collected from the students on the final day of the project seminar.
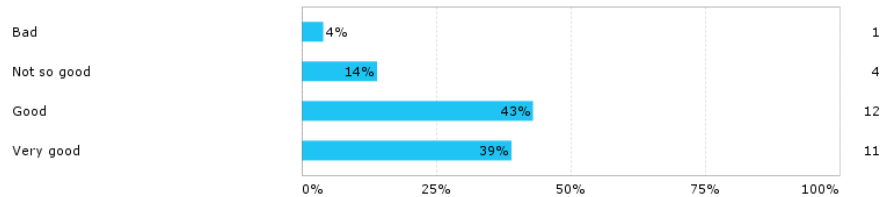
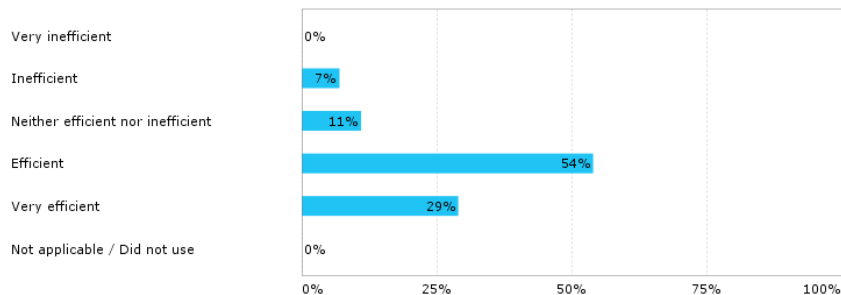Figure 1. Please rate your overall satisfaction with the project.

Figure 2. Please rate how efficient the following parts of the project have been for you with respect to learning: The project overall.
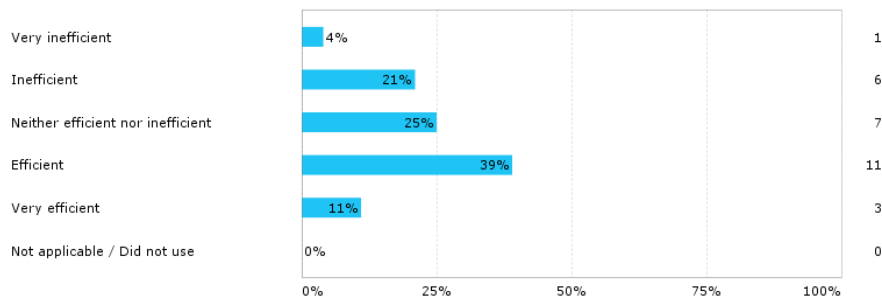
Figure 3. Please rate how efficient the following parts of the project have been for you with respect to learning: The virtual collaboration in the group between midway and project seminars
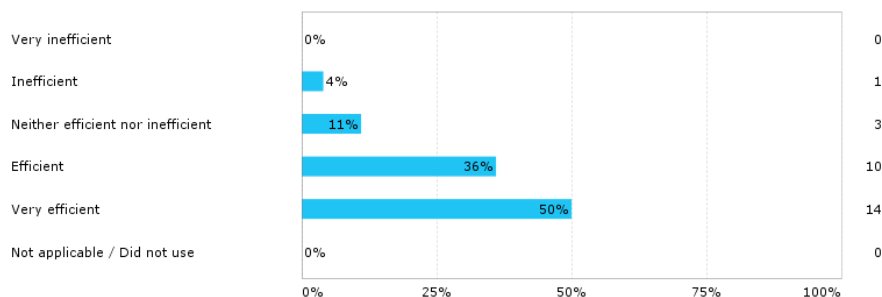
Figure 4. Please rate how efficient the following parts of the project have been for you with respect to learning: The physical collaboration in the group (midway and project seminars).
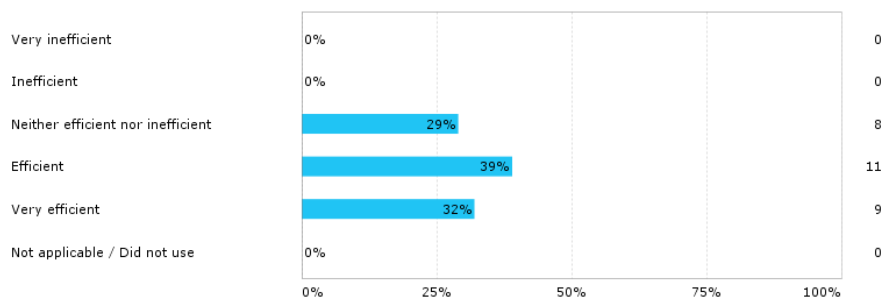
Figure 5. Please rate how efficient the following parts of the project have been for you with respect to learning: The use of blended learning overall (mix of virtual and physical mobility)

We see in Figures 1-2 that the students are generally happy with the project. However, there are also students who are less happy about the project. Among the most satisfied students, many point towards the following:

- The international dimension
- Working together with students with other cultural and academic backgrounds
- The mix of academic, cultural and personal development
- Getting to work with real problems from real companies.
- Technical students were happy to learn more about the business context of the work, and business-oriented students were happy to learn more about the technical context of their work.

Among the less satisfied students, the most common points were:

- It was unclear what was expected from the project
- It was not clear how the projects were related to the modules
- Project descriptions were vague
- The groups were formed late in the midway seminar, so not enough time to get to know each other.

Studying figures 3-5 it is clear that the physical part of the blended learning overall received better ratings than the virtual collaboration. Especially from the reflection reports it can be seen that there is a big variation between the groups in how well the virtual collaboration worked out. It is difficult though to point out exactly what makes it work in some groups but not in others, but it seems that the groups who were successful in project management and planning generally were happier about the virtual aspects.

Some students found the project descriptions to be broad, vague or imprecise. We believe this is not only related to the formulation of the projects, but also because it is important to formulate clearly the goals and expectations when working problem oriented rather than task oriented.

In addition to the specific evaluation of the project, the students were also asked to evaluate the Colibri project overall (including e.g. the modules). On a general level, the students found that the teaching methods in Colibri increase the quality of the learning offer (average 3.7 on a scale 1-5), that the teaching methods increase the relevance of the learning offer (average 3.7 on a scale 1-5), and that the teaching methods used in Colibri increase the labour market relevance of learning provisions and qualifications (average 4.0 on a scale 1-5).

On a personal level, the students found that the teaching methods to a high extend will make them better prepared for the national (average 3.9 on a scale 1-5) as well as international (average 4.3 on a scale 1-5) labour market.

3.2   Feedback from teachers/supervisors

The qualitative evaluation from the teachers/supervisors covered the whole course, including modules and projects. They found that the teaching methods in Colibri increase the quality of the learning offer (average 4.0 on a scale 1-5), that the teaching methods increase the relevance of the learning offer (average 4.4 on a scale 1-5), and that the teaching methods used in Colibri increase the labour market relevance of learning provisions and qualifications (average 4.4 on a scale 1-5). Besides the positive comments regarding working on real-life problems in an international and multidisciplinary environment, the ability to exchange best practices between

institutions is highlighted by several of the teachers. Also, it is highlighted that the blended approach makes it possible to give a highly international experience on a moderate budget, and in a way that is accessible also for students who are unable to travel for longer durations.

3.3 Feedback from company representatives

The qualitative evaluation from the companies covered the whole course, including modules and projects. The companies generally found that the teaching methods in Colibri increase the quality of the learning offer (average 4.1 on a scale 1-5), that the teaching methods increase the relevance of the learning offer (average 3.7 on a scale 1-5), and that the teaching methods used in Colibri increase the labour market relevance of learning provisions and qualifications (average 3.7 on a scale 1-5). The feedback from companies pointed a bit in different directions. As a general conclusion, the multidisciplinary work in a cross-cultural environment, focusing on real problems, and based on remote collaboration, was seen as a very positive supplement to the existing learning offer.

4 Learning points

Based on the experiences from the project work as described in section 2, together with the evaluations from students, teachers and companies as described in section 3, we have derived a number of learning points which will be described in the following. Where applicable we will also describe how we plan to take these learning points into account in future versions of the course.

Generally, students as well as teachers and company representatives were happy with the projects. Especially the aspect of international collaboration was highlighted as positive together with the work on solving real-world problems in interdisciplinary groups. However, we have derived the following learning points, indicating also

- When working with students from different institutions and learning cultures, it is important to be very precise regarding the expected outputs. This is especially true when only remote interaction is possible. It seems that students from different universities have different understandings of what a "project" is, and it is necessary to create a joint understanding of what the students are expected to deliver during this project.
- We found that discussing the learning objectives with students was useful for aligning expectations. We will consider working more structured on this part in the next edition of the course, and consider if we should require each group to specify in writing how they intend to reach each of the learning objectives.
- In the midway seminar, we tried to focus a lot on bringing the students together and introduce them to team work, different personalities and cultures, conflict handling, project planning etc. However, it seems like we could do even more, and also consider bringing the groups together before they start the course modules. This would also allow for more interaction in the groups from the beginning of the midway seminar.
- Some students found it initially difficult to figure out how their knowledge (whether it was from their previous education or Colibri modules) could be brought into use in the context of the projects. This might be something we could practice more during the midway seminar, e.g. through shorter workshops on problem solving.
- By creating the groups before they start the course modules, it would also be possible to discuss the technical roles of the group members even before the module selection, and to let them coordinate which modules to choose in order to support their different roles.
- Given that only remote interaction is possible we would also recommend to monitor and support the students in a structured way during the virtual collaboration phase. This can be done for example by providing templates for minutes and ask them to report on their progress in specific intervals. However, there is a trade-off between "forcing" the students to a specific structure, and asking them to organise the work themselves.

- Not only the students come from different backgrounds – so do the supervisors. A short supervisors guide with help and hints could be useful, especially if combined with discussions and reflections during the seminar to create a joint understanding of the supervisor role.
- It is our experience that the more concrete the problems are, the easier it is for the students to get hold on, especially given the relatively short time available for the projects. However, a part of working problem based is also that the students should not just be given a specific task. It would be helpful if company representatives were physically present also during the midway seminar, to help understand and narrow down the problems.
- Also, we note that the students were very positive about the training of presentation techniques. For many it was their first exam where they had to present in a foreign language and in front of a large audience.
- Before starting to work on the projects, the students followed different course modules to support the project work. It seems that the relation between courses and modules were not always clear. While not all modules were used in all projects, maybe this line could be clearer by keeping the content of the modules in mind when drafting the project proposals. However, if project proposals are adjusted there will often be a trade-off between how" designed" it is and how well it reflects the real challenges in the company.
- In this edition of the project, we assigned the projects randomly to the groups. If we have a clearer idea of which projects rely more on which modules, we can do the assignment so there is a better fit between the competencies in the groups and the projects they are assigned.
- Some students expressed that they would have preferred to choose the projects by themselves. This is worth considering, since it might create more ownership and enthusiasm among the students. On the other hand, there are two drawbacks. It would take time to discuss project choices, and we still might not be able to give everyone their first choice. Also, it could potentially create conflicts in the groups that could be hard to resolve given the limited time available during the midway seminar.

5 Conclusions

This paper has demonstrated how problem based learning can be done in a highly international and interdisciplinary environment, across universities, and through the combination of physical and virtual collaboration. Overall, the project was successful and received positive evaluations from the participants, particularly regarding the international and interdisciplinary dimensions, and regarding working on real life problems from real life companies.

We also gained important experiences which will help us improve the teaching methods during future offerings of the course. In particular, we will spend more time in the midway seminar to facilitate the collaboration, group work, and project planning. We will also try to create a better link between course modules and projects, and change the way we distribute projects between groups so they fit better to the student's backgrounds. On the other hand, we will focus more on training the student's problem solving abilities, and thus help them to bring their knowledge into play when facing concrete real-life challenges.

We found that it is both challenging and important to be very explicit about what exactly is expected from the students, as both students and supervisors have differing understandings of what a project is. We will try to work on this part, for example by discussing the learning objectives with the students in a more elaborate fashion.

Finally, we gained valuable experiences in how to combine project work and blended learning. There is a potential in improving especially the virtual part of the blended learning, e.g. through supporting the students better in structuring this part of the project work.

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