

EPIC: Making Multinational Student Projects Happen

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Abstract

EPIC (Improving Employability Through Internationalization and Collaboration) is an Erasmus+ 3 year Strategic Partnership, which explores how blended learning can support multinational and interdisciplinary student projects. In this way it searches to combine the flexibility and cost-effectiveness of virtual collaboration with the benefits of physical meetings for establishing the collaboration. It is carried out in collaboration between eight European universities and two companies. This paper describes the experiences from the first year, where seven different projects with a total of 25 students were carried out during spring 2018: The projects differ in terms of group sizes, student workloads, and academic levels. Even though the projects are different, a similar structure is defined throughout the semester: In particular, all students follow a short virtual course before the semester starts, then all students and supervisors meet for a one-week seminar in February. From there the collaboration is mainly virtual, with the possibility for each group to meet one additional time. By the end of May a joint report has to be submitted. This paper describes how the projects were set up and executed, along with evaluation results and experiences. Overall, all stakeholders found it to be a good experience, but also with some challenges: A main contribution of the paper is the discussions of two of the most challenging aspects, namely, how to facilitate that the students actually work together when evaluated according to their home university rules as well as how to facilitate supervision in a setup like this, which is more complex than usual problem based learning projects.

Keywords: Interdisciplinarity, Blended learning, Problem Based Learning, Teamwork, Internationalisation.

1 Introduction

Students that graduate today are educated for a global labour market, and companies and projects are often set up across borders. Employability is getting higher on the agenda in higher education and especially in engineering education (Small, Shacklock, & Marchant, 2017; Craps, Pinxten, Saunders, Cruz, & Langie, 2017). It is therefore necessary to equip the students with the competences that enable them to operate under these circumstances, including skills to work in multinational teams, skills to work in close collaboration with industry, and skills to work together across disciplines. This is also in line with the policy of the European Commission (European Commission, 2011), and builds well upon the well-known Problem Based Learning (PBL) model (Kolmos et. al, 2004). The ERASMUS+ EPIC (Improving Employability Through Internationalization and Collaboration) project searches to develop a way to provide the students with these skills through working together on projects across disciplines and countries and in collaboration with companies. It builds upon a good experience from the ERASMUS+ COLIBRI project (COLIBRI, 2018) which showed that students, teachers and companies find that working on smaller multinational student projects is very beneficial for the students. In the case of COLIBRI, the learning activity was organised as a joint 5 ECTS course, including both seminars and virtual work. This approach, while receiving good evaluations from all stakeholders, did not offer the companies the same value as larger projects with a higher workload for students, and it also required many ad-hoc solutions to ensure that all students had the project recognized in terms of ECTS points.

In EPIC these shortcomings are avoided by offering the collaborative projects based on existing student projects, which are transformed into collaborative projects through EPIC: For instance, semester projects, thesis projects or even smaller research projects. In EPIC the students work together on a joint problem to develop a joint solution. There is a requirement of a joint EPIC hand-in that covers both the learning process and the content of the project, but otherwise hand-in and examinations are done according to the rules of each institution, reflecting the learning objectives of their students. Also, timing of e.g. project start and finish is

done according to the home university rules, meaning that the students do not always start or end at the same time. While this does indeed solve the challenges stated above, it requires a very careful design of projects, supervision and support to ensure that the collaboration actually happens.

Another approach to international student projects was taken by e.g. the Technical University of Munich in 2009 through the GlobalDrive project, an initiative that is still ongoing. It was initiated by the institute of Automotive Technology (FTM). Each year, 3 - 4 students from FTM start an individual project together with a foreign team. A foreign team is selected from the globalDrive consortium spread among 9 universities all over the world. Similar to EPIC, the industrial partners are also involved and the kickoff is always done at a foreign partner university. This is the place where all students and supervisors get to know country and life abroad. At the end of the semester, there is a multi-week stay of the whole team in Munich to finalise the project activities. In contrast to EPIC, the sole research focus is on automobile industry and the whole project is driven by FTM (GlobalDrive, 2018). Other works within the field focus on particular aspects of the setup, e.g. on how IT tools support collaborative learning, e.g. (Reis et.al, 2018) and (Weiman et.al, 2013), or the pedagogical aspects of student participation in globally distributed project teams (Bartel-Radic et. al, 2015). The latter study is based on only virtual collaboration. Some of the challenges they experience with respect to e.g. communication and conflict handling is exactly what EPIC searches to address during the physical seminars.

In this paper, we focus on discussing the project work and supervision, and in particular addresses two of the challenging aspects: how to facilitate that students actually work together when their work is evaluated according to the guidelines of their home university, and the related question of how to facilitate supervision in such an environment. It extends the previous contributions in (Pedersen & Jensen, 2018) through focusing more on how the project work was supported through various learning resources, training materials and supervision. We will refer to the previous contribution for further details on how EPIC and the student projects are setup. The paper is structured as follows: First we provide a brief overview of the setup of the EPIC project and its organisation in Section 2, then present the first year cycle in Section 3, the evaluation methods and results in Section 4, discussion in Section 5 and the conclusion in Section 6.

2 EPIC setup

In this section we provide a short description of the EPIC setup. This is described in further detail in our previous paper as well (Pedersen & Jensen, 2018), and on the EPIC website (EPIC, 2019). EPIC is an Erasmus+ Strategic Partnership with eight universities and two companies, presenting countries from all over Europe: Universitat Politècnica de Catalunya (Spain), Saxion University of Applied Sciences (the Netherlands), University of Stavanger (Norway), Abdullah Gul University (Turkey), Hamburg University of Technology (Germany), Riga Technical University (Latvia), UTP University of Science and Technology (Poland), Aalborg University (Denmark), Atene KOM (Germany), Auvik Networks (Spain). The universities represent widely different teaching traditions, from a focus on "classical lectures" to a strong focus on PBL – any many in-between. To be able to do project work in this diverse setting, it is crucial to support the whole process from defining projects and problems, to seminars and evaluations. To do this, a number of materials are developed:

- Training materials for students, which combine online materials with materials used during the seminar(s). The main focus of this material is to support the collaboration process, and special effort is made to ensure that the materials are actually used in practice, e.g. through the provision of templates for project work.
- Training materials for teachers. These are mainly online materials, but also materials used during the teacher training of the seminar. One of the main tasks of this material is to clarify the roles of the different supervisors involved, but also to give the supervisors tools for working with companies and in interdisciplinary and multinational settings. Aspects of virtual collaboration are also important.
- Guidelines for companies, which will both encourage companies to participate in the project and provide them an overview of different roles a company can play also depending on their willingness to invest resources/time. The guidelines also support supervision and describe different kinds of supervision and supervisor roles, and how to handle challenges and unforeseen situations. Finally, advice on how to ensure that the student projects create value for the companies is provided. This is important also to ensure that companies will participate in the future.

- A public online data bank with learning resources for the projects. The purpose is to support that the students can find relevant knowledge for their project work when they need it. It is not so much materials produced by us, but rather pointers to material of good quality, which is available from other sources.
- A framework for setting up project proposals and projects. This is necessary to handle the complexity in matching industry interest with the students' learning objectives, and to ensure that all project groups are multinational and with the right fields of studies represented.
- A description of methods to assess and document the students' learning. This is also important for the students, as it helps them to understand the learning objectives and workload of each student, and to use this information to define the role of each student in the project. It also presents peer assessment as a tool for evaluating the contribution of each student throughout the project period.

The project is running for three years, starting in September 2017, and each year a cycle is repeated that allows for testing, evaluation, and adjustment of the approach: A planning meeting is held in September, followed by a preparation phase October-January, where the materials are prepared and students selected. In fact, some students start their project work already in January. In February the projects are really starting with a 5-day seminar for all students and supervisors, which includes both student centred activities and teacher training activities. The virtual project work runs from February until July, where each student group also has the option of a second physical meeting. July-August is the evaluation phase. EPIC is co-funded by the Erasmus+ programme of the European Union, which made it possible for the students to participate free of charge.

3 The first year cycle

In this section we describe the experiences from the first year of EPIC and discuss some of the experiences that led to adjustments during the second year. The timing of the study activities for the first year is illustrated in Figure 1. As it can be seen, both start and finish time for the project work varies a bit from university to university: This is something the students need to consider when planning their work. The joint project hand-in deadline was set to June 1, which was close to some of the earliest local deadlines. However, some groups all had later deadlines, and were granted a later joint project hand-in as well.

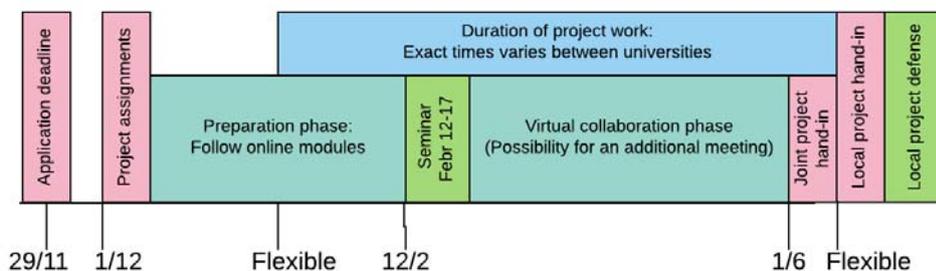


Figure 1 Timing of the project work during the first year of EPIC.

3.1 Project setup and student selection

Each university developed project proposals together with companies, and offered these to the students across the consortium. Then the students selected a project when applying for EPIC. However, some adjustments had to be made to ensure that all projects that were done had students from multiple countries represented. Eventually, seven projects were chosen, with a composition of the groups ranging from two students (from two countries) to nine students (from four countries). A total of 25 students participated in the first year. Table 1 provides an overview of the participants of the largest project with nine students, to show the diversity of the participants.

Table 1: Overview of the EPIC Honeyjar project

Type of Thesis	ECTS	Duration	Focus of the report	Joint part	Other comments
Semester project (5 students from DK). 2nd semester.	15	Feb-May	System development, technical aspects.	EPIC report, Plan of Action, joint system development.	An additional physical seminar was organized in Barcelona (UPC) in order to discuss with their UPC supervisor, and to present and get feedback from the industry partner Auvik Networks.
Project of Smart Solutions Semester (6th semester) (2 students from NL)	24	Feb-June	Business aspects	EPIC report, Plan of Action, joint system development.	
Project work (1 student from Turkey) (6th semester)	8	Feb-May	Technical aspects: Machine learning	EPIC report, Plan of Action, joint system development.	
Project work (1 student from Poland) (6th semester)	5	Feb-May	Technical aspects: System architecture	EPIC report.	

There are some inherent challenges especially when it comes to the students' selection of projects and subsequent allocation of students to projects. In particular, the students from different institutions have different selection deadlines, and when they do not know if they are accepted for their EPIC project this can make it impossible for them to apply for other priorities. On the other hand, it was not possible to confirm all projects until the last students had applied, as it was not clear whether the requirement of having students from at least two countries per project would be fulfilled. This led to some students being accepted very late in the process, an uncertainty that would be good to avoid. For the second year, the application process started earlier, and the project proposals were grouped into themes where students then had to select themes instead of specific projects. In this way, it would at least minimize the chance of having only one student assigned to a project, and therefore awaiting confirmation.

3.2 Preparing students and supervisors

For the first year, students and supervisors had to prepare themselves for the project by studying the blended learning materials mentioned in Section 2 before the project seminar. These focus mainly on PBL, team work, conflict resolution and distance collaboration. For supervisors, the main focus was on supervising students, virtual collaboration, and collaboration with companies.

3.3 The project seminar

The project seminar is where the students get the chance to meet face-to-face with each other and their supervisors for the first time. The duration of the seminar is five full working days, which is also partly due to the fact that this is the minimum duration according to Erasmus+ rules. The seminar for the students is combined with a teacher training seminar for the teachers, but the programs are integrated: Most of the time supervisors are working together with the students, but during some time slots the students work on their projects, while the teachers meet for lectures and workshops regarding supervision.

The seminar is a mix of workshops, group work in the project groups, supervisor meetings and interaction, as well as other project-related activities such as sessions where students present their work and receive feedback from both other students and other supervisors. The program is designed for the students to achieve these goals at the end of the week: a clear project scope and idea of the outcome, a clear overview of how the different students are contributing to this also according to their own learning objectives, a clear project plan,

and a collaboration agreement among the groups. The different activities throughout the week are designed to support these goals, with the content shifting throughout the week from focus on teambuilding and collaboration, over tools for problem analysis, to intensive work in the groups towards having a strong project plan at the end of the week.

The majority of the project work is carried out during the virtual collaboration phase. The collaboration and communication were organised differently between the different groups, reflecting that there is a big difference between being two students and nine students. Throughout the virtual collaboration phase there would be regular supervisor meetings with the EPIC supervisor, and peer assessments would be carried out three times during the project to facilitate discussions in the group. A collaboration platform was offered to the students, but almost all groups chose to use other tools/platforms instead, and we did not enforce using a specific platform. The collaboration worked well, but without one communication/collaboration platform it was hard to have an overview of the different groups – this was in the hands of the supervisors. Also, supervisors involved in multiple groups found it challenging that each group was using a different system/platform. In the following year, we will use a single platform for all communication, and also do more to make the students use it. We believe this is best done by having the platform available from the moment the student gets on board, by using it as an information channel even before the project seminar, and by ensuring that it is also used during the seminar, so that it becomes well established as the communication channel of choice.

3.4 The blended learning seminar

The blended learning seminar was an offer to those project groups who wanted a second meeting during the semester, usually around half way into the projects. The geography and timing can vary between the groups, and to minimize travel expenses each group would meet in the country of one of the institutions involved in that particular project.

3.5 Finalising the project work and hand-in

All groups handed in both the projects at their home universities and the joint EPIC report, which consists of one part reflecting on the learning experience of EPIC, and one part to describe the overall problem, how they approached it, and what solution(s) they reached. The groups seemed to overcome the challenge of different timings of hand-in well.

4 Evaluation methods and results

Before presenting the evaluation and results, the methods for data collection will be explained. These methods reflect that data were collected throughout the project period, and more thoroughly after project hand-in.

- Each day of the project seminar, evaluations forms were used to evaluate all student activities during the day in terms of relevance, quality and own participation. The data collected were quantitative, with space for comments.
- At the end of the project seminar, an electronic survey was used to evaluate the seminar (students, teachers, company representatives). The data collected were mainly quantitative, with space for comments. We also asked the students for their motivations for joining EPIC (the options were collected during a plenum session at the beginning of the seminar). The seminar survey was repeated after the blended learning seminar.
- During the virtual collaboration phase, data were collected in two ways: Quality Committee meetings were held approximately every two weeks, with at least one representative per group. The objective of the meetings was to address quality issues, but the comments also provided valuable insights to the progress of the projects, and the challenges experienced by the students. Moreover, all groups performed peer assessments 2-3 times during the project. The main objective of the peer assessment was to support the group work, but these forms also provided good insights into the progress of the students.
- At the end, a final electronic survey was distributed to students, teachers and company representatives, evaluating their experiences, their personal outcome, and their evaluation of the teaching methods used, including the supporting materials. Again, a combination of quantitative evaluations and comments.
- An in-depth interview was held with company representatives, but this falls outside the scope of this paper.

Figure 2 illustrates the answers of the motivation study, confirming that the results are in line with the objectives of EPIC: To enable students to work on real-life projects in a multinational and interdisciplinary setting.

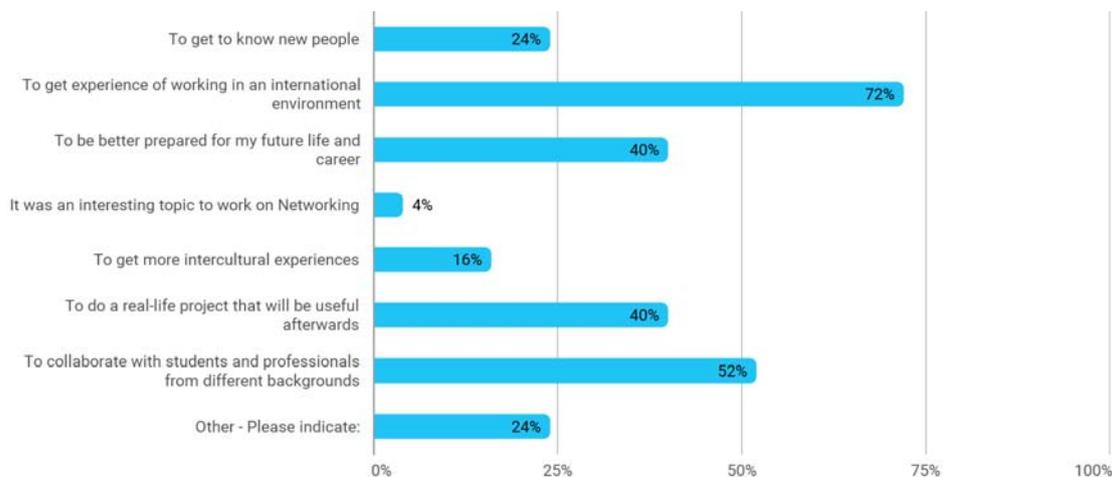


Figure 2: Students motivations for joining EPIC.

The overall evaluation and evaluations of the seminars were already presented in (ETALEE, 2018), so here we just summarize the most important numbers. The evaluations were based on a scale 1-5, where 1 is "Not at all" and 5 is "Very much". When counting the positive replies, we see how many responded either 4 or 5.

- 88% of the students and 90% of the teachers found that EPIC had been a good experience.
- 80% of the students and 90% of the teachers found that EPIC will help students in their future career.

The evaluations of the seminars were based on a scale with four levels: "Bad", "Not so good", "Good" and "Excellent".

- 100% of the students found that the project seminar had helped them to prepare for the upcoming project work to an either good (36%) or excellent (64%) extent.
- 96% of the students found the project seminar to be overall good (44%) or excellent (52%).
- 96% of the students found the project work during the project seminar to be either good (32%) or excellent (64%).
- 96% of the students found that the other academic activities during the project seminar were either good (64%) or excellent (32%).

For the blended seminar, all students answered all questions with either "good" or "excellent". 75% answered "excellent" to how well the seminar helped in the project work, and 67% "excellent" to the seminar overall.

These evaluations are positive, but we notice that for the project seminar the project work receives a better score than the other academic activities, which are there to support the project work. It is also interesting to see that the blended seminars receive such good evaluations. The students commented that these were so productive because they would at this stage have a good understanding of the topic, yet still enough time to work with the outcomes of the seminar.

For the project seminar, the daily evaluations demonstrate that we might have been too ambitious when designing the different workshops, and actually provided too little time for the students to work in the groups, either independently or together with their supervisors. While we encouraged the students to seek advice from all the supervisors/teachers present at the seminar this did not happen as often as we would have liked: We believe that in coming seminars it would be beneficial to facilitate this more actively. We also observed that the different groups worked very differently: Having a programme where the timing works for both 2 students working together on their master thesis and 9 students working together on projects with different workloads and levels is challenging. The students expressed that they felt somewhat unprepared for the project seminar with respect to their topics. This is something we also could see in the way the projects progressed, since many groups had to do major revisions of the plans and scopes in the weeks following the seminar. If the students were better prepared with respect to the subjects and division of work in groups, they might have been able

to make more robust plans during the seminar. For the second year, the students were encouraged to meet virtually before the seminar (which required that project groups were decided earlier), and we also made a catalogue describing the background of all participating students and teachers.

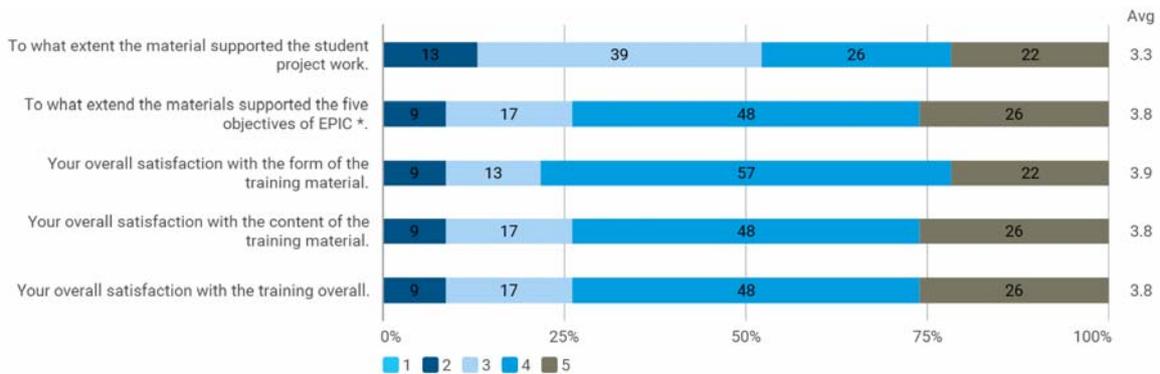


Figure 3: Students evaluation of the teaching materials for students. 1="Not at all", 5="Very much".

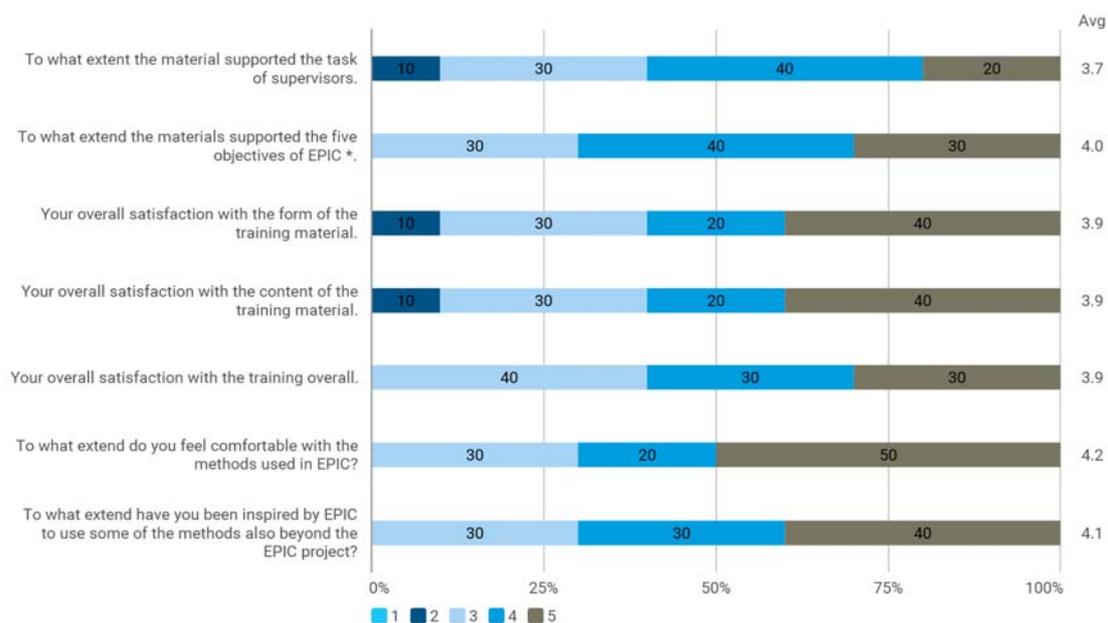


Figure 4: Teachers evaluation of the teaching materials for teachers. 1="Not at all", 5="Very much".

As described in Section 2, one of the pillars to support the project work is the materials for training students and teachers. These evaluations can be seen in Figures 3-4. Again, the evaluations are positive overall, but also with room for improvements. For students, the comments indicate that the materials were too generic, which we believe can be solved by making e.g. assignments that are more project related. If this is done in the project groups, this could also help the groups get to know each other even before the project seminar.

Through the comments collected both throughout the project and at the end, two particular challenges were identified. First, in some groups it was challenging to actually work together instead of "just" splitting the work into subprojects, which would make it hard to write a coherent joint report at the end. Second, some students experienced challenges with respect to supervision, especially if the advice from overall and local supervisors were not in line. This raises central questions for the EPIC approach, which is treated more in-depth in the discussion.

5 Discussion

In general, students and teachers were happy with the results and outcomes, but there are also focus areas for the second year. In particular, we have chosen to focus on making the students better prepared even before the project seminar, and to streamline the process of making project proposals and student selections. Another

focus point is to integrate the supporting teaching material better with the project work. We would like to further discuss two central questions, which are critical in order to further promote the approach taken in the EPIC project: Namely how to facilitate that the students actually work together even when evaluated according to (different) home university rules, and how to facilitate supervision in such a diverse environment.

5.1 How to ensure that the students actually work together

This question is central for the EPIC project, since we have chosen an approach where existing study regulations are not altered, and therefore the students are evaluated according to (different) home university rules. Depending on the home university rules and traditions, there is a risk that the students feel that the time spent on collaboration and coordination is not properly rewarded compared to spending the time on getting in deep with e.g. their thesis topics. There is also a risk that the projects are simply divided into subprojects, where the students are essentially working independently from each other, until the subprojects are merged in the end with some joint conclusions. We find that the following considerations can be a help in motivating the students to work together:

- It is important that both students and supervisors are aware of the learning objectives when scoping the projects in the groups and deciding upon roles and tasks of individual students. This can help them see how the work of individual students can benefit from the collaboration. When diving tasks and roles, it is important that each student can see both how he/she contributes and how he/she benefits from the work of the other members of the group.
- It is also recommended that students and supervisors go through the learning objectives together at an early stage of the project and see how the work in EPIC can help fulfil the learning objectives. Sometimes there are broad formulations included, e.g. such as “professional development”.
- In a student project within the EPIC framework, there will often be multiple supervisors involved, which can be a challenge. If the academic supervisor, who is responsible from the local university, is not supporting the joint project work – e.g. due to lack of insights – then it is just too likely that the students will be drawn in different directions. This underlines the importance of being explicit about the roles of the different supervisors, and of providing all supervisors an overview of the overall joint project. If possible, all supervisors should attend the project seminar.
- The three aforementioned points deal with alignment between the project work and the learning objectives of each student, and in EPIC this is facilitated through the document produced by each group specifying the learning goals, tasks and workloads of each student. It is created during the project seminar, but projects will always change over time. It is therefore important that this alignment is done throughout the project period, not just in the beginning.
- Finally, we would mention that the best way to support such collaborative projects is to create study regulations which in one way or the other make it possible to reward it in the learning objectives. Also, we notice that the regulations in terms of possible collaborations vary from university to university: In some institutions, it is allowed to make joint reports or joint parts of reports between students from different universities (of course subject to proper academic referencing etc.), where in other cases students must submit individually.

5.2 How to facilitate supervision in such a diverse environment

Supervision in collaborative student projects such as EPIC is characterized by different cultures, different traditions, multiple stakeholders, and multiple supervisors from both industry and academia. Also, each university has their own tradition with respect to supervision and supervisor roles; agreeing on a common set of guidelines is made difficult also by the fact that often these traditions are linked to different requirements in study regulations. Yet, the supervisors play a major role in the success of a collaborative student project. The following considerations are in our opinion helpful when it comes to providing good supervision of collaborative student projects:

- It is important to discuss mutual expectations between students and supervisors, including supervisor roles. There are so many implicit understandings of supervisor roles and different cultures for dialogue between professors and students that we recommend to make a written contract (supervisor agreement) as precise

as possible, and also to evaluate and revise this along the way. Ideally this should cover all the involved supervisors.

- The roles of different supervisors were not always clear to the students and supervisors. This especially happened when there were more persons from the same university involved, i.e. different “EPIC contacts” and supervisors, but also between the main supervisor of the EPIC project and the local supervisors. For instance, the largest group with students from 4 different countries had one “main” supervisor who was responsible for the whole group (and acted as local supervisor in one country), as well as three local supervisors for the students from other countries. This has led to a clear and written definition of supervisor roles. It includes four roles: EPIC supervisor (supervising the overall group), Industry Supervisor (supervisor from the company), Local Supervisor (EPIC contact person) and Academic Supervisor (the local supervisor with specific topic-knowledge – can be the same as the Local Supervisor).
- With respect to the roles of supervisors, it was discussed among the partners whether it is a good idea that the EPIC supervisor of the project and the local supervisor can be the same, without any clear conclusions: It is important though to handle the risk that the students who are also locally supervised by the EPIC supervisor becomes the “leaders” of the project and that supervision of the overall group does not go through the local group of students.
- Having multiple supervisors can be a valuable source of inputs, and many good discussions happen when supervisors have different opinions. On the other hand, there is a risk that the students feel they get contradictory advice. This can be more difficult to handle in a virtual collaboration situation, where the supervisors might not meet the students at the same time, than in a traditional setting where everyone can meet around the same table. Therefore, it is important that the supervisors coordinate their supervision efforts throughout the project timespan.

6 Conclusion

This paper described how multinational, interdisciplinary student projects based on real-life problems from companies are established within the Erasmus+ Strategic Partnership EPIC. The idea is to make the projects happen within existing study rules and regulations, i.e. within the scope of existing learning activities of the participating universities: In this way, the approach becomes scalable even outside of the consortium. Moreover, the amount of travelling is reduced through a high degree of virtual collaboration, which is important for the approach to be sustainable after the Erasmus+ funding expires. This paper presents the evaluations made after the first of three yearly cycles of the project, which are overall positive, but we have identified some focus areas to adjust for the coming years. Moreover, the paper includes a discussion of two key challenges in the project, namely how to ensure that students actually collaborate even when the learning objectives differ depending on the home institution of the student, and how to facilitate good supervision of students in such a diverse environment.

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