Integrating project management and peer assessment: a case for increased teamwork

Natascha van Hattum-Janssen[1], Christian Mensink[1], Jens Myrup Pedersen[2], Ahmet Türkmen[2]

[1] Saxion University of Applied Sciences, Enschede, the Netherlands
[2] Aalborg University, Denmark

Email: n.vanhattum@saxion.nl, c.e.b.mensink@saxion.nl, jens@es.aau.dk, atu@es.aau.dk

Abstract

In the Erasmus+ project EPIC, students from different degree programmes, degrees, universities and countries work together in groups on authentic problems for the industry. The goals of EPIC are to explore how this approach can increase students' learning and make them better prepared for both national and international labour markets. As student numbers are relatively low, EPIC allows for experiments with different ways of project organisation, such as the number of students per group and the level of integration of their contributions. Students participate in an EPIC semester, bringing different characteristics into their project team. Their level, e. g. bachelor or master and first year of more advanced, the degree programmes they are enrolled in, e. g. technical programmes, creative programmes or busines programmes, and the amount of time they invest in the project is different for each student, apart from the country of their university and their own (cultural) background. Especially with the students coming from different backgrounds and educational traditions, it is crucial to prepare them for effective and efficient groupwork during the EPIC semester. To support this, a platform called MECEPIC was developed that combines different features: exploring and outlining the background of each participating student and the added value of each student for the project, the project management and a peer assessment system that allows for reflection on the contribution of each individual student to the joint outcomes of the project. This paper aims to evaluate the use and the impact of the platform. An analysis of the data on project management and peer assessment as filled out by the students in the platform shows that it contributed to a more focused starts of the students as a team, streamlining the project and staying in control of the project deliverables and also showed that the peer assessment requires a strong involvement of supporting teachers and/or tutors.

Keywords: Active Learning; Engineering Education; Conference Information; Project Approaches.

1   Introduction

The Erasmus+ project EPIC, Improving EmPloyability through Internationalisation and Collaboration, has a number of objectives. It seeks to increase employability through closer collaboration between students and industry, by promoting active and problem-based learning, and by promoting international collaboration. The project also aims to increase the labour market relevance of education through closer collaboration between industry and academia, and make the students better prepared for both national and international labour markets in a globalized world. EPIC is focused on increasing the students learning outcome by promoting active learning methods, based on students solving real-world problems and promotes the take-up of ICT tools and Open Educational Resources (OER) to facilitate international student projects based on blended learning, thus making international collaboration more scalable and sustainable by reducing the costs. This also makes it possible to give students an international experience without the need for spending prolonged times abroad. Finally, it provides the students with transversal competencies, especially focusing on problem solving skills, collaboration skills, entrepreneurial skills and skills within creativity and innovation. Students from eight different institutions of higher education from eight European countries participate in a project semester in which they work on an existing problem from a company or institution in multidisciplinary heterogeneous teams. These teams consist of two or more students that may have different background in terms of their degree programme, their level (Bachelor or Master), the year they are in and the amount of EC they spend on the project. For the students, it is crucial to learn to work together as a team on a distance. In order to form constructive teams with a joint project plan that work together effectively and efficiently, all project semesters start with an offline project week in which the students and teachers from all participating institutions get to know each other and make a project plan. They use this plan during the remaining weeks of the semester for

their teamwork and their interaction with their company and their tutor. Each project proposal is developed in collaboration between at least one of the universities and one or more companies and chosen as to fit to a theme that was established on beforehand (for EPIC, in 2020, all projects were dealing with the UN Sustainable Development goals). The project proposals are published in a catalogue, so each student can select either a topic or a specific project of his/her interest and based on this be assigned the project and group ahead of the semester. In addition to the project proposal, the company supervisor(s) would be available for co-supervision throughout the semester – in most cases virtually, but in some cases with a possibility also for a physical visit as part of the blended mobility scheme. The project setup is described in more detail by Pedersen, Kirkova, Kuladinithi and van Hattum-Janssen (2019).

The project plan that students make in the project planning week as well as getting to know each other are both essential elements in the start of a project. Powell and Weenk (2003), categorise both elements as basic student training needs. Project management is a competence not only required to complete a student project successfully, but also a competence necessary for engineers (Du & Kolmos, 2006; Ravankar, Imai, & Ravankar, 2019). The process of getting to know each other in the EPIC project goes further than meeting each other in person and finding the most adequate way of dividing tasks. As the students in the EPIC teams are different in many ways, exploring the possible contribution of each team member to the solution of the joint problem is a complicated process. The phases as distinguished by Tuckman (1965), forming, storming, norming and performing, also discussed by Powell and Weenk (2003), get an extra dimension because of the intercultural and online collaboration within the student teams. Saarikoski et al. (2015) define intercultural competences as "the ability to establish and maintain relationships, to communicate with minimal loss or distortion and to collaborate in order to accomplish something of mutual interest or need with people coming from other cultures" (Saarikoski, Lautamäki, Kaufman, & Bengoa, 2015, p. 3). They highlight the need for intercultural communication skills and the need for understanding each other to achieve common goals. The online cooperation of the student teams is another challenge that makes teamwork different. Although Çakiroğlu and Erdemir (2019) conclude that online project-based learning is possible also when all activities and project management are transferred to an online environment, even before the necessity due to COVID-19 restrictions for offline interaction, the EPIC project semesters were organised to enable an actual meetup of student teams.

In order to support the students in the EPIC student teams to effectively work together in heterogeneous intercultural teams, manage their projects and monitor the contribution of each individual student, a tool was developed to use by the teams during the project semester. The tool, called MECEPIC and based on TEAMMATES[1], combines both project management as well as peer assessment features. It consists of an online platform that is used as a team. Each team uses the platform for three distinct purposes. Firstly, they identify the characteristics of each team member, including education background, expertise and the number of ECs to dedicate to the EPIC semester. Secondly, they discuss the project and make a project outline that incorporates a clear project description, milestones and project deliverables. Furthermore, the group also defines criteria for peer assessment of the contribution of each individual team member to the team project. The MECEPIC-tool is designed to be leading throughout the whole project. By determining the personal goals, the milestones and project deliveries, and the evaluation in between and at the end, the entire project period. It is an instrument for the project members to determine the goals and milestones, as well as an assessment instrument throughout the entire project.

Peer assessment can be used as a way to evaluate the contribution of team members to a group project (Bong & Park, 2020; van Hattum-Janssen & Lourenço, 2006). As tutors nor teachers can see what is actually taking place within a team, students themselves are in charge when assessing the contribution of each individual team member to the process and outcomes of a student project team, although peer assessment can serve as a tool for teachers to provide additional support to students and be informed about who needs more attention (Ashenafi, 2017). Giving them not only the opportunity to assess each other on the contribution of each member to the project, but also making the students define the assessment criteria to do so, makes the

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[1] https://teammatesv4.appspot.com/web/front/home

students not only more responsible for their own assessment process, but also makes them reflect as a team on what they value when working together and on how this can be assessed.

The peer assessment consists of three peer assessment moment that the team uses to assess all members, including a self-assessment, with regard to their contribution to the joint output. During the project planning week at the beginning of each EPIC semester, students learn to work with the platform. On day 1, they get to know each other and explore the company problem. On day 2, they identify the possible contribution of each team member and define deliverables. The third day is used to define project milestones and think about how to assess the project. On the penultimate day of the project planning week, the teams define their own peer assessment criteria, and they plan the assessment moments that they will have together with their project tutor. The last day is the presentation day and the teams share their project and assessment planning with each other. In this way, the EPIC team aimed to give the student teams a head-start with their project because of a clear planning, an agreement on what needs to be done and why in the following weeks and an instrument to monitor the contribution of each team member through peer assessment. The last EPIC edition, running in the spring semester of 2020, was the first time that project management and peer assessment were integrated in a single tool. The question is in what way the student teams used the tool for the defined purposes. The EPIC project was funded through the Erasmus+ programme of the European Union.

2   Methods

During the project planning week in the first week of the EPIC semester 2020, students needed to register themselves as a participant on the MECEPIC platform and were assigned to one of the nine student teams. In a number of sessions during this week, the teams were guided through the platform and each of the different topics. A content analysis was made of the student data to answer the following questions:

- To what extent does the platform facilitate the identification of individual contributions of team members? (part 1 and 3 of the tool)
- To what extent does the platform facilitate project management? (part 2, 4 and 5)
- To what extent does the tool facilitate peer assessment? (part 6, 7 and 8)

For each part, all responses were listed and the usability for the purpose of the platform part, the degree of detail and the meaning of the content for the student team were analysed.

3   Results

All nine student teams were asked to complete the eight parts of the tool, in order to accompany their project management and peer assessment. Part 1 was a straightforward description of their name, degree programme, year and the number of European Credits (EC) dedicated to EPIC. It was completed by all participants. Part 3 allowed for a description of the possible contribution of each team member to the project. Descriptions were given by 35 out of 58 students. Of the 22 students who did not enter any description, nine were not officially part of the EPIC project, as they came from a Brazilian university. While not funded through the EPIC project, they still contributed to the teamwork and projects on the same terms as the official EPIC students, and their efforts were recognised by their home university in Brasília, UnB. The descriptions ranged from rather general like "I will be focused on technical part of the project like frontend" to detailed descriptions like

I can contribute with:

- Costumer journey (how people will use the app, their "throwing waste out routine" linked to the routine of using the app)
- Building the app (not in the programmer perspective, but by doing the layout, the visual structure, the requirements)
- Validation of the app with the population
- Data use for the SLU (how to use it in their perspective?)
- Communication with SLU, teachers and other stakeholders

- Management of the project (time, people, things to do) *(Student response to part 3)*

The answers also showed more technical and more general aspects like project management, writing reports and making presentations. Part 2 is the first part that is aimed at project management. Student teams were asked to give a short problem definition. Eight out of nine teams completed the field for the problem description. Most of the descriptions were more aimed at describing the solution that was going to be developed, although some teams made an effort to actually describe the problem that was given to them by the company and indicate why the solution was relevant. Part 4 of the MEC platform is aimed at the project deliverables. All teams described their deliverables, also here with a large variation in the degree of detail provided by the teams, ranging from rather basic "We will create most probably a web application which runs on a server and has vulnerabilities" to detailed:

- Deliverable 1: Systematic Literature Review / Mapping: Theoretical background about the carbon footprint;
- Deliverable 2: Systematic Literature Review / Mapping: Current methods for gathering the data and calculating the emissions for carbon footprint; Deliverable 3: Systematic Literature Review / Mapping: Sustainability strategies of companies regarding emissions;
- Deliverable 4: UML model for the database, infrastructure, and apps;
- Deliverable 5: General database for storing all the activities/products and the emissions;
- Deliverable 6: Prototype Infrastructure for interacting with the database and calculate specific information (API);
- Deliverable 7: Web Interface to access and update the information. *(Student team response to part 4)*

Part 5 of the MEC tool seeks to collect the milestones of each project. As students are working on a distance and with different end dates of their contribution to the project work, this part is an important, but complicated part. One of the teams described the different end dates for the team members in this section. Other teams defined the final deadline only and nearly all teams made identified specific weeks for the deliverables. One team only defined the month is which the deliverables had to be ready. Part 6 of the MEC platform asked the students to define two sets of criteria for self and peer assessment: part 6A for three criteria on online collaboration within the team and part 6B is on international collaboration, taking into account the intercultural aspects of EPIC. The definition of the criteria included a brief description that would facilitate the assessment process. All teams defined two sets of criteria. Criteria for online collaboration include responsibility (carrying out duties, letting the team know individual progress), using scrum methodology (team members use "Trello" for regular update on tasks "In Progress", "Done", ''To Do" for every step so other team members can follow and add comments when needed), active participation in meetings (team member is well prepared for each meeting and gives relevant input on issues that are discussed where possible) and criteria related to the attitude of the team members like being and team player (communicating issues, being able to meet in the middle). Criteria for international collaboration include cultural awareness (the student is able to respond adequately to issues related to cultural differences), use of expertise (the student uses the expertise available at other EPIC partner institutions), and using English as a language. In part 7, all teams establish a schedule for the peer assessment moments based on the criteria of part 6. The platform also provided the infrastructure to carry out the peer assessment during the semester. The outcomes of the peer assessment are not discussed in this paper.

4   Discussion and conclusions

Looking at the way the students used the MEC platform both individually as well as in their teams, it becomes clear that the platform is used by each team and by nearly each individual student. As most of the parts were filled out during the project planning week, specific moments were planned for the students to work on the platform, both as a team as well as individually. Especially part 3, the individual contribution, shows a high number of missing students, which may affect the insight of teams into the available expertise negatively.

The team descriptions show a large variety of answers on all project management parts. The degree of elaboration of the problem description, the deliverables and the project milestones varies significantly between

the teams. Although during the week, each team had extensive discussions internally and with teaching and other staff available, little coherence between the different teams can be found. This may be caused by the lack of explicit instruction in the platform itself. Plenary explanation to all students was given at the beginning of all sessions in which the worked on the platform, but the platform itself allowed for a wide variety of answers, from rather basic to highly detailed. For the problem description, the distinction between an analysis of the problem provided and possible solutions as proposed by the team was not clear and could have made the descriptions more focused. The deliverables had many different formats and types of content. When analysing these more in detail, it becomes clear that many of the deliverables were not actual deliverables for the company, but intermediate products for the teams themselves. Also in this case, the plenary explication during the project week was clear on the nature of the deliverables, but as the platform itself did not provide this information, not all teams took the explanation into account and described what they thought was asked for. With regard to the milestones, all teams described clear milestones, in a comparable way. If the format for the milestones would be more closed, all teams would have done this in exactly the same way.

The criteria as filled out in part 6A and 6B by all teams were quite alike. All teams had extensive team discussions on the criteria and the way they had to describe them, but in the end came to rather similar criteria that were clear indications of the way online and international collaboration in student teams can be measured. The teams all made a clear planning of the three assessment moments.

In spite of the many limitations of the platform as described, all student teams used it and aligned their project management efforts during this week. The combination of the platform and the instruction given during the week helped students to focus and to reflect on their individual and their joint efforts. Combining the individual contribution, the project management input and the peer assessment into one platform instead of organising these features in different tools helps student to experience that the way they contribute to, organise and evaluate their projects are interrelated. Students were forced to go through all steps and time was given to discuss, reflect and define all parts of the tool.

5   Limitations and future work

The MECEPIC platform is based on TEAMMATES, a sound basis for a customised peer assessment for the EPIC project but never meant for project management. The project management part is more descriptive and serves for interaction within the student teams and between the tutor and the student team. The peer assessment part of the MECEPIC platform is more in line with the original purpose of TEAMMATES. The two different parts and the use of peer assessment criteria that were defined by each student team required a highly inventive approach of the programmers who adapted TEAMMATES to the specific requirements of EPIC and improvisation skills during the project planning week. The instructions for students on the platform itself as well as the instructions during the project week may need to be more explicit to enhance the quality of their input.

The development though of a platform that supports both project management as well as peer assessment, accessible for students and tutors has proven to be useful. For the future, the authors recommend a further development of the platform to make input of the peer assessment criteria per team more user-friendly, to include more instruction in the platform itself on how to work with it, to help tutors more in their role of supervising the peer assessment process using the platform and to benefit more from the project management information during the project semester. More research on the peer assessment outcomes and their link with the online and intercultural collaboration is also recommended.

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