



## Methodological framework for peer learning in mechatronics

Miruna Peris, Alexandru Oarcea, Sergiu Stan, Albert Meij, Virginie Siret, Christine Galez, Laurent Tabourot

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Erasmus+ Strategic Partnerships for higher education

**XP2P**

## **CROSSING BORDERS: PEER-TO-PEER EDUCATION IN MECHATRONICS**

### **IO2 REPORT**

|                            |   |
|----------------------------|---|
| <b>Project Title</b>       | <b>Crossing Borders: Peer-to-Peer Education in Mechatronics</b><br><b>2019-1-FR01-KA203-062208</b>                        |
| <b>Intellectual Output</b> | <b>O2 - Methodological framework for peer learning in mechatronics</b>  |
| <b>Date of Delivery</b>    | <b>12<sup>th</sup> of August 2022</b>   |
| <b>Authors</b>             | <b>Miruna Peris, Alexandru Oarcea, Sergiu Stan<br/>Albert Meij, Virginie Siret, Christine Galez,<br/>Laurent Tabourot</b> |

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## 1. Introduction

The innovation of this intellectual output lies in giving a methodological framework for the implementation of a whole peer learning semester/module, coupled with project-based learning in an international context and in a post-graduate program (master's level).

The methodological framework will pave the way for other implementation in the future and in other disciplines by defining the requirements, the opportunities but also the risks afforded by this innovative teaching approach.

# IO2

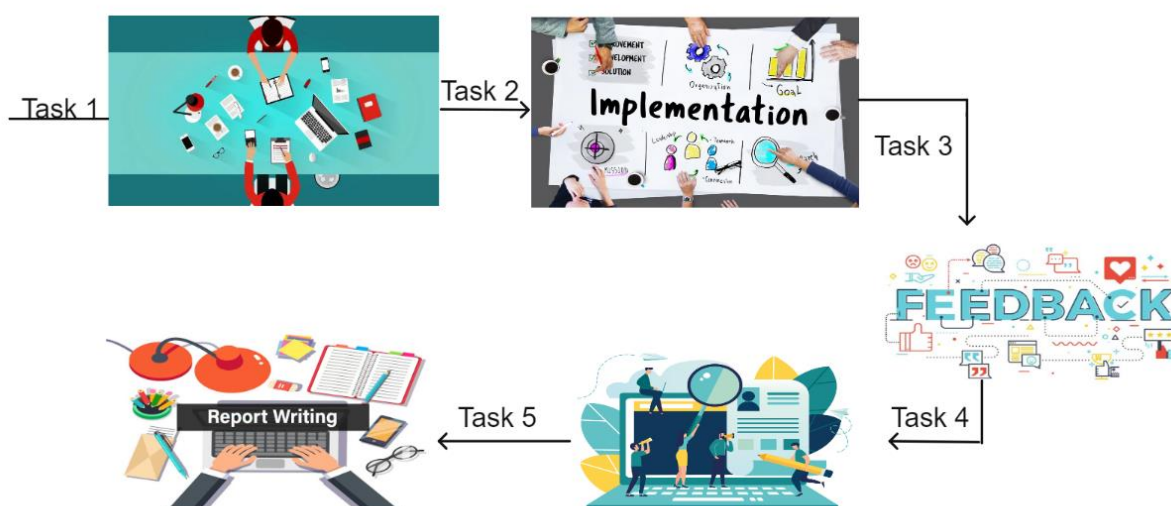


Figure 1. Presentation of the IO2's tasks

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## 2. Initial Timetable for Intellectual Output 2

| IO 2 - Methodological framework for peer learning in mechatronics |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|---|-------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| TASK LIST (Short name)  | MONTH | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |  |
| Task 1. Identification of the existing methods                    |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| Task 2. Determination of a set of relevant methods                |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| Task 3. Collection of teachers' and students' feedback            |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| Task 4. Analysis of the results of task 3                         |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| Task 5. Interim report writing                                    |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| Task 6. Collection of teachers' and students' feedback            |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| Task 7. Analysis of the results of task 6                         |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| Task 8. Final report writing                                      |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
| Task 9. Report translations                                       |       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |

Figure 2. Initial Timetable for IO2

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### 3. Identification of the existing methods in peer learning

#### 3.1 Technical University of Cluj-Napoca

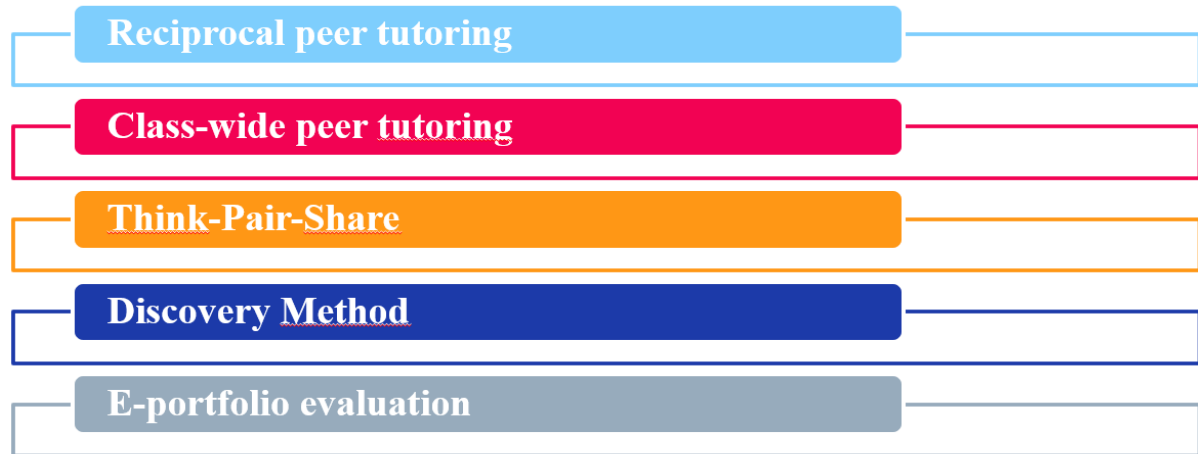


Figure 3. Used methods in peer-to-peer learning

1. Role play where students are changing their status from students to teachers
2. Class-wide peer tutoring
3. Think-Pair-Share
4. Discovery Method
5. E-portfolio evaluation

Regarding the first task, entitled identification of the existing methods in peer learning (requirements, pros, and cons), by studying the scientific literature and with the help of some of the results from IO1 we concluded that the major methods used in peer learning are: Reciprocal peer tutoring, Class-wide peer tutoring, Think-Pair-Share, Discovery Method and E-portfolio evaluation.

The first major peer learning method is **Reciprocal peer tutoring (RPT)**.

RPT is a form of collaborative learning that involves students of similar academic backgrounds experiencing interchanging roles of tutor and learner.

The major advantages of this method are the fact that gaps in understandings can be checked, because you can say that you know something when you teach it to someone else, it develops a greater sense of responsibility, and does a better job in developing the organizational and management abilities.

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On the other side, students might find difficulties in adapting the role, fact that is caused by the variation of abilities and tempers of each student.

**The class-wide peer tutoring method** proposes the division of the class in smaller groups for solving different assessments in which each student of the smaller group has a separate subtask for which he is responsible, and it is relevant to the given task.

The major advantage of this method is its efficient learning curve, the development of managerial and organizational skills and the development of team-work skills.

The major downside of this method is the fact that the groups need to be created by counting for the abilities and competences of each member in order to avoid issues that might occur by the disequilibrium of the group.

**Think-Pair-Share** is where the teacher poses a challenging or open-ended question and gives students a minute or two to think about the question individually. Students then pair with a cooperative group member or neighbour sitting nearby and discuss their ideas about the question for several minutes. After several minutes, the teacher solicits student comments or takes a classroom "vote." Students are much more willing to respond after they have had a chance to discuss their ideas with a classmate because if the answer is wrong, the embarrassment is shared.

**Discovery Method** This method is similar to the structured problem-solving method except that student teams are asked to find the information they need to solve the problem on their own without the benefit of a mini lecture. The instructor can structure a multi-layer discovery task. This method ensures that groups that work faster than other groups can develop more deeply into the problem.

**E-portfolio method** is another well-known method for implementing peer learning and the method itself was presented and discussed in intellectual output 5.



### 3.2 Hochschule Kaiserslautern - University of Applied Sciences

In the context of peer-to-peer education as a teaching/learning method, social science literature offers a variety of different terminology and definitions. For the purpose of this project, a definition was established that consists of the following three components:

- Reciprocal Peer-Learning
- Peer-Tutoring
- Peer-Assessment

#### Reciprocal Peer-Learning

"Reciprocal peer learning" describes a method in which students learn independently and at the same time contribute to the learning of peers (fellow students) by passing on knowledge to them and participating in group activities. This creates shared experiences and enables students to make equal contributions to a group effort (Boud, 2001<sup>1</sup>/ Sampson et al., 1999<sup>2</sup>).

The method builds on the natural behaviour of students to turn to each other first when problems arise instead of consulting directly with instructors (Boud, 2001). This creates numerous benefits for the students, as they take responsibility for their own learning and thus learn to learn (Sampson et al., 1999)

#### Peer-Tutoring

In Peer Tutoring, one party assumes the role of an expert in a topic area and tutors another party who has limited knowledge in the same topic area (Damon, Phelps, 1989<sup>3</sup>). Students take on specific roles that they maintain in the course (Topping, 2005<sup>4</sup>). This role assignment can occur between students of the same semester or between older and younger students. The only prerequisite is that "asymmetries in relevant knowledge" (Haller et al., 2000<sup>5</sup>) are

---

<sup>1</sup>Boud (2001). Making the move to peer learning. In Boud, Cohen, Sampson (Eds.) (2001). Peer Learning in Higher Education: Learning from and with each other. London: Kogan Page (now Routledge), 1-20.

<sup>2</sup>Sampson et al. (1999). Designing peer learning. HERDSA Annual International Conference, Melbourne.

<sup>3</sup>Damon, W., & Phelps, E. (1989). Critical distinctions among three approaches to peer education. International journal of educational research, 13(1), 9-19.

<sup>4</sup>Topping (2005). Trends in peer learning. Educational psychology, 25(6), 631-645.

<sup>5</sup>Haller et al. (2000). Dynamics of peer education in cooperative learning workgroups. Journal of Engineering Education, 89(3), 285-293.

encountered, which are perceived by the students as obstacles that need to be overcome together and therefore lead to teaching activities by the students (Haller et al., 2000). In doing so, students turn away from an individualistic approach to learning and build interdependencies among each other (Clark, Andrews, 2009<sup>6</sup>).

### Peer-Assessment

In peer assessment, students evaluate each other in a formal or informal way.

To encourage peer assessment, it is important to include it in the instructor's evaluation so that students perceive feedback as an essential part of the curriculum (Keppell et al., 2006<sup>7</sup>).

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<sup>6</sup>Clark, Andrews (2009). Peer mentoring in higher education: a literature review.

<sup>7</sup>Keppell et al. (2006). Peer learning and learning-oriented assessment in technology-enhanced environments. *Assessment & Evaluation in Higher Education*, 31(4), 453-464.

### 3.3 Université Savoie Mont Blanc

There seems to be a need to make students active and to ensure that they learn in depth<sup>8</sup>. To this end, peer learning, which allows students to collaborate and become more motivated, is a pedagogical method used in the XP2P project.

**Project-based learning** is an active pedagogical method that allows students to learn through the realization of concrete productions<sup>9</sup>. Projects can be individual or collective: the student has to solve problems in a given situation and context. The teacher then becomes a coach for groups or individual students, to guide them in their work and research. During the work carried out within these projects, the students build and co-construct the expected knowledge and skills, which are linked together by this project and by its different stages and tasks to be carried out.

Moreover, through this type of work, learners develop greater autonomy, greater self-confidence and confidence in their abilities, have less of a sense of judgement than in the presence of the teacher, learn negotiation and are at the center of the learning process<sup>7</sup>.

Other activities that enable students to learn together include:

- **Brainstorming:** this is joint work that can be carried out in the presence or at a distance (forum/chat) when a question is asked or when initiating an activity or project. It must lead to a choice, a decision and the exchange of experiences.
- **Problem situations/case studies:** in a problem situation, subjects, while carrying out a task, face an obstacle and thanks to the instructions and materials provided to them, use skills and abilities they already possess to acquire new ones<sup>10</sup>. Working on situational-problem studies can be one step in a longer project mode. This type of work can be done entirely in the presence or initiated in the presence and monitored at a distance with compulsory steps to be carried out in the form of activities on the LMS for example.

<sup>8</sup> Biggs, J. B. (1987). Student Approaches to Learning and Studying. Research Monograph. Australian Council for Educational Research Ltd., Radford House, Frederick St., Hawthorn 3122, Australia.

<sup>9</sup> Perrenoud, P. (1999). Apprendre à l'école à travers des projets : pourquoi? Comment ?. Genova, Faculté de psychologie et de sciences de l'éducation, Université de Genève, < [http://www.unige.ch/fapse/SSE/teachers/perrenoud/php\\_main/php\\_1999/1999\\_17.html](http://www.unige.ch/fapse/SSE/teachers/perrenoud/php_main/php_1999/1999_17.html) > [Consulté en mai 2020].

<sup>10</sup> Meirieu, P. (1988). Guide méthodologique pour l'élaboration d'une situation-problème. Cahiers pédagogiques, 262, 9-16.

- **Synchronous and asynchronous face-to-face and distance exchanges** (forums, chat, question-answers): between students and sometimes with teachers, they allow learning in a way that is sometimes freer and without fear of judgment. They can be carried out during group work in class but also through the LMS in a synchronous way in chat or videoconference or asynchronously thanks to forums in particular.
- **Tutoring:** peer tutoring can also be considered, between students from the same class or between senior and junior students. This activity can strengthen the bond between students, increase confidence in their peers and in themselves, and build new knowledge and skills together. The students recruited come from different disciplines. Each one can be considered as an expert and therefore provides other students with help and support in their discipline and/or based on their past experiences. Tutoring can be envisaged between students of the same year and between a senior and a junior student. Groups can be tutored, thus offering autonomy and more responsibility to each student. It is possible that questions and remarks from students among themselves have more impact than when they come from teachers.
- **Constitution of pairs or complementary groups or spontaneous groups:** they allow for group work and cross presentations.
- **Peer review:** it is possible to allow peer review, particularly within projects, leading to the drafting of comments or even the attribution of marks using a detailed evaluation grid. It is nevertheless up to the teacher to validate or give the students the final grade. It is essential to provide learners with a precise evaluation grid that has been clearly explained beforehand.
- **In group work,** the teacher can also ask the group to write a few pages on how the group was organized and conclude with a self-assessment in the form of comments on this work. Each student can then provide the teacher with a few lines about how they were involved in the group work. This can help to balance the final assessment of each student's work and individualize the grades.

These different activities allow, in person or at a distance, to predefine a problem or a question, to share knowledge, vision, experience, and to make decisions. This can be used as group work to guide students in terms of methods, but also independently, during a case study for example, during a lecture, or in an exercise. These activities can be carried out by the teacher in person or remotely via a chat or virtual classroom, or conducted by the students themselves.

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The role of the teacher working from a peer learning perspective is to accompany the students in their journey to build their skills. In order to do this, it is strongly recommended to provide students at the beginning of the course <sup>5</sup>:

- Detailed evaluation grids
- The skills repository
- Course syllabus
- The detailed calendar of the course with its different expectations
- A tutorial or course guide

The e-portfolio tool supports the peer learning process as students can work on common pages and collections, comment on the productions of their peers, but also with a collective e-portfolio. Collaborative digital work tools such as wikis, tables, streaming tools, etc... also allow this type of activity to be carried out.

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#### 4. *Determination of a set of relevant methods to implement in mechatronics learning during the first peer-to-peer semester*

##### 4.1 *Technical University of Cluj-Napoca*

Relevant skills for a mechatronics engineer:

- Problem solving
- Thinking Critically
- Making Decisions
- Learning New Things

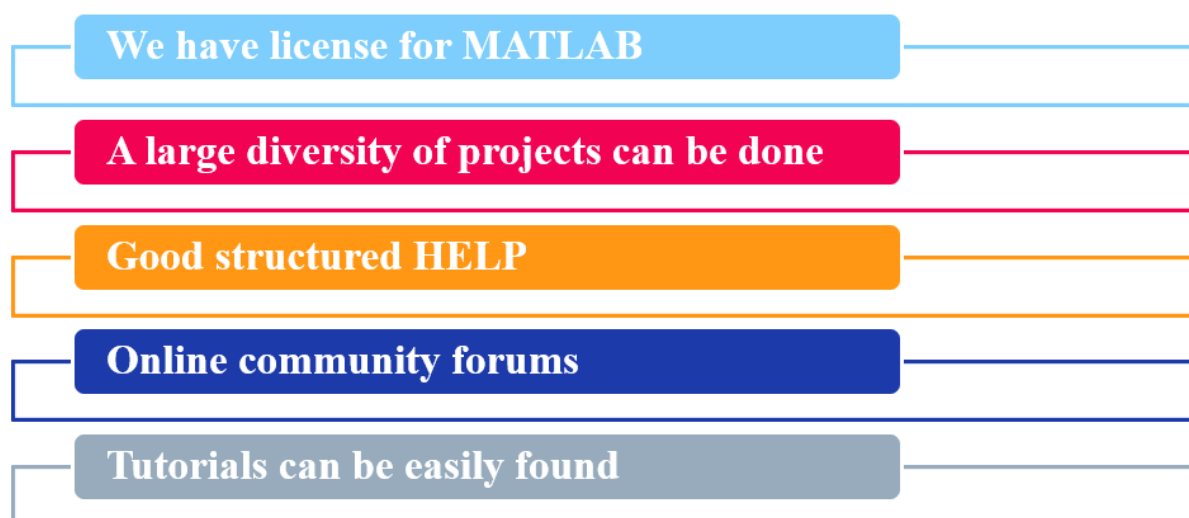


Figure 4. Relevant methods to implement in mechatronics learning during the first peer-to-peer semester

The 2<sup>nd</sup> task, entitled “Determination of a set of relevant methods to implement in Mechatronics learning during the first peer-to-peer semester” required the determination of a set of peer learning methods to be used for mechatronic learning and the methods chosen are based on the major skills required in mechatronics.

The most relevant skills for a mechatronic engineer are problem solving, critical thinking, taking decisions and having the concept of constant learning.

In our case, the first peer semester was implemented for our master students, and we will also present a short description of the development of the Research activity.

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Traditionally, the research activity is a discipline mandatory for all students, and it requires the student to ask a teacher for a research topic for the whole semester. The coordinator will supervise the development of the research and provide materials for the development of the research. The research activity is completed by submitting a paper to the coordinator that will evaluate and mark the student.

In the P2P approach, the discovery method and the class-wide peer tutoring were implemented, and the students were grouped and had regular meetings during the semester. Two meetings had the coordinator involved to giving advice regarding the workflow and current state of the research. Furthermore, the students chose at their own will the platform for working and the topics were more complex in order to divide them in specific tasks for each student. The completion of the research activity was made by presenting the results of the work to the whole class and the final mark was composed of the paper itself and the presentation by the coordinator.

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## 4.2 Hochschule Kaiserslautern - University of Applied Sciences

In particular, **project-based learning** was used to promote *reciprocal peer-learning*: Project-based learning is an active pedagogical method that allows students to learn through the realization of concrete projects (Perrenoud, 1999<sup>11</sup>). These projects involve challenging and authentic tasks that have references to real work situations (Kokotsaki et al., 2016<sup>12</sup>/ Solomon, 2003<sup>13</sup>) and extend over time (Gary, 2015<sup>14</sup>). Through this type of work, students can gain greater autonomy, confidence and trust in their abilities, feel less judged than in the presence of the instructor, learn to negotiate, and be at the centre of the learning process.

In addition, the learning management system (LMS) **OLAT** and the portfolio platform **Mahara** were used to promote and facilitate *reciprocal peer-learning* and *peer-assessment* in the lectures.

For the purpose of *peer-tutoring* an **assistant** was also employed who was both a project staff member and a master's student. Due to his parallel roles, he was able to act as an optimal link between the teachers and the students, since the students could accept him as an equal point of contact.

<sup>11</sup>Perrenoud (1999). Apprendre à l'école à travers des projets: pourquoi? Comment ?. Genova, Faculté de psychologie et de sciences de l'éducation, Université de Genève.

<sup>12</sup>Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. Improving schools, 19(3), 267-277.

<sup>13</sup>Solomon, G. (2003). Project-based learning: A primer. Technology and learning-dayton-, 23(6), 20-20.

<sup>14</sup>Gary, K. (2015). Project-based learning. Computer, 48(9), 98-100.



### 4.3 Université Savoie Mont Blanc

Several pedagogical methods and activities have been implemented with Master students (in Advanced Mechatronics) at the University of Savoie Mont Blanc to allow peer learning:

- **The creation of mind maps on competences:** a first common work, by group, on the students' own competences at the beginning of the Master/semester is carried out. The idea is then to compare at the end of the course the skills developed by the course. This can also be done in the form of a cross presentation.
- **Collaborative work on wikis:** Students were asked to work collaboratively on wikis and to create a glossary to build definitions together
- **Project-based learning:** the students carry out three projects, two of which are collective, during the semester. During the collective projects, students exchange, collaborate and cooperate. Coming from different geographical and disciplinary backgrounds, they learn from each other and build their skills by adapting. They also deploy cross-disciplinary skills such as project management, communication, documentary research, etc...
- **Peer evaluation and Moodle workshops:** Moodle peer evaluation workshops have been offered several times to students in different modules.

One example is the Research funding and PhD Communication module where the teacher in charge used Moodle workshops. They were asked to identify a research job offer that might interest them and to prepare a cover letter and CV which they were to post in the Moodle workshop.

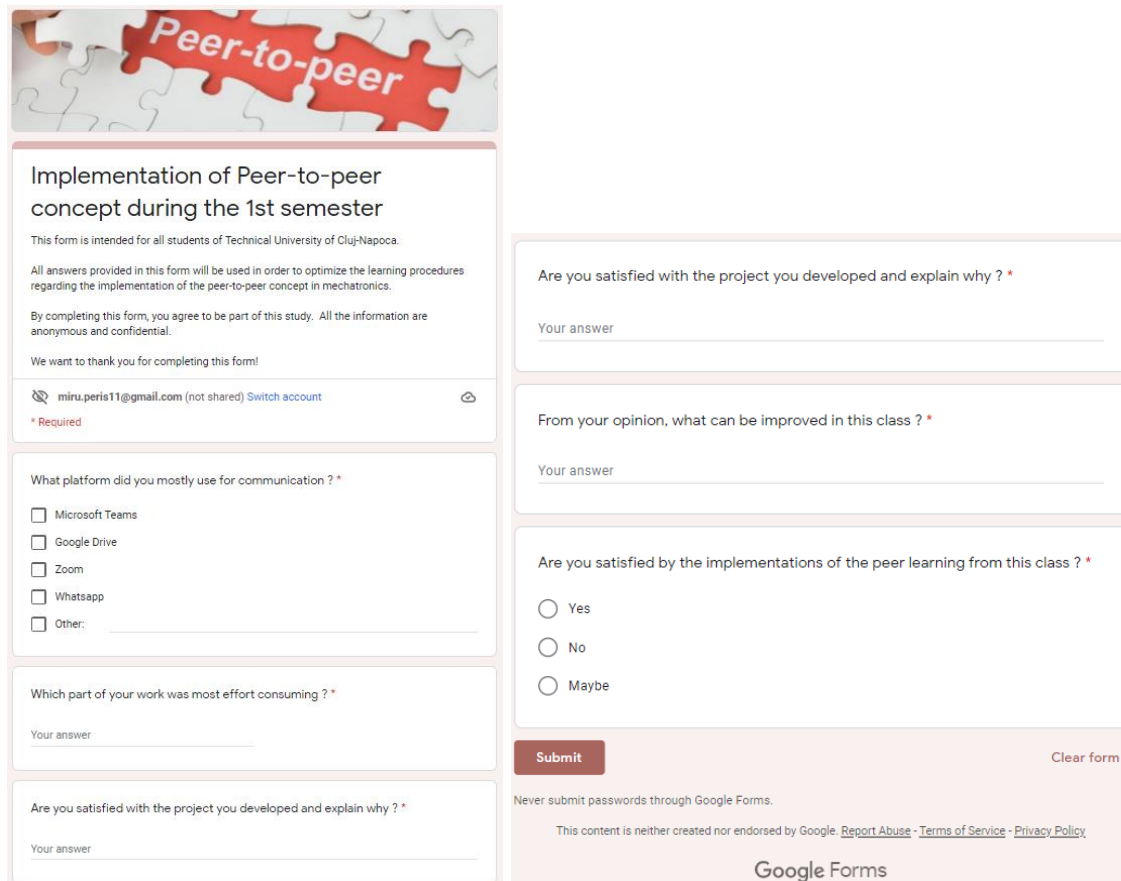
The teacher gave them guidance for this step and a rubric for evaluation was provided. Each one then received feedback from 3 other students and each one was able to see 3 different ways of presenting themselves by evaluating the documents of 3 students. The Moodle peer review workshops were also used to involve students in peer project defences.

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## 5. Collection of teachers' and students' feedback during and after the first peer-to-peer learning semester

### 5.1 Technical University of Cluj-Napoca

The feedback from students was gathered by using the institutional evaluation platform where students give feedback anonymously.



The form is titled "Implementation of Peer-to-peer concept during the 1st semester" and is intended for all students of Technical University of Cluj-Napoca. It includes a header image with the text "Peer-to-peer" on a puzzle piece. The form contains several sections:

- Introduction:** States the form is for all students, answers will be used to optimize learning procedures, and information is anonymous and confidential.
- Communication Platform:** A multiple-choice question asking "What platform did you mostly use for communication ? \*". Options include Microsoft Teams, Google Drive, Zoom, Whatsapp, and Other:.
- Effort Consuming:** A text question asking "Which part of your work was most effort consuming ? \*".
- Satisfaction:** Two text questions asking "Are you satisfied with the project you developed and explain why ? \*".
- Submission:** A "Submit" button and a "Clear form" link.
- Footer:** Includes a disclaimer "Never submit passwords through Google Forms" and a footer "Google Forms".

Figure 5. Google forms created for collection of students' feedback

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From the information gathered until this time of the semester, the following can be concluded:

### 1. What platform did you mostly use for communication?

- 85% of the students have used Microsoft Teams and WhatsApp

**What platform did you mostly use for communication?**

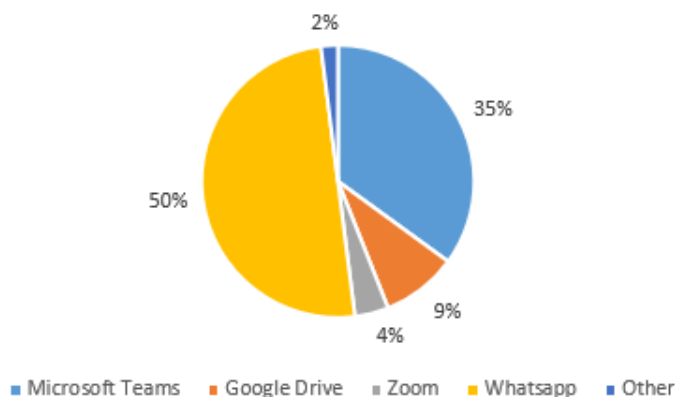


Figure 6. Results extracted from students' feedback

### 2. Which part of your work was most effort consuming?

- Structuring the materials for the presentation
- Organizing the teamwork
- Finding the relevant resources for the topic documentation

**Which part of your work was most effort consuming?**

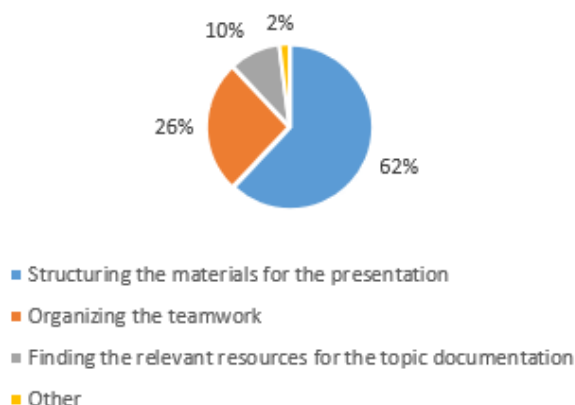


Figure 7. Results extracted from students' feedback

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### 3. Are you satisfied with the project you developed and explain why?

- Organized the working time as they wanted
- Liked to coordinate the group
- Satisfaction of getting the project done with own efforts

#### Are you satisfied with the project you developed and explain why?

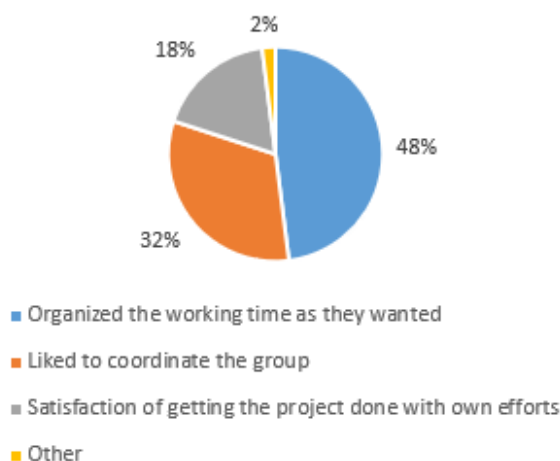


Figure 8. Results extracted from students' feedback

### 4. From your opinion, what can be improved in this class?

- Workplan for the discovery method

#### What platform did you mostly use for communication?

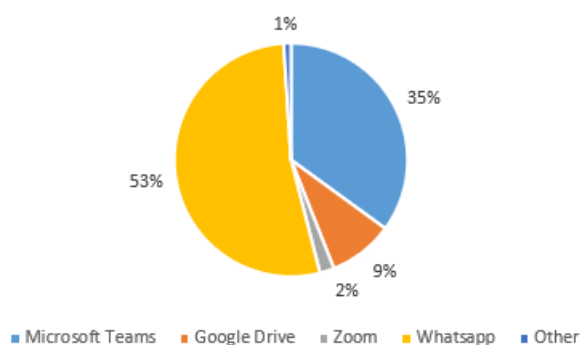


Figure 9. Results extracted from students' feedback

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**5. Are you satisfied by the implementations of the peer learning from this class?**

- 90% of the students were satisfied with the implemented peer learning methods

Are you satisfied by the implementations of the peer learning from this class?

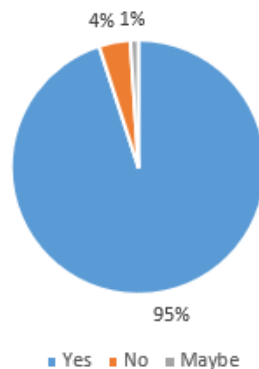


Figure 10. Results extracted from students' feedback

For the second semester of the peer learning we chose the course "Advanced programming in MATLAB" which is held in the first year at the master program called Mechatronic Systems Engineering. We chose this because thanks to the possibility of having MATLAB licenses, a large diversity of projects can be developed. MathWorks MATLAB has a good structured and clear documentation, that can be used by students in discovery method. MATLAB also has an own online community where students can write their questions/problems in order to find solutions on their own. Many tutorials and YouTube videos can be found on the internet.

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## 5.2 Hochschule Kaiserslautern - University of Applied Sciences

Qualitative survey methods were introduced for feedback from teachers and students. Students were invited to write their feedback on the courses in the closing reflections of the e-portfolios and were free to choose their own focus. Questionnaires with open-ended questions were created for teachers and staff to answer in (group) interviews. Since the format was new for the project team involved, this type of survey was deliberately chosen in order not to steer or distort the answers in certain directions. In this way, the multi-layered subjective views of the students and teachers could be elaborated and new perspectives and impulses for the project could be revealed.

### Student feedback on P2P activities:

- The intensive group work was positively highlighted by almost all students in the reflections
- Students had the feeling of gaining practice-oriented skills
- Flexibility to accommodate students' individual situations was gratefully acknowledged
- Particularly positive given the pandemic situation: students were also able to collaborate digitally
  - International students who had to stay in their home countries due to the pandemic were happy to be able to participate digitally in the course, but had to cope with various challenges (e.g. time differences)
- Continuous feedback from the teaching staff was appreciated
- Peer assessment was positively received, as new perspectives could be introduced
- Dividing the lecture into milestones was helpful for students to organize themselves
- Regular consultation hours of the staff were found to be helpful
  - Students have requested that these consultation hours align with milestone dates
- High time consumption was criticized since much of the content had to be worked out by the students themselves

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### Staff feedback on P2P activities:

- Mandatory meetings in P2P courses can be greatly reduced
  - An optimal working method is achieved when students remain in the group work for the most part and there are only meetings of the whole lecture for intermediate presentations
- If students can choose their own groups, this tends to create highly homogeneous groups that find it difficult to get beyond their own personal limits
  - Teachers must either determine the group constellations
  - Or create better opportunities for students to receive more outside stimulus to be successful even in homogeneous groups
- Lack of shared physical work/learning spaces due to the pandemic
  - Has slowed down P2P efforts and prevented exchange beyond own group
- Problems & backlogs are more likely to be noticed through regular exchange with the assistant, who has a better connection to the students due to his position
- Concept must include intercultural differences and leave choices open which can be adapted to the individual groups (e.g. more or less structuring of the lecture)

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## 5.1 Université Savoie Mont Blanc

Questionnaires to assess student satisfaction were drafted and offered in both semesters. Each course was evaluated. In total, 7 questionnaires per semester were sent to students. For each questionnaire, the different teaching methods used were evaluated, including peer learning.

### USMB questionnaire



|  |  |   |
|--|--|---|
| EvaSys   | Évaluation du Master Advanced Mechatronics [Copy] [Copy]   |  |
|   |  |   |
| <p>Cocher : <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Veuillez utiliser un stylo ou un marqueur fin. Ce questionnaire sera traité automatiquement.</p> <p>Corriger : <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Remplissez complètement la case faussement cochée, puis cochez votre nouveau choix.</p> |  |   |
| <b>1. Overall evaluation</b>   |  |   |
| 1.1 I have achieved significant learning in this course.   | Completely disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Completely agree |   |
| 1.2 I am satisfied with the teaching methods used.   | Completely disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Completely agree |   |
| 1.3 Overall, I liked the contents of this course.  | Completely disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Completely agree |   |
| 1.4 I feel that I have provided a sufficient amount of work to achieve the course objectives.  | Completely disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Completely agree |   |
| 1.5 I have the impression that the amount of work required was too much.   | Completely disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Completely agree |   |
| <b>2. Evaluate how the following aspects of the course helped you</b>  |  |   |
| 2.1 Distant learning on Moodle   | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |
| 2.2 Face-to-Face course  | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |
| 2.3 Project based learning   | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |
| 2.4 Collaborative learning (peer learning)   | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |
| 2.5 Eportfolio   | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |
| 2.6 Complete your rating with explanations   | <div style="border: 1px solid black; height: 40px; width: 100%;"></div>  |   |
| <b>3. Evaluate how the exchanges with the teachers helped you carry out the activities.</b>  |  |   |
| 3.1 At distance (mail, Moodle, Mahara, Whatsapp, Zoom ...)   | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |
| 3.2 Face-to-face   | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |
| <b>4. Evaluate how the exchanges with the other students helped you to carry out the activities</b>  |  |   |
| 4.1 At distance (mail, Moodle, Mahara, Whatsapp, Zoom ...)   | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |
| 4.2 Face-to-face   | Did not help <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Helped a lot            |   |

Figure 5 USMB questionnaire part 1

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## 5. What could be done to further assist you in your learning in this course? [suite]

5.3 Additional comments, clarifications, and suggestions:

## 6. Specific questions about project based-learning courses and competencies approach

- |  |                     |                          |                          |                          |                          |                          |                          |                  |
|--|---------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|------------------|
| 6.1 To learn, I preferred to work collaboratively rather than alone.   | Completely disagree | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Completely agree |
| 6.2 To learn, I preferred to get involved in a project than in classical pedagogical activities.                 | Completely disagree | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Completely agree |
| 6.3 I have learned more from working on a project than from more traditional activities                          | Completely disagree | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Completely agree |
| 6.4 I have learned more from working collaboratively than alone.   | Completely disagree | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Completely agree |
| 6.5 I get sufficiently help from the teachers throughout the projects.   | Completely disagree | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Completely agree |
| 6.6 I am able to cite the skills I have developed in the projects.   | Completely disagree | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Completely agree |
| 6.7 I felt supported by my project classmates.   | Completely disagree | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Completely agree |
| 6.8 I felt I could help my project classmates.   | Completely disagree | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Completely agree |
| 6.9 Do you have any suggestions for improving communication between students and with teachers in these courses? |                     |                          |                          |                          |                          |                          |                          |                  |

6.10 What could be done to facilitate the collaborative work in the project teams?

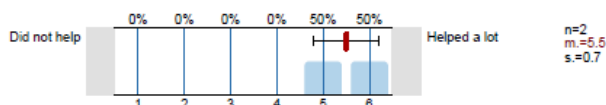
Figure 6 USMB questionnaire part 2

In particular, we looked at whether peer learning and student exchanges had helped students. We also asked students about collaborative work and project work.

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## Collective project:

### 2.3) Project based learning



### 2.4) Collaborative learning (peer learning)

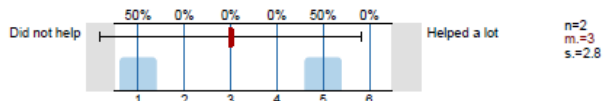


Figure 7 USMB summary of responses to the question "I think that the follow aspects of this course have helped me most in my learning" (first semester)

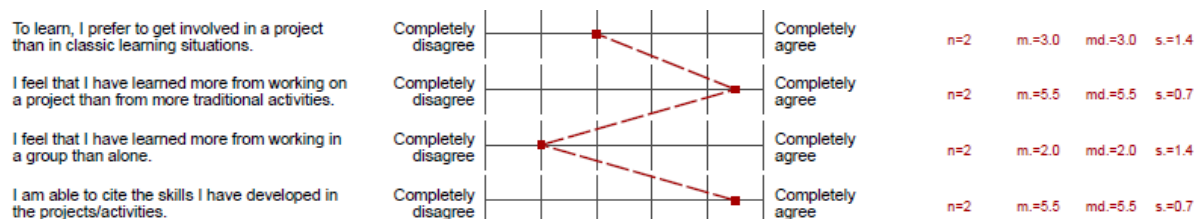
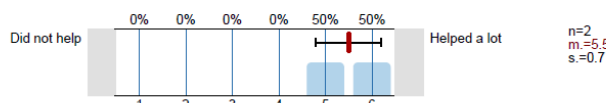


Figure 8 USMB summary of responses to the question concerning project based learning courses (first semester)

## Individual project:

### 2.3) Project based learning



### 2.4) Collaborative learning (peer learning)

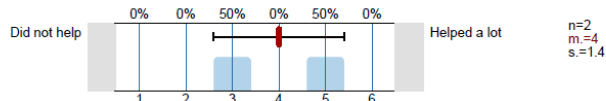


Figure 9 USMB summary of responses to the question "I think that the follow aspects of this course have helped me most in my learning" (first semester)

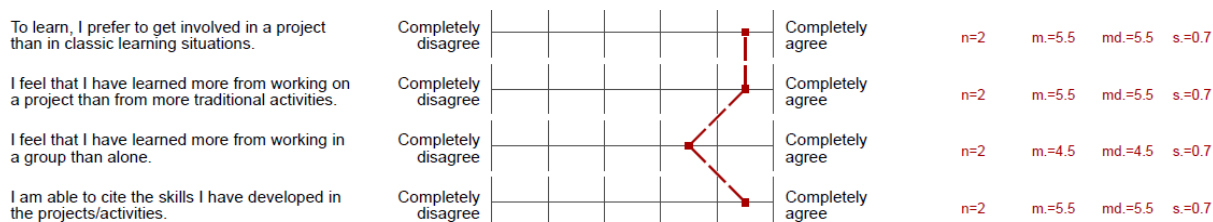
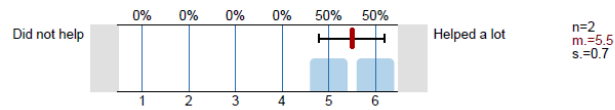


Figure 10 USMB summary of responses to the question concerning project based learning courses (first semester)

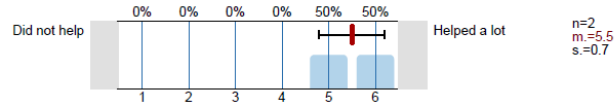
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## Robocup project:

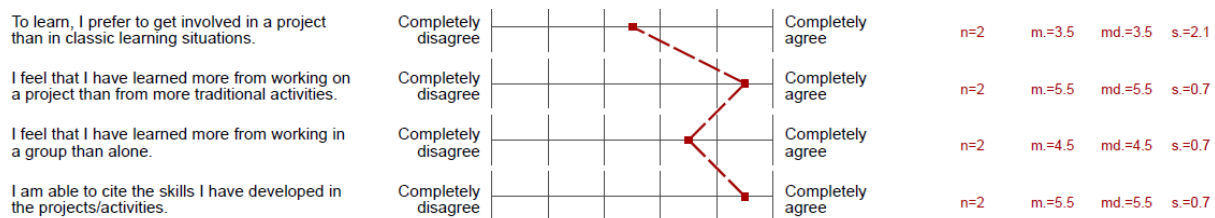
### 2.3) Project based learning



### 2.4) Collaborative learning (peer learning)



**Figure 11 USMB summary of responses to the question "I think that the follow aspects of this course have helped me most in my learning" (first semester)**



**Figure 12 USMB summary of responses to the question concerning project-based learning courses (first semester)**

It seems that peer learning and collaborative project work were generally appreciated by the students. Furthermore, they stated that they were helped in their progress by this type of teaching method.

As far as feedback from teachers is concerned, some of them have become familiar with this type of methodology and activities. Nevertheless, it is still sometimes difficult for them to clearly identify peer-to-peer learning in the project activities.

The appropriation of the tools for setting up peer learning activities and helping students to appropriate them is a gradual process that needs to be supported by the learning designers in particular.

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