



## Peer feedback: quality and quantity in large groups

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### INTRODUCTION

Providing peer feedback is an activity that does not only support the receiver of the feedback in his or her learning process, it is also useful for those who provide feedback, as they have to critically analyse the work or performance of colleagues [1]. Apart from the specific contents of peer feedback comments, the quantity and the diversity of peer feedback in comparison with the quantity and diversity of teacher feedback is one of the main advantages on the inclusion of peer feedback in the assessment methods of a course.

This article describes the second edition of a 15-ECTS project-oriented course for Informatics Engineering Master's students at the University of Minho, in which peer assessment of team performance is part of the assessment method. In the first year in which the peer assessment method was implemented, students worked in large teams and assessed their peers at four moments on the behaviour in the team, using a single comment to justify all grades given on the assessment criteria. In the second edition, students used a comment for each one of the assessment criteria, multiplying as such the quantity and diversity of the comments. This article seeks to explore the change of quality of peer feedback for the second edition in order to improve the current model of peer feedback used in this and other engineering courses and make peer feedback as helpful as possible for both the giving as well as the receiving students.

### 1 PEER FEEDBACK

A shift from teacher- to student-centred learning also implies a larger involvement of students in their assessment. Peer assessment and peer feedback are elements of the assessment process that transfer responsibilities from the teacher to the students. They are not just assessment

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activities, but part of the learning process itself [2]. Students develop skills like making informed judgments, self-evaluation, critical thinking, and coping with frustration by analysing learning outcomes of their peers and formulating feedback. Topping [3] and Fallows and Chandramohan [4] acknowledge that students are more involved in their assessment process when they have a larger responsibility. During the peer assessment process, students do not only have a close look at the performance of their peers, but they are also constantly reminded of their own performance and are likely to use that as their frame of reference.

Gielen et al. [5] distinguish five goals of peer assessment: (i) as social control, used as a precautionary measure, to prevent students from getting lazy, (ii) as an assessment tool, either as complementary or as replacement, (iii) as a learning tool, recognising the impact of assessment on learning and using it as an instrument, (iv) as a learning-to-assess tool, and (v) as a tool to enhance active participation of students. Many authors, who studied peer assessment and peer feedback, refer to the assessment of *products*, like test results, presentations, prototypes, far more than to the assessment of *processes*, like group work processes, project management process or to specific individual behaviour like leadership, punctuality and meeting deadlines. The assessment of these aspects requires a prolonged interaction between students in order to be able to pronounce themselves with regard to their peers.

Peer assessment of processes creates the opportunity to provide students with extensive feedback that, in terms of time and effort, cannot be given, in general, by teachers. Apart from the lack of time, teachers are not constantly present in student teams, in which students have to assess the performance of their peers and are therefore unable to have a comprehensive view of what is taking place within the student teams. During the project, students work in teams on a realistic problem for a long time and, apart from the development of technical skills, they work on professional skills like leadership, communication and team work. Formative evaluation through peer assessment is a tool that can be used to develop these skills. In that case, peer assessment has multiple goals [5]. It is a replacement of teacher assessment, a developmental tool, it teaches students about how to assess and it can stimulate the participation of students in the project work. Feedback is a crucial element of formative peer assessment [6]. Topping [7] finds that the most significant quality of peer feedback is that it is plentiful. Student who give feedback to a number of peers and, therefore, also receive feedback from a number of peers are faced with a wide range of feedback statements that represent more than one interpretation, as would be the case of teacher feedback. According to Topping [7], student feedback is more open to discussion than teacher feedback.

In this study, peer feedback as given in a project work context is analysed and compared with peer feedback of the previous year, in which the demands for students were less extensive.

## 2 CONTEXT

This 15-ECTS course aims to emulate real-life situations faced by software engineers. The main aim of this course is to enable students to acquire a set of skills related to: (1) the development of a software product, system or service (hereafter, referred simply as product) in a team, and (2) the analysis of the potential business value of the product.

By working in relatively large teams the students learn many professional skills, such as interpersonal communication, leadership, responsibility, human resources management, project management, marketing, and presentation for different audiences. The project should be carried out within a strict time limit.

The software engineering students are expected to already know how to develop software applications, but they need to combine their software engineering skills with professional ones in order to correctly master and cope with the envisaged requirements. The course



requires the teams to address all the main software development tasks, such as analysis, design, implementation, testing, and management. In this course, the students need and develop many competencies in software engineering and other professional skills, including:

- Interact with a customer; Communicate requirements and design decisions with the users.
- Plan and follow up a software development project; Review the plan during the execution of the project; Reflect over the initial expectations and estimations.
- Work in a team; Coordinate a team, its meetings, and the internal communication; Use basic collaboration tools in software development, such as a tracking system, a software repository, and a version control system.
- Carry out a software development project from beginning to end; Elicit and prioritize the requirements; Create and document the design that supports the requirements; Implement the design; Test and validate the implementation.
- Present the project, product, plans and documents to colleagues, stakeholders and the public; Produce documentation that is understandable and usable.
- Create a new product; Compare the product with the competition; Produce a business plan for the product.

Globally, the course is scheduled as follows. In the inaugural lecture, the lecturers present the projects to be developed, some of them proposed by students and others by external customers. Teams for the projects are formed (around 12 students). During the semester, each team develops the product and carries out the business plan that supports it. Finally, students have to prepare a showroom, in which each team shows in its booth the product and the business plan to a panel of experts.

During the first three weeks of the semester, the students attend a set of seminars that are organized to help them setting up the teams and preparing the projects. These seminars address issues like market analysis, investment, software process, and project management. From the fourth week until the end of the semester, the teams work in the development of the products and in writing the business plans. Each team is assigned a room where they should meet twice a week. Presences in the meetings are mandatory. Once a week, the coordinators of each team meet with the lecturers to discuss the progress of the project.

Each student works in a team. Thus, it is not possible to pass this course by working alone. The students are responsible for forming the teams, which ideally are composed of 10-14 members. However, the lecturers may modify the team composition for the benefit of the course.

Whenever possible, the teams should be composed of students from different disciplinary fields (e.g., software engineering, management, and marketing), so that students are forced to communicate and collaborate with other “professionals” during the project. This requires the faculty to look for collaborations with other departments, since the members of the teams are necessarily from different degrees (from different schools). It is reported that sustaining multidisciplinary pedagogical efforts is extremely demanding, typically requiring motivated champions [8].

### 3 METHODS

For this study, five teams of students involved in peer assessment were analysed. The total number of students participating in the study is 61, divided in 5 teams, varying from 8 to 14 students each. All teams had to choose five peer assessment criteria, describe briefly those criteria, decide on the relative weight of each criterion to the overall assessment calculation, and define five benchmarks: 35, 50, 60, 75 and 90. These benchmarks were defined to



facilitate the students in evaluating their peers, but also to prevent extremely high marks, a phenomenon that was witnessed in the previous year.

All teams were asked to send the criteria and the benchmarks to their teachers, who then introduced the criteria in a web-based peer assessment tool. Student had to assign a grade, expressed as a number between 0 and 100, to their peers on each one of the five criteria. These grades had to be justified with a feedback comment. Feedback comments were analysed using the categories shown in *Table 1* and developed for the first edition of the peer assessment system in this course [9].

*Table 1. Categorisation of comments*

Category	Description
Identification of strength	Comment that identifies a strength in the behaviour of a student in the project team
Identification of weakness	Comment that identifies a weakness in the behaviour of a student in the project team
Remark on specific task	Comment related to specific tasks in the project
Remedial action	Comment aiming to improve the behaviour of the student
General encouragement	Comment aimed at praising a student for his or her effort
Justification of grade	Comment explaining why a certain percentage was attributed to a student
Specific comment on transferable skills	Comment aimed at the development of a specific transferable skill
Not enough information	Comment that states the inability to assess due to lack of information on the behaviour of a student
No comments	Comment that states that there is nothing to say about (aspects of) a student's behaviour
Other	Remaining comments

The first four categories are based on the intents of formative assessment as defined by Topping [7]- identify strengths, identify weaknesses, target areas for remedial action and the development of professional skills. The remaining comments were, after content analysis, divided into the remaining six different categories.

#### 4 RESULTS

This section discusses the results of the feedback process. *Table 2* shows the criteria as defined by each team and a short description:

*Table 2. Criteria, weights en descriptions defined by the teams*

Team	Criterion	Weight	Description
1	Meeting deadlines	0,20	Assesses if the team member has finished the given tasks within the defined time
	Punctuality	0,10	Refers to punctuality and assiduity in meetings
	Proactivity	0,20	Assesses whether the team member takes initiatives, participates actively in meetings and has a critical attitude towards his own work and the work of his/her peers
	Quality of work	0,30	Assesses whether the work produced by the team member is of quality and shows effort and professionalism.
	Team work	0,20	Assesses if the team member shows good interaction with his/her peers, shows solidarity and is able to delegate tasks.



2	Assiduity	0,10	Shows assiduity and punctuality on Wednesday meetings and others, if planned with the group.
	Meeting deadlines	0,30	Each task that a team member carries out is bound to a deadline. This criterion reflects the achievement of the deadline.
	Effort	0,30	This criterion seeks to assess the quality of the work developed during the project.
	Proactivity	0,10	This criterion reflects the pro-activity of the team member, or the capacity of solve and anticipate problems. The willingness to increase value to the project through new ideas will also count.
	Team work	0,20	This criterion reflects the capacity to help other team members as well as the involvement is that tasks that the members work on.
3	Cooperation	0,15	Team spirit.
	Initiative	0,10	Ability to participate spontaneously.
	Organization	0,15	Ability to present/document the results of the work that was done.
	Productivity	0,30	Ability to produce useful results.
	Responsibility	0,30	Ability to meet deadlines.
4	Assiduity	0,10	Shows assiduity in meetings and other activities agreed upon by the team.
	Constructive attitude	0,15	The team member contributes with constructive ideas to the other sub-teams or the project as a whole. This criterion is not necessarily related to technical questions.
	Pro-activity/Initiative	0,20	Ability to anticipate the needs of the project and demonstration of motivation or initiative to satisfy these needs. Having autonomy to solve the problems that appear without the need for other team members to intervene and assume responsibilities.
	Productivity	0,30	Shows dedication, initiative and meets goals and defined deadlines, presenting high quality work.
	Team work	0,25	The ability to work in teams is a necessary component for the success of the project. Each team member should participate in discussions when necessary, supporting the resolution of possible problems, and have an ability to accept criticism and contribute to a team atmosphere. Give constructive feedback to the other members of the team, while giving them the opportunity to improve lower grades.
5	Meeting deadlines	0,20	Meet the final dates for delivery of reports. If these deliveries have to be corrected by other members due to an excessive amount of errors, a severe penalty may apply.
	Team spirit cooperation	0,25	The student is able to anticipate needs of the project and take initiatives to help others team members. The student contributes to the well-being of the team.
	Ideas/Creativity	0,20	Critical attitude during meetings and on the forum in a constructive way. Contribution of ideas to the project for improvement and solving problems.
	Punctuality and assiduity	0,10	Reflects the punctuality and assiduity during the Wednesday work sessions and another compulsory days (Monday or Tuesday) as agreed upon by the team.
	Quality of work	0,25	Quality of the work that is presented and delivered (e.g. documentation of the coding, treatment o exceptions, well written reports), the delivered coding has to be functional.



The teams were divided in sub-teams, except for team 2 that chose to do the peer assessment in the whole team. At four different moments, a given student had to assess, through the web-based tool, each of their peers on all the five criteria, by assigning a grade between 0 and 100 and writing a justification for that grade. This led to a total of 4,369 justifications written by students. In 1,181 cases, students attributed a grade without writing a justification, most of them at the first assessment moment, after which the teachers insisted on constructive feedback in the peer assessment system.

Looking at the distribution of the comments over the different categories per student team, as presented in *Fig. 1*, the identification of strengths is the category with the highest frequencies. More than 65% of all comments concern this category. When comparing the four assessment moments through a one-way analysis of variance (ANOVA), no significant differences were found between the relative distributions over the categories comparing the four moments. A one-way ANOVA between the five teams revealed significant differences with regard to “Identification of Weaknesses”, ( $F=9.720$ ,  $p < .05$ ), “Remarks on Specific Tasks” ( $F=7.161$ ,  $p < .05$ ), “Remedial Action” ( $F=5.819$ ,  $p < .05$ ), “General Encouragement” ( $F=5.315$ ,  $p < .05$ ), “Transferable Skills” ( $F=20.250$ ,  $p < .05$ ), “No Comments” ( $F=13.873$ ,  $p < .05$ ) and “Other” ( $F=8.093$ ,  $p < .05$ ).

A closer look at the comments made by the students, shows that the comments of the first assessment moment were less specific than those of the next moments, most especially the last assessment moment. Examples of comments made at the first assessment moment are:

She participates well and contributes to the success of the work  
(*Criterion Pro-activeness Team 1, Moment 1*)

Willing to help when asked  
(*Criterion Team Work; Team 1, Moment 1*)

Showed to be organised with the tasks he worked on  
(*Criterion Organisation; Team 3, Moment 1*)

Always present at meetings  
(*Criterion Assiduity; Team 4, Moment 1*)

Very participative and with good ideas for the project  
(*Criterion Ideas/Creativity; Team 5, Moment 1*).

At subsequent moments, students made more specific comments with regard to the performance of their peers. The identification of strengths became more directed and was, in many cases, accompanied by the identification of references to specific tasks and suggestions for the improvement of performance.

Participates actively. Always carries out the tasks that were attributed to her. She should share her ideas and opinions more.  
(*Criterion Proactivity; team 1 Moment 2*)

Worked well on the documentation.  
(*Criterion Effort; Team 2, Moment 2*)

He produced satisfactory results for the tasks that were assigned to him, but he should share his work more and ask others for help.  
(*Criterion Productivity; Group 3, Moment 3*)

At the final stage of the project, some of the comments were very critical.



He did not follow previous recommendation. He likes to create chaos and jeopardises the group atmosphere

(Criterion Teamwork; Team 1, Moment 4)

Group member who hardly appears at meetings.

(Criterion Assiduity; Team 4, Moment 4)

He had a passive attitude in the last stage of the project.

(Criterion Initiative; Team 5, Moment 4)

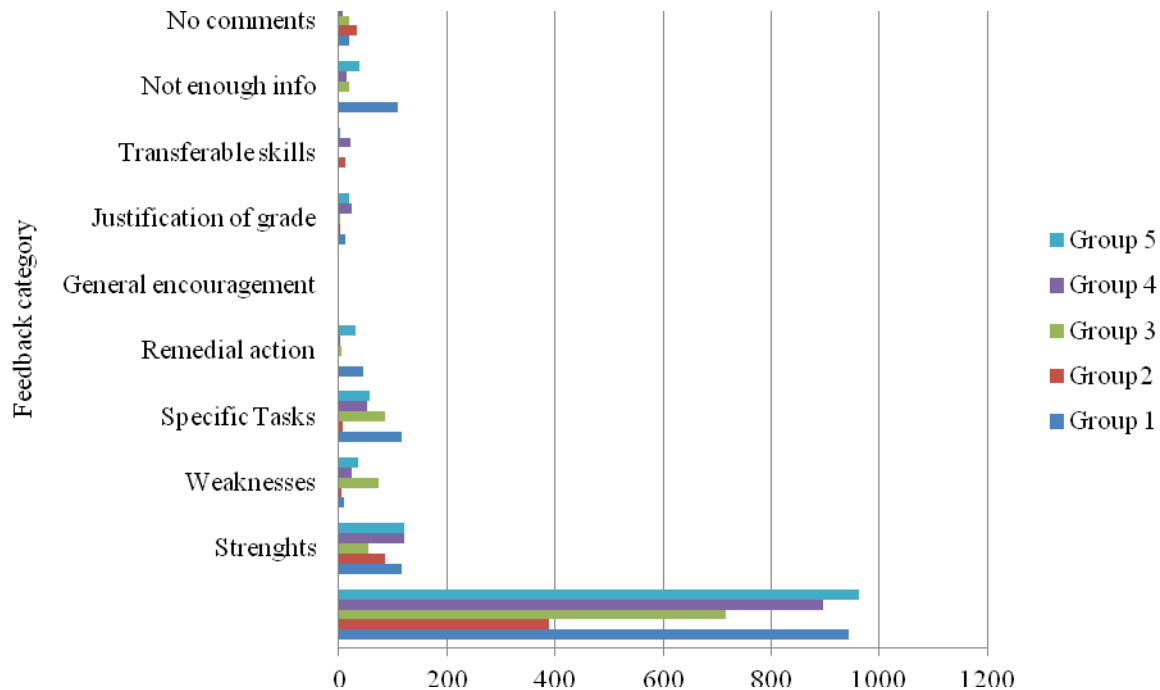


Fig. 1. Frequency distribution of feedback comments over categories

The critical comments as given by the students are, in general, related to lower grades -under 70%- although some students still give rather high grades-over 80%- while at the same time identifying negative aspects of the work or their peers.

## 5 DISCUSSION AND CONCLUSIONS

The first and most important conclusion of this study is that the peer feedback system enabled an amount of feedback that is impossible to provide by one or more teachers of a course. Students wrote more than 4,500 feedback comments and each one received at least 60 feedback comments (at least 3 peers in a sub-team, 5 criteria, 4 assessment moments), although many students received a lot more comments. It is close to impossible for a teacher to provide such a quantity of comments. As the comments were provided by different peers, they reflect different opinions and serve as a diversified input for improvements.

The distribution over the categories is still rather unbalanced and using the identification of strengths as the major category of feedback comments leaves out opportunities for improvement that could have been created through the use of the other categories. Identification of weaknesses together with Remedial action could help students to work on the improvement of their performance in a more focused way. General encouragements, good to keep up a pleasant working atmosphere, were not made very often.



From the results it seems that students are not comfortable with being critical to their peers, especially at the beginning of the project. Only at the last assessment moments, when frustration and irritation with peers who work less, have taken over, students feel at ease to make critical comments and tell their peers they should have contributed more to the project.

For following editions, it will be necessary to prepare students better for the feedback comments and make sure their comments are more beneficial to their peers. Making more balanced comments that also take into account aspects of improvement will also contribute to reflection on and improvement of their own work, according to Liu and Steckelberg [1].

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