

DEVELOPMENT OF AN ASSESSMENT METHOD FOR INDIVIDUAL GRADING OF A GROUP PROJECT WORK

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Abstract

In engineering education, project-based learning (PBL) is irreplaceable for implementing active studies in applicable, engineering courses. The example of this paper is taken from a course Product design and development given for the third-year students at speciality Product development for mechanical engineers at Linnaeus University. The course is project-based and the projects are given by the industries where students work with an external collaboration partner. In the 15 ECTS course, done in one semester the students are trained in conceptual product design using different methods for problem solving and decision-making. They work in project teams of 3-4 students. The assessment and grading were done on the base of the grade of the report written during the project time. The individual knowledge and contribution to the project work was evaluated more in informal than in a formal way during the tutoring sessions and the seminars. This is where the authors have faced a big challenge to assess formally and individually the students when a group has done the work. The question was how fairly to evaluate the students' knowledge, skills and contribution to the group work. In this paper, the authors are presenting an attempt to answer this question and to propose a method for individual grading of a group project work. The method for assessing individually the students' performance is based on a Competence Advancement matrix with standardized criteria- production, perception, reflection, systematic approach and complexity.

Keywords: *Evaluation method, individual grading of a group work, higher education in engineering, project-based learnings.*

1. Introduction

In the engineering field and especially in the field of mechanical engineering, it is both the problem analysis and the problem-solving phases that are important learning phases. Furthermore, it is important that these learning processes are team based in order to acquire the knowledge sharing within a smaller team as well, and that the collaboration is oriented toward both process and product so that engineers learn the competence of collaborative knowledge construction. The dual purpose of group work - to develop the ability to collaborate and to acquire academic knowledge, seemed to be an issue for the teachers. The issue became even more challenging when the groups were working in different locations in the school and the teachers' chances of observing the groups for more than short periods were limited. The focus in this paper is to understand what happens in the meet point between group work and assessment in pedagogical practice. There seems to be a tension between the demand for individual assessment of students' knowledge and abilities and the demand to teach students collaboration abilities through group work. The challenge is to define the right criteria and to concretising what and how is to be assessed. The dilemma comes from the fact that that a collectively produced assignment is to be assessed individually what creates competition among students in the group, contrary to group assessment, which creates interdependence and collaboration among the group members. (Chiriac & Frykedal, 2022).

2. Method

Assessment of group work could be undertaken with help from the students through self and peer assessment. The students might be active in their own assessment process to control their own learning and outcomes. There are two different learning outcomes that could be assessed - academic achievement (result or product) or collaborative and learning strategies (process). The product is the result of the

students' work, while process is mainly considered as the collaboration between the students when they work on a common task. The product outcome can be informally accessed by the teachers valuing such aspects as A) seminars and tutoring presentations; B) final result, and C) written report. The evaluation of the product could give possibilities for individual but mostly group assessment. The final product is a significant basis for assessment at both the group and the individual levels. How the final product turns out depends on the task, and, consequently, a text, a 3 CAD model and a simulation will be assessed according to different criteria. The teachers assessed the final product as a whole (group level), as well as assessing if and how group members assumed responsibility (individual level) during the work process. The process outcome could be also informally accessed by the students, measuring such criteria as A) time in hours for reading theory and external research; B) time in hours for preparing the planning and the presentations; C) time in percentage for group work and tutoring and D) contribution in percentage to the midterm and the final result and the final report. (Backlund & Garvare, 2019; Frikedal & Chiriac, 2011)

The example of this paper is taken from a course Product design and development given for the third-year students at speciality Product development for mechanical engineers at Linnaeus University. The course is project-based and the projects are given by the industries where students work with an external collaboration partner. In the 15 ECTS course, done in one semester the students are trained in conceptual product design using different methods for problem solving and decision-making. They work in project teams of 3-4 students. The project follows the steps of the Product design and development process for achieving a conceptual solution presented in text, 3D models and simple prototypes, optimized, and verified by computer simulations. The course consists of lectures, guidance lectures, seminars, tutoring sessions and written report. Flipped education is applied – the lectures are available on the platform of the course and the students can read them and the reference literature in their own pass. The guidance lectures are given in synchronous mode and help students to understand the theories and to apply them in the project. There are three seminar presentations during the course. The assessment and grading used to be done on the base of the grade of the report written during the project time. The individual knowledge and contribution to the project work was evaluated more in informal than in a formal way during the tutoring sessions and the seminars.

The developed method consists in several steps where students are also actively involved together with the teachers in self and peer assessment. The first step is an individual evaluation of the time dedicated to the project work, and to acquire knowledge done by the students. (see Table 1)

Table 1. Method of acquiring information for informally accessing the process outcome (done by students).

Group #	Time for reading theory and external research (h)	Time for planning and preparing presentations (h)	Time for group project work + tutoring (h)	Contribution to the result (%)	Contribution to the written report (%)
Name 1					
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Name4					

Students are submitting the fulfilled Table 1 twice during the course- in the midterm presentation and in the final presentation. In this way they are assessing the learning process inside the group. The criteria affecting the most the individual final grade is the contribution to the result and to the written report. They will be directly applied to the final grade of the written report. (see Table 3)

Table 2. Method of acquiring information for formally accessing the continuous tutoring presentations (done by teachers).

Group #	Tutoring Sessions & Seminars				Σ_n/n
	Meeting 1 (date)	Meeting 2 (date)	-----	Meeting n (date)	
Name 1					
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Name 4					

In Table 2. the teachers are filing in during each tutoring session. The feedback in the course is given very often 1-2 per week. The grading scale used in filling the table and assessing the continuous activity of the students in the tutoring sessions is 0, 1, 3, 4, 5. The grade "0" is given when students are

missing the tutoring meeting. While “1” stands for poor performance, when the students are not active or he/she does not understand what the group has done in the respective step of the project. The rest of the grades “3, 4, 5” are the grading scale for the performance of the student during the tutoring session. In the last column, the mean value from all the tutoring meetings is calculated and it goes to Table 3.

Table 3. Method of acquiring information for formally assessing the product outcome (done by teachers).

Group #	Tutoring sessions	Seminars sessions	Midterm result	Final result	Written report
Name 1					
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Name 4					

In Table 3 the summarized information for formally assessing the product outcome, both result and written report, is presented. The column for tutoring sessions is filled by the information from Table 2. The grading scale for all the criteria is the same as for Table 2. Table 2 and 3 are filled once for the whole course. For the midterm and final result, the criteria used for grading are production, perception, reflection, systematic approach and complexity. The result is assessed also together with the collaboration partner from the industry (the expert from the project company).

At the end of the course, for final evaluation and individual grading of the course is systemized in a Competence advancement matrix (CAM) (Koblank, 2007), There using the information acquired in Tables 1 and 3 on a single A4 page is reflected the work and the result of the group. In the CAM it is possible to see how the time dedicated to work on the project and the actual contribution to the group project work imposed on the grade of the report are giving a clear picture of the individual grade of student working in group and taking part in cooperative learning. The assessment of individual knowledge and abilities should be frequently undertaken when learning is developed in interactions with other students, such as in group work. That is why the basic of the proposed method are the active presentation of the student in the tutoring sessions and the seminar presentations. According the syllabus they are only graded by passed and not passed, but with applying the proposed new methodology they have huge impact on the individual grading of the project-based course.

3. Conclusion

On many occasions in educational settings, an assessment of individuals' knowledge and abilities need to be accomplished in situations where learning is developed in interactions with other students in a social context, such as in group work. There is a tension between the demand for individual assessment of students' knowledge and abilities and the demand to teach students collaboration abilities through group work. The focus of this paper is methodological, and its purpose is to provide a systematic approach to the individual grading of a group project work. (Frikedal & Chiriac, 2011),

For the successful application of the proposed method, it is important to inform the students about how the assessment will be implemented during the course, about their role in self and peer assessment. This will not only give the students clear picture on how they will be evaluated but also will reduce the tension among the group members. They need to feel that the project work is a result of team cooperation but also that the efforts and acquired knowledge of every one will be fairly graded. The students have to be informed that the final grade is not only result of written report and taking part in seminars, but it is result of continuous active performance along the whole course. Another positive side of the new method is that every step in the process is documented and teachers are ready to give detailed feedback on the continuous performance of the students.

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