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ABSTRACT

Keywords – motivation, industry, active learning,

Rationale

The challenge presented here is how to motivate students to promote active learning. The method used is constructive alignment (Biggs & Tang, 2007) of learning objectives, learning and evaluation along with further considerations including which competences are promoted. The case presented is from a Master course, which is organised around two projects: a feasibility study and a national energy system analysis. The course is taught using the principle of inductive learning (Prince & Felder, 2006) with the students being presented with the case from the beginning and subsequently achieving the tools to perform the projects. This is both frustrating and motivating for the students as they know why they need to have the tools, but they feel they get them too late.

Both with the feasibility study and the energy system analysis the students work in groups with a somewhat loosely defined project. The feasibility study is performed on real cases supplied by two energy companies, who are interested in the cooperation with the students, but also in the results of the feasibility studies, which gives them indications on whether a project is worthwhile investigating more. An element of competition is introduced in the sense that the best groups within each case are asked to present for managers from the companies as well as the rest of the students. This has turned out to be highly motivating for the students, who wish to have their project chosen and to present for possible future employers and their fellow students. Furthermore, the remaining students prove to have highly relevant and critical questions to the methodology, assumptions, etc. making the presentations a great learning experience for all.

The course is taught in 4 hour modules. In practise the first two hours of each lecture is spent on presentations and exercises and the last two hours are spent on group work on the cases. Often lectures are with invited speakers from relevant companies. This is very interesting for the students, making up for the fact, that it also somehow disturbs the red thread in the course. Furthermore, at the end of each module, two volunteering students give feedback on the lecture. This feedback is used both to make adjustments along the way, but also to inspire to major changes for next year's course. Seeing that we listen and try to adjust motivates the students to active participation as it is clear that teachers and students have the common goal of students learning as much as possible and also a shared obligation to do our best to make that happen. In general the course is very well suited for discussions and organising the course with group work allows for plenty of that. Furthermore, as group work is how many companies organise work today – the ability to cooperate well in groups is assessed to be an important competence for engineering students to achieve.

The students are assessed through one written report (feasibility study) and one poster (energy system analysis) (each 25% of final grade) and furthermore an individual written examination using the tools which are taught in the course (50% of final grade). The chosen evaluation form motivates the students to work hard in groups with the projects as well individually with the tool exercises. Furthermore, from the

student questions received in the time up to the exam it was obvious that the students were practising the use of the tools, thereby ensuring an additional learning loop in this respect (Argyris & Schön, 1978). Finally, it is possible to assess both conceptual and technical competences in a group and individually.

Results

After having changed the course into its current form the students are much more motivated. They work hard and learn a lot. This entails some amount of frustration along the way. But in the end most agree on having learned a lot during the course, which is the main goal of the course. A long list of questions was asked to the students in fall 2011 regarding their learning experience. The students had to answer whether they strongly agreed in the statements (5) down to strongly disagreed (1). Most answers were between 2.5 and 3.5. The only outliers are the ones highlighted in bold in Table 1. These results illustrate that the students appreciated the effort we made in general and to take their concerns into account in particular.

Table 1 Student evaluation

1 . 1 This course was intellectually stimulating (3.6)
1 . 2 The aims and learning objectives of this course were NOT made clear
1 . 3 The teacher normally gave me helpful feedback on my progress
1 . 4 It seems to me that the syllabus in this course tried to cover too many topics
1 . 5 The teacher showed no real interest in what the students had to say in this course (1.5)
1 . 6 I have usually had a clear idea of where I was going and what was expected of me in this course
1 . 7 I have found the course motivating
1 . 8 It was often hard to discover, what was expected of me in this course
1 . 9 This course helped me sharpen my analytical skills
1 . 10 This course made me feel more confident about tackling new and unfamiliar problems
1 . 11 This course has stimulated my enthusiasm for further learning
1 . 12 In this course it was always easy to know the standard of work expected from me
1 . 13 The course helped me to develop the ability to plan my own work
1 . 14 Where it was used, Information Technology has helped me to learn
1 . 15 I was generally given enough time to understand the things I had to learn in this course
1 . 16 The teacher made a real effort to understand any problems and difficulties I had in this course (3.8)
1 . 17 This course has stimulated my interest in the field of study
1 . 18 This course developed my problem-solving skills
1 . 19 The teacher has put a lot of time into commenting (orally and/or in writing) on my work
1 . 20 In this course it was made clear right from the start what was expected from me
1 . 21 The teacher worked hard to make the subject of this course interesting (3.9)
1 . 22 The volume of work necessary to complete this course means that it cannot all be thoroughly comprehended

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