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ENHANCING STUDENT MOTIVATION – 'RAISE THE BAR'

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ABSTRACT
The quest for enhancing student motivation, commitment and performance in higher education is an ever-present struggle for university teachers. Of course, the hunt for a good grade is something that is very central for students, but as a teacher you would like to reach further and find a deeper, more personal motivation within each student. A hypothesis that was investigated was that students will accept high demands if they are clearly defined and presented directly in the beginning instead of being introduced gradually during the course. In the present course, a team of six teachers was put together in order to be able to handle the students' need for coaching and support. The course included multiple sub-deadlines concluded by status presentations, called Design Reviews, where the groups updated the teaching team and other groups on the project's progress. The Design Reviews included both an oral presentation of five minutes and a written memorandum, called PM. Each student was responsible for one oral presentation and one PM. Examination of the course was based on the final project result as well as on performance during the Design Reviews. The conclusions from this approach are that the general motivation was increased. The project results were very good and included several innovative solutions. Student reaction to the high demands was positive but teacher coaching is a very important factor for keeping this on a manageable and stimulating level for the students and preventing it from being an oppressive stress factor.

Keywords: Motivation, commitment, coaching, expectations

1 INTRODUCTION

This paper describes a study made to investigate how raised demands/challenges and more formalized coaching would affect student motivation. Felder and Brent [1] argue that a necessary condition for students' intellectual growth is challenge; however, this challenge should be adapted to their current development level. The study took place during a project course for the third-year students at the Industrial Design Engineering program at Luleå University of Technology, Sweden.

The quest for enhancing student motivation, commitment and performance in higher education is an ever-present struggle for university teachers. Teachers constantly develop means to try to bring out the full capacity of the student. Motivation is a substantial subject, and researchers seem to agree on three basic aspects of human behaviour involved with motivation: to choose a particular action, to persist with that action, and to put effort into that action [2]. This implies that, in order to facilitate this theory, the goals and purposes are made clear to the students (and adapted to the students' current development level) or, rather, that the students identify the goals and purposes. One must understand that students in most cases carry more than one goal and that these goals interact, both positively and negatively, in each given situation [3]. It is therefore important to place the course goal in question in a context meaningful to the student. It is also of great importance to understand the students' underlying goals in order for a teacher to provide the most effective coaching. Research has shown that informal contact between students and faculty can influence student persistence positively [4], [5], [6].

Kolić-Vehovec et al. [7] identify four different types of goal orientation among university students and the learning strategies among these four types differ regarding goal orientation, perceived effort engaged, reading strategy, and the like. Placing different types of goal-oriented students in the same project group implies conflicts and difficulties to cooperate within the group. Taylor et al. [8] emphasise that to that successful learning experiences for capstone design teams require faculty to shift their role from a traditional lecture or consulting role to a coaching role. Coaching has been used

in sports for a very long time and is used more and more in professional work and education. Bresser and Wilson have put together four examples of definitions of 'coaching' [9]:

- 'Unlocking a person's potential to maximize their own performance. It is helping them to learn rather than teaching them' [10].
- 'A collaborative, solution-focused, results-oriented and systematic process in which the coach facilitates the enhancement of work performance, life experience, self-directed learning and personal growth of the coachee' [11].
- 'A professional partnership between a qualified coach and an individual or team that supports the achievement of extraordinary results, based on goals set by the individual or team. [12].
- 'The art of facilitating the unleashing of people's potential to reach meaningful, important objectives' [13].

These definitions emphasize the development and growth of the individual's potential and the achievement of a deeper understanding for the task at hand. Coaching can have a big impact on team performance, Taylor et al. [8] presented four key indicators of successful design teams in which two where related to the coaching – 'Coach awareness of team success and the coach ability to assist in both team and design process'. Taylor et al. [ibid.] also found that one activity of successful teams where their ability to prepare for and reflect on design reviews an activity where the coaches played a large part in helping teams prepare for and reflect on periodic reviews. In this study, much effort was put into goal definition and goal positioning together with substantial resources regarding available coaches.

2 COURSE CONTEXT

This study was initiated to investigate the benefits of changes made to the layout and work methods in project courses at the program for Industrial Design Engineering at Luleå University of Technology. Traditionally, the projects are carried out with very few restrictions and much responsibility on the students [14]. Advantages with this approach are mainly real-life contact with industry for the students and the possibility to run a project on their own. Disadvantages are that group projects tend to have students keeping in the background, not contributing to the group and a tendency for less work in the beginning and more and hectic work at the end. Few involved teachers in the projects results in high workload for teachers with less possibility of in-depth feedback. To overcome these disadvantages a new layout was proposed and implemented in the course A0013A, Product and Production design.

The course A0013A, Product and production design, (7.5 ECTS) is a course in integrated product development for third-year students in the Industrial Design Engineering program (300 ECTS master's program), focusing on the interaction between product design and production design. During the course (10 weeks) students start from an existing product with the aim of developing and improving it based on a user perspective, in terms of design, ergonomics, durability, and manufacturing. In this course the students are for the first time presented with a vague design problem, previous project courses has often had a fairly detailed design brief with a clear intention, requirements and goals. In this project the problem was wicked or ill-defined [15] and it was up to the students to understand which users the product was intended for, their needs and requirements. The human centred design approach is present in all stages from the pre-study, where e.g. observations and interviews aims to capture the users point of view on the product at hand, to the production design, where not only suitable manufacturing techniques are investigated but also the plant layout is designed with regards to logistics, safety and worker comfort. The course is carried out in project teams that are provided with coaches from the teaching staff. To further support the coaching function, more teachers were engaged in this course compared to previous ones in order for each coach to be able to provide the in-depth and individual feedback needed. The course uses an approach where market research, product development and manufacturing are accomplished in parallel. The design of the new product also includes materials and production choices as a natural part of the innovation process. The course does not include new theory, but instead draws upon the theory, knowledge and practice from previous courses. The teaching team has designed a stage-gate based framework on *what* to deliver; *how* this is achieved is up to the student teams. Given the nature of creative work a structured approach with checkpoints and intermediate goals reduces uncertainty and creates structures for ill-defined problems [16, 17]. The course framework is a simplified design process with five phases. After each of the four first phases a design review (DR) is done, during which the students present the results in an oral design review and with a short written report (PM). In the end a longer presentation is held, during

which the students present their final product (including how it will be produced) and deliver the final documentation. See Figure 1.

Figure 1. The framework of the course with four design reviews

During each DR, the students receive feedback from the whole teaching team as well as feedback on the written PM from their coach. The coaching team tried to create an environment where students had to present their results and conclusions and also the underlying rational (i.e. knowledge and arguments that form the basis for these results – '*Why have you selected this material? Why is this important? Why is this concept better?*'). This type of critique forced the students to reflect over their own decisions and conclusions. Feedback was very clear and direct, which can seem harsh at first but which the students appreciate more towards the end of the course.
To ensure that the different coaches assess the work in a similar and objective way, grading templates are used throughout the course. An example from the oral presentation is found in Table 1 (grading is done using a graded scale where 3 is pass and 5 is pass with distinction).

Table 1. Grading template for oral presentation

3	Construct coherent arguments and articulate ideas in an acceptable manner, does not feel well-rehearsed. Content is acceptable. Means of communication is acceptable.
4	The presentation was performed in a good and steady pace, and the content is highly relevant and feels rehearsed. Means of communication in the form of pictures, models, visualizations are used well and show good design that is clear, well designed, and structured.
5	Presents a convincing show of good design, argument is clear and logical, and contains the design rationale for choices and decisions. Answers questions quickly with honed and logical arguments.

In the design process students are encouraged to explore the different concepts by experiments and prototypes, this experimentation takes time and one of the most important parts is to selecting the right prototypes. Houde and Hill [18] highlights *'...Prototypes provide the means for examining design problems and evaluating solutions. Selecting the focus of a prototype is the art of identifying the most important open design questions'*.

2.1 Relation to learning outcomes for Industrial Design Engineering

The examination goals for Swedish higher education are regulated in Sweden by Universitetskanslersämbetet (UKÄ); the course has a strong relation to the following skills and abilities:

- Ability to critically identify, formulate and handle complex issues
- Ability to create technical solutions
- Ability to design and manage products, processes and systems; Ability to take into account the circumstances and needs
- Ability to verbally and in writing present and discuss problems and solutions in dialogue with different groups.

This is quite similar to the recommendations from the Accreditation Board for Engineering and Technology (ABET) in the United States indicates the importance of design courses:
"The engineering design component of a curriculum must include at least some of the following features: development of student creativity, use of open-ended problems, development and use of design methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations, and detailed system descriptions. Further, it is essential to include a variety of realistic constraints such as economic factors, safety, reliability, aesthetics, ethics, and social impact." [19].

3 RESEARCH DESIGN

The paper is based on the development of the course and two years of implementation of the course. Data are collected from debriefings with students, course surveys and evaluation at the programme board (student representatives meet with the programme responsible four times per year to evaluate courses). The study was made in the form of action research [20]. The hypotheses for this study were that student motivation can be increased with high but clearly defined course objectives and that active teacher coaching assists in achieving this. The main changes in the course from the previous year were that the course was broken down into several milestones where constructive feedback was given. The overall objectives were made clearer and linked to the overall intended learning outcomes for the education in a more evident way, and that teacher coaching was more emphasized and explained. During the course, the involved teachers made observations and in their role as coaches they could follow the students closely throughout the project. This produced both qualitative and quantitative results for the study.

4 RESULTS

The results are based on the design reviews, supervision meetings, and the course survey.

4.1 Design reviews and critique

During the course, four different design reviews, (DRs), were carried out. At these DRs the students presented their current project status with emphasis on the specific stage gate. The teaching team responded with in-depth questions on both a general and a detailed level. The students also were given a written feedback on their oral presentation and the PM. The break down into several milestones resulted in a more distinct project process that was easier for the students to understand and follow. The objectives became easier to grasp and fulfil and the continuous feedback and fulfilment of the milestones boosted the students' self-esteem and motivation. The design critique was difficult to handle for some students at first but when clarified it was seen as very useful.

'It is important that it comes out even if it hurts to accept criticism. Once you've learned from the criticism it feels so much better afterwards!' (Quote from Course Survey 2012)

It was observed that the students used the feedback to improve their performance for the next DR. The content of the presentation and the quality of the delivery was constantly improved throughout the course.

'*With critique from each design review, you learn what went well and what needs improvement, a good development for both the individual [student] and [other] industrial design engineers.'* (Course Survey 2012)

'The critique was super; [the project] took into account the economy, design and production thereby creating a realistic project'. (Course Survey 2013)

The four design reviews also helped the students to distribute the workload.

'Nice that we had four design reviews – it helped to keep the pace'. (Course Survey 2013)

Also much more constructive feedback on how to improve the design was provided in a coaching session after the DR.

4.2 Observations from coaching

During the individual coach meetings, it was observed that the coaches played an important role when it came time to put things in perspective. To discuss course objectives and to help the students interpret task descriptions made it more comprehensible for the students and kept the workload at an acceptable level. *'...very good with the coaching', 'It was easier to get answers to our questions when we had more personal contact with a specific teacher'.* (Course Survey 2012)

'It was very rewarding when we got feedback [from the coach] from the DR and assistance at appointments'. (Course Survey 2012)

'Lots of work on your own. But the coaching has been good. The teachers also participated in coach meetings outside the course schedule'. (Course Survey 2013)

'It has been great to have a private coach. Our group has used extra meetings over scheduled coaching time, which is appreciated'. (Course Survey 2013)

The students also used these coaching meetings to try ideas, and to get early feedback from the coach. This led to animated discussions between the students and the coach on a very equal level. During coach sessions, the coach also could identify the underlying individual goals for each student and try

to make it possible for the student to reach those goals as well in order to increase motivation at an individual level. It was also clear that if the coach showed enthusiasm and dedication, it rubbed off on to the students and they showed a higher level of commitment and responsibility.

4.3 Course survey and programme board evaluation

Course evaluation was done both with a survey in the final lecture in the course, where all student participated as well as at the evaluation in the programme board. The survey shows that the students are highly motivated during the course. See Figure 2.

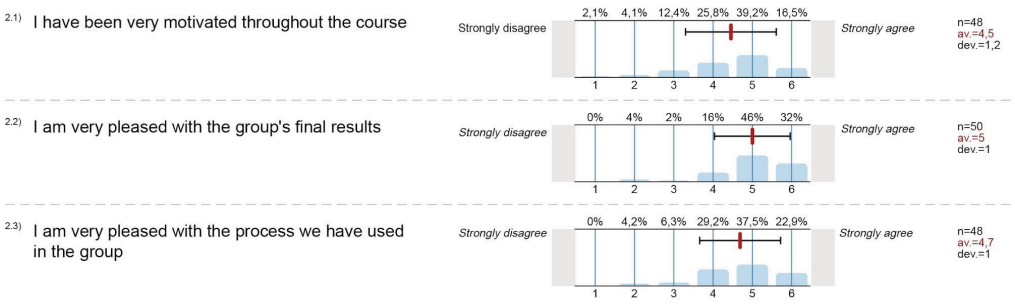

Figure 2. Extract from course survey

From the survey we can also see that 85% of the students are satisfied or very satisfied with feedback and support from their coach and that 75% have had regular and frequent contact with their coach during the project. The Design Reviews are considered as positive; 91% say that the feedback during the Design Reviews has improved their result.

5 DISCUSSION

One of the limitations in this study is that it has a quite limited dataset; it is based on evolution of one new course over a period of two years. Also the analysis and reflections presented in this paper is the result of being involved in the course as a lecturer and coach. With these limitations in mind some interesting results can be highlighted. The coaching was a critical element for the success of the course. It became obvious during the coaching sessions that the course objectives and deliverables needed further discussion to settle properly within the groups. Because of the fast, pace the students had to deliver immediately, and it was crucial to focus on the right things from the start; there the coaches played an important role. Results from the course survey show that more than 75% (61% in 2012) of the students claim that they have spent more than 100% of the expected 20 hours per week. Because the groups consisted of 4 students, the total available time for each group was 80 hours per week. Looking at the results, including DRs, PMs and final results, the claim to have spent more than 100% seems a bit exaggerated. This might be due to the many deadlines and the feeling among the students of being constantly evaluated. Another reason for this could be inefficient project organization; students are not used to working in projects with time pressure. To properly divide the work between the team members is crucial when working in a complex group project with tight deadlines. This will be pointed out more clearly in future courses. This was also mentioned by one of the students in the survey: '*Clarify for all students that effective group work is of great importance*'. (Course Survey 2013)

6 CONCLUSIONS

This paper is focused on increasing student motivation in project courses. The study has been performed in an integrated design course for industrial design engineering students.

The study shows that students are perfectly capable of managing tough and high demands if broken down into manageable milestones.

By using periodic design reviews the students get critique early on, which was much appreciated and was perceived by the students to improve their final result. By completing the individual milestones, the student motivation was boosted throughout the project. Compared to last year, the overall result this year was more elaborated and of better quality. It also shows that it is very important that the students are given proper coaching to be able to manage these demands, where the coaches play an important role to clarify critique, deliverables, and expectations for each stage.

To improve further the course, expectations and demands will be discussed (in an individual meeting between students and coach) in an early stage in the project where a common understanding of expectations will be formulated.

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