

# Project-based Learning with Examples from Industry in University Courses

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**Abstract:** This talk is based on a paper originally published in [Da16]. The talk deals with the use of industrial case examples in university education to improve students learning success. University education it is often burdened with conveying highly theoretical topics and students experience theory-driven instruction often as boring. In consequence, students show little interest or motivation. Rather than dry academic assignments, experience-based learning using industrial case examples fosters collaboration, communication, and self-directed exploration of the instructed principles and can thus increase students interest and motivation. We first introduced a project-based learning approach using industrial case examples in the summer term of 2012 in a graduate requirements engineering course [Da14], and later on in its undergraduate companion. We report on our long term experiences gained from using case examples based on real industry projects in graduate and undergraduate requirements engineering courses. The use of industrial case examples resulted in higher student motivation and improved students exam results. Furthermore, the talk discusses the differences between the application of project-based teaching in undergraduate and graduate courses, which should be considered by lecturers of such courses.

## 1 Teaching Approach under Investigation

Our teaching goals were to improve students industry-orientation, method competence, and problem-solving skills. The key focus of our teaching approach was for the students to gain awareness of industrially relevant problems and, at the same time, foster an in-depth understanding of requirements engineering theory. To do so, we relied on a combination of several key elements:

- *Theory-centric meetings.* Since, lecture-based teaching is the common teaching approach for theoretical concepts, we employed a series of traditional lectures.
- *Voluntary assignment sheets.* We designed biweekly assignment sheets consisting of easy to moderately difficult theoretical problems. Assignments were discussed in weekly tutorial sessions, but were never collected nor graded.
- *Industrial case examples.* Students were grouped into teams and provided with an industrial case example. Students worked on the case examples over the entire semester and completed several obligatory milestones. To aid knowledge discovery, students were allowed to revise and resubmit milestones.

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## 2 Results

We applied the teaching approach in two university requirements engineering courses, both at graduate level and at undergraduate level. After having applied the case example-centric approach in the graduate requirements engineering course over several years now, we are satisfied that placing such a strong focus on individual knowledge discovery in case study milestones improves student communication and leads to lively discussions beyond the milestone assignments. In the graduate course, we consistently recorded a strong positive impact on the students self-reported learning experience and increasing exam scores. In the undergraduate course, the same positive change in classroom discussions was noticeable. However, quantitatively, the course was not evaluated better in terms of learning experience (see Fig. 1). Neither was there an impact on grades.

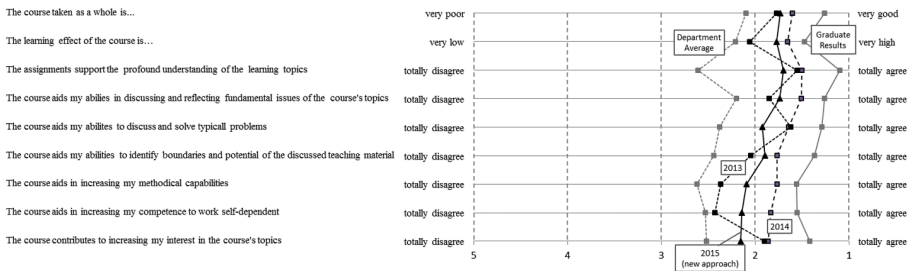


Fig. 1: Development of the Results from the Annual Student Evaluation of the Undergraduate Course in Comparison with Base Lines from the Graduate Course and the Departments Average

Our experience shows two key findings: (1) undergraduate students are increasingly preoccupied with exams and passing grades than with knowledge discovery and (2) undergraduates show a low level of resilience and discipline needed to succeed in self-directed learning environments. To some degree, differences in self-directedness, procrastination, and motivation between undergraduate and graduate students are to be expected, and widely documented in various studies. Nevertheless, as a side-effect of applying our teaching approach over several years, we observed an increased tendency for students to be concerned with what they need to do, rather than what they can learn.

## References

- [Da14] Daun, M.; Salmon, A.; Tenbergen, B.; Weyer, T.; Pohl, K.: Industrial case studies in graduate requirements engineering courses: The impact on student motivation. In: 2014 IEEE 27th Conference on Software Engineering Education and Training (CSEE T). pp. 3–12, 2014.
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