University Meets Industry: Calling in Real Stakeholders

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Abstract

Teaching the discipline of requirements engineering (RE) is slowly establishing at universities within the software engineering curriculum. While several studies have shown that case study-based education was more efficient in RE, many teachers are still reluctant to change their teaching style, and stay with classical lectures and complementary exercises. These courses often fail to relate the different steps and stages of RE to each other and do not address crucial communication and project management issues that are common in industrial RE practice. They also miss the chance for using the classroom as a near-to-real-settings research lab, and won’t show students the stakes existing in doing engineering in our society. We describe our experiences in teaching RE with a case study in two universities, achieving a triple-win: putting students in contact with real stakeholders, showing students their responsibility towards a sustainable world and doing empirical research in the classroom. We report on the course design, the evaluation, the lessons learned, and the potential success factors for such courses. We conclude that case study-based approaches to teaching RE considerably improve skills valued by industry, are feasible at a reasonable cost, and are enjoyable for the students, the teachers and the stakeholders. With this paper, we want to encourage RE educators to implement such courses in their setting.

1. Motivation: Case Study based Learning

According to Armarego and Minor [2], practitioners see shortcomings in formal education, particularly with respect to more generic skills such as communication, team skills and affective attributes of novices. Consequently, Armarego et al. provided a case-based Software Engineering (SE) course concept [1]. The results were mostly positive, showing that “students placed in an environment that enables them to model professional practice (...) should be much better prepared for the workplace”. Very recently, Hermann [12] analyzed over 200 job advertisements and confirmed that recruiters were more looking for soft skills (92%), in particular team work and communication skills (about 57% each) than for RE specific knowledge (37%).

Another positive aspect of case-studies with real stakeholders in the classroom is their ability to provide a near-to-real-settings lab for researchers, making winners for both education and research [15]. Li et al. report that, for the researcher, students feedback provides empirical evidence and opportunities to improve. For students, they underline the potential reflection-in-action
provided by experimental work, and Wong’s study confirmed that “an early exposure to actual research practice can help these students more quickly and effectively grasp the principles and goals of research in general” [23].

Finally, case studies with real-life problems have the ability to inform the students of their future responsibility as engineers. If the problem is well chosen, it may give the student a greater feeling of the impact of his/her work on the society as a whole.

**Problem:** Despite these very positive characteristics, it seems that such case-based courses have not been widely adopted in universities or practitioner’s courses. To confirm this intuition, we ran a quick poll through the RE-online mailing list, reaching several hundreds of RE teachers. We collected only nine answers, so could not conclude anything statistically. However, only four respondents reported running a case-study for more than half their course, and only one of the respondents reported doing so with real stakeholders. The number of students did not seem to have a strong impact on teachers decisions, as some teachers with big audience did use case-study (with role-played stakeholders) and some teachers with small audience did not. While we ignore the reasons for this low adoption, one can imagine that many teachers fear that such a course might be complex to design and implement, and costly in general, or even impossible given their own settings.

**Contribution:** In this paper, we report on running three instances of such a case-based RE course, at the Technical University of Munich (TUM) and the University of Namur (UN). The courses integrate RE lectures and/or readings with direct application in a real project, where students are expected to gather, model and write requirements for a to-be-defined system satisfying the needs and constraints of real stakeholders. The courses were used as a research ground for various research objectives. And the topic chosen was apt to show the responsibility of designing software for the society. The paper describes the courses in detail, compares them with one another and with other ways of teaching RE, and discusses the pros and cons for students, teachers, stakeholders and future employers. It offers insights on what we believe were success factors of the courses and on feedback by all parties.

**Impact:** The approach of teaching RE using real-life stakeholders and a real case study happened as described in the literature (for example, [1]), and we therefore expect that the gains for all parties involved was as described by this literature. Seen the relatively low cost of doing such courses, we strongly advocate for broader application of this concept in teaching. This paper offers three more positive experiences, and guidance for other RE teachers willing to implement case-based RE courses.

**Outline:** We report on related work (Sec. 2), describe the study design (Sec. 3) and the implementation (Sec. 4), and discuss the results (Sec. 5).

### 2. Related Work

There has been ample work showing that active or reflexive teaching modes are more desirable than passive ones [6, 14]. Furthermore, there are case-studies showing that case-based course are particularly desirable and effective in SE. Armarego and colleagues have proposed and analyzed the SE Design Studios mentioned above in an important body of work [1, 2]. Ghezzi and Mandrioli [11] consider the contextualization of SE courses an important challenge, as the difference between “learning by studying” and “learning by doing” is bigger in SE than in other disciplines. Richardson et al. [20] describe how problem-based learning can be used to accomplish both pedagogical and research-related goals in a single course module, but report the challenge of finding problems interesting to industry and manageable for students. Others report on successfully
including research into the classroom, e.g., Li et al. [15] and Wong et al. [23]. Furthermore, there are some experience reports with running case-based courses with real stakeholders [10, 13], while others describe how it is possible to cope with more students thanks to virtual, or role-played, stakeholders [9, 22, 4]. Most of these experiences perform the case study as a final year project, where the project is a test case for the acquired RE skills, and may also involve skills that can actually hardly be taught, for example unrealistic customer expectations and changing requirements as described by Barnes et al. [3]. In RE, course-related experience reports exist, covering various aspects of the discipline, such as requirements prioritization in the course proposed by Nancy Mead and implemented in class by Port et al. [19], or requirements negotiation, in courses described by Fernandes et al. [8] or Callele and Makaroff [5].

3. Study Design

Objectives: This course has objectives at several levels. It should firstly be a place for students to learn about RE. Secondly, it would offer the chance for a near-to-real-settings lab for our research. Finally, and perhaps in this objective we differ from previous similar initiatives, we took the chance to let students understand their responsibility in shaping tomorrow’s socio-technical systems.

For the educational purposes, we derived our objectives from the description of the industry’s expectations for the requirements engineer, as given in Armarego’s [1] and Macaulay and Mylopoulos’ studies [16]. The seven extracted key competencies and their learning objectives are listed in Tab. 1.

<table>
<thead>
<tr>
<th>Competency</th>
<th>Learning Objective</th>
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<tr>
<td>Analytical skills</td>
<td>Be able to articulate a problem and separate it from its solution, while understanding that both are interrelated and influence each other.</td>
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<tr>
<td>Abstraction skills</td>
<td>Be able to distinguish between various levels of abstraction in a requirements specification, and travel from one level of abstraction to another consciously.</td>
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<tr>
<td>Phrasing skills</td>
<td>Be able to write understandable requirements artifacts.</td>
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<tr>
<td>Communication skills</td>
<td>Be able to manage an efficient communication with a team of peers and with stakeholders.</td>
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<tr>
<td>Method competency</td>
<td>Understand the main steps of a requirements process, be able to follow and adapt a plan.</td>
</tr>
<tr>
<td>Reflective skills</td>
<td>Be able to reflect on one’s own work and adapt where needed.</td>
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<tr>
<td>Sensitivity for customer problems</td>
<td>Be able to listen truly to the customer.</td>
</tr>
<tr>
<td>Creativity</td>
<td>Be able to solve conflicts creatively and think out of the box.</td>
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Above these competencies, we also wanted our students to get an understanding of what RE is, and why it is important. They had to gain knowledge of some important terminology in RE, a sense of the fundamental steps of the RE process and the fundamental artifacts to be delivered. Finally, it is important that they get an initial mastering of some basic elicitation, analysis, specification, documentation, and quality assurance techniques.

For research purposes, our objective was to run experiments for the initial evaluation of techniques developed in our fields of research: creativity in RE and sustainability in RE, respectively.

Finally, for the responsibility aspect, we wanted to let students with a feeling of how socio-technical systems could affect the sustainability of human behaviour, and how RE was crucial in shaping this impact.

Study Plan: Similar to Design Studio [1], the core of our course is the execution of a relatively large case study in near-to-real-world settings. For this, we have invited industrial stakeholders into the classroom to present a high-level problem and its domain as starting point for the case study. Student teams were then given the task to write the requirements for a sub-problem that they
would define themselves. During the course, the students went through all the basic steps until the elaboration of specifications, including interviews, workshops and/or presentations to stakeholders. The main steps of the course are described in Tab. 2. Each step takes one to two weeks, at a rate of 3 to 4 hours a week, to reach a total of 50 to 60 hours in 15 to 16 weeks, representing a classical optional course during a semester at our universities.

Table 2. Study Plan for the “Sustainable Mobility” RE Case Study

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.</td>
<td>The students receive introductory lectures on RE by the professors plus reading material.</td>
</tr>
<tr>
<td>2.</td>
<td>The students participate in a team-building event (at UN only).</td>
</tr>
<tr>
<td>3.</td>
<td>The real stakeholders (local domain experts) give a one hour presentation on the challenge for the case study.</td>
</tr>
<tr>
<td>4.</td>
<td>The students receive their task assignment for the case study and are asked to form teams of 4-5 students.</td>
</tr>
<tr>
<td>5.</td>
<td>The students brainstorm and form ideas on potential systems useful for the challenge as they understood it.</td>
</tr>
<tr>
<td>6.</td>
<td>The students perform an interview with the main stakeholder(s) to get a deeper understanding of the problem.</td>
</tr>
<tr>
<td>7.</td>
<td>The students elaborate high-level requirements artifacts, with feedback from tutors.</td>
</tr>
<tr>
<td>8.</td>
<td>The students present the results in a workshop to the stakeholder(s) for feedback and initiate new artifacts with them during the workshop.</td>
</tr>
<tr>
<td>9.</td>
<td>The students rework their initial artifacts and develop additional artifacts to draft the complete requirements specification. Tutors provide feedback again.</td>
</tr>
<tr>
<td>10.</td>
<td>The students give a final presentation and receive feedback from the stakeholders and the professor (at TUM only).</td>
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<tr>
<td>11.</td>
<td>The students participate in the exams.</td>
</tr>
</tbody>
</table>

Evaluation Plan: In order to assess if the pedagogical objectives described above would be reached, we planned to combine several artifacts: the RE deliverables, the individual exams, and a reflexive “project diary” on the case study development that describes how the students proceeded and how they managed the various arising challenges. The RE deliverables had to be assessed for their closeness to real-world setting, as well as the quality of the delivered artifacts. This had to be done in conjunction with an analysis of the project diary. Indeed, students were allowed to make mistakes and be far away from real-world practice, as long as they were conscious of these lacks, that they would describe in the project diary to indicate their understanding of what would have been an ideal result. Those documents were cross-checked with informal feedback by the main stakeholders and by the students, as well as by tutors involved. Ideally, we would have liked to survey the employers of students who finally got hired as requirements engineers after our course. We could not practically do this, but managed to interview briefly some students working as requirements engineers after following the course. Finally, exams were planned to bring an individual level to this assessment, as the other measures were mostly at group level. Furthermore, we had to assess if we could run fruitful experiments for our research, and assess whether the topic chosen was apt to let students observe a potential impact of their work on a sustainability challenge.

4. Study Implementation & Results

Table 3 provides an overview of the course settings at both universities. In the following, we describe them in further detail, highlighting the peculiarities of the course instances at either university when needed. The main difference lies in the amount of time dedicated to the case-study versus lectures, where TUM had a much more balanced distribution and UN a stronger focus on the case.

Course Deliverables: Deliverables included requirements artifacts and a project diary, all available online\(^1\). The structure of the requirements artifacts differed slightly in both universities, but

\(^1\)http://www4.in.tum.de/~penzenst/sources/RealStakeholdersRECaseStudy.zip
Table 3. Summary of the settings

<table>
<thead>
<tr>
<th>University</th>
<th>TUM</th>
<th>UN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible</td>
<td>Prof. Manfred Broy</td>
<td>Prof. P. Heymans</td>
</tr>
<tr>
<td>Designer</td>
<td>Dr. Birgit Penzenstadler</td>
<td>Martin Mahaux</td>
</tr>
<tr>
<td>Tutors</td>
<td>Birgit Penzenstadler, Mario Gleirscher, Max Junker</td>
<td>Martin Mahaux, Nicolas Genon, Patrice Caire</td>
</tr>
<tr>
<td>Trainees</td>
<td>22 Master students Software Engineering</td>
<td>18/22 Master students, half Information Systems, half Management Sciences</td>
</tr>
<tr>
<td>Time frame</td>
<td>60 hours in class (28 lecture + 32 case-study)</td>
<td>50 hours (4 lecture + 46 case-study)</td>
</tr>
<tr>
<td>Course type</td>
<td>Optional course</td>
<td>Optional course</td>
</tr>
<tr>
<td>Real Stakeholder</td>
<td>Initiative Leader and Manager for “DriveNow” from BMW AG</td>
<td>HR Director from UN, Experts in Mobility, in Mobile Application Design, in Business Development</td>
</tr>
<tr>
<td>Project</td>
<td>case study for system already implemented</td>
<td>system possibly intended to be built</td>
</tr>
</tbody>
</table>

they converged in demanding various major RE artifacts, covering both problem and solution, from high to low level of detail. The requirements-related deliverables structure at TUM is represented in Fig. 1. In the case of UN, students were allowed to chose the template for the requirements artifacts, inspired from existing templates such as Volere [21]. Given the short deadlines, students were not required to be exhaustive in their deliverables, but to show a certain level of mastering various modeling and writing techniques. For example, rather than poorly writing all requirements, they were asked to efficiently write some of the requirements.

The project diary describes the experience of running the project as lived by the students. It highlights what was perceived as well done, and what should have been done differently. The project diary enables them to reflect on the effectiveness and efficiency of any activity undertaken, and document particular insights. For example, several teams had been conducting their interview with the stakeholders not listening to them but defending their vision of the problem. This experience was debriefed with tutors, and students indicated in their project diary where they failed and how to improve. The project diary also included raw student notes from interviews and workshops, plus the documents to prepare those exercises.

**Informal Assessment of Experience and Lessons Learned:** In this section, we report informally on how the course did reach its triple objective. We report in particular on the learning made by the students, as the evaluation plan permitted. While more formal analysis might have been desirable, the size and complexity of both the experiments and the deliverables, along with a short time for tutors dedicated to meta-analysis, did not allow for delivering any more significant results than a report by the tutors. Consequently, most of what follows reflects tutors perception only, however backed with as many objective statements as we could in an *a posteriori* analysis.

**Students:** According to feedbacks from both students and tutors, the three instances of this course were an enjoyable experience. Most students showed motivation, as indicated by the additional work put into the exercise by most of the students compared to what was expected to simply
succeed. We had the chance to interview four students from Namur that we knew had started their career as requirements engineer in the industry. Their answers gave the course positive ratings with regard to its usefulness for their career pursuit. In particular, students strongly agreed that the course encouraged them to start a requirements engineer career. They also agreed that the course helped them in getting the job. At TUM, none of the students who responded had yet started their professional career, but the answers indicated that some of them considered a career in requirements engineering and the majority thought the acquired skills were going to help them in their future career. The formal evaluation of the course showed an improvement from 2.3 to 1.8 on the rating scale (where 1 was best and 5 was lowest).

Artifact Quality: The final deliverable exhibited a considerable quality for the short timespan for their elaboration. In particular, the students creativity, i.e., their ability to produce useful and novel work, was explicitly high. For example, two years after the first requirements documents were written in Namur, we are observing start-ups and authorities developing applications that are mostly in the scope of what was then a students’ work. In other words, they were visionaries in developing dynamic car-sharing applications for solving mobility problems. Some other artifacts were clearly not of industrial quality, nor of the quality that tutors would expect at the end of an exercise session in a classical lecture & exercise setting. However, 32 to 46 hours to fulfill the given task would certainly be judged impossible by any industry person. Students were aware that this kind of assignment would require several months of full time work for an analyst, as the individual exams confirmed (this was one question at Namur’s exam). Students efficiently distributed the work among them, spontaneously using various online collaboration tools. Finally, they reached a deliverable exhibiting many of the characteristics of a valid industry requirements work, in a fraction of the time. The quality of individual artifacts sometimes suffered from this, but students were able to identify low quality. Indeed, a discussion with the teacher during the exam would in general reveal that they were able to enhance the poor artifact by themselves.

Success Rate: All students passed the final exam with good grades, meaning tutors and professors had a positive perception of students’ ability with regard to the fixed didactic objectives. It has to be noted that the involved professors have a longer experience in giving RE courses than the tutors having designed and managed the course. They consequently could compare to what was done before, and this is an indication, while certainly subjective, of the efficiency of the course.

Competencies: With regard to the analytical skills, method competency, and abstraction skills, students were “on the right way” in the case study deliverables, i.e., they made mistakes but learned from them and achieved overall reasonably good results in the final exams. Their phrasing skills and communication skills were quite diverse at the beginning, and we noted a significant improvement between the first and the following workshops and presentations with the stakeholders. Naturally, there were different levels of how serious students took the case study. One team showed up in suits and another one spent days on elaborating an animated video pitch for the product while others just did the most necessary. However, all of the teams engaged in active discussion with the stakeholders and received good feedback. Their reflective skills were enhanced over the time of the case study and they understood how the communication had worked and which were the critical factors for writing a good requirements specification (e.g., more feedback questions for stakeholder instead of assumptions for fuzzy requirements). The communication practice over the course of the workshops also increased their sensitivity to customer problems, which was reflected in the oral exams at Namur, when students were put into typical RE situations and had to act accordingly.

Stakeholders: According to their own statements, stakeholders did not perceive they had lost time in participating in interviews and workshops. As far as the topics were chosen to their best
interest, the only chance for not getting them to at least learn something in the process was to have students behaving in a really non-professional way. In case this was observed, tutors could quickly intervene to avoid such negative situations. In general, stakeholders were happy to have participated in this experience and learned about current RE methods as well as about potential business ideas.

**Research:** Various techniques under experimentation at our lab were tested during the course. In Namur, students spent two sessions doing team building using improvisational theatre techniques [17]. As this technique is supposed to have an influence on how stakeholders can be creative within a group, we filmed group work before and after the team building. This way, we attempted to assess if the team building had an impact. While those laboratory settings are not perfect, they are certainly interesting as this kind of process is very hard to do in real industry settings.

In Munich, students were asked to specifically focus on the aspect of the environmental sustainability of the project. This work formed the basis for a case study for a generic sustainability model [18]. The case study is available online [7].

**Responsibility:** This exercise is one of the first time that students are facing a design problem that looks like what real life can offer. We believe this is one of the first time that they can really feel their potential impact on the world as solution makers. Consequently, we consider important that this is not ignored by the teachers when they choose the subject. Including the sustainability dimension in this exercise was an important point for us, and we think it also helped in motivating the students, who generally consider this as an important element, and were probably happy to see that engineers and managers do not necessarily have to work for banks. Probably few among the students had really thought about the impact of socio-technical systems on sustainability. The case-study forced them to realize this impact, and this is certainly an interesting learning for the coming generation of solution designers.

**Effort & Costs:** The main effort that needs to be conducted in comparison to other forms of teaching requirements engineering is to find one or several industrial stakeholder(s) willing to participate. However, tutors don’t have to prepare unitary exercises, and the reduced number of classical lectures reduces the number of slides to be prepared. In our cases, we got access to the stakeholders by using our extended personal networks. We found it quite easy to find in our networks someone with an IT-related challenge that required the design of a relatively undefined solution, and that included elements of sustainability. In Namur, we also invited IT-related stakeholders. There are plenty of these available in our faculties. One expert in business creation from regional authorities had also spontaneously declared interest to be a stakeholder.

The effort for stakeholders is relatively small. In our cases, students require an initial presentation that is made in a plenary session (1h). Then each group needs to have one or several interviews, preferably two or three, with different kinds of stakeholders if possible. If all groups go to see the same people, those people might end up with N hours of interview, with N being the number of groups. As stakeholders are also invited to a 1 hour workshop per group, this adds N hours of work for each stakeholder. This limits the possible number of groups to 4 to 8, to limit the total workload to 8 or 16 hours for most stakeholders (one more for the sponsor doing the first presentation). In the second instance of the course in Namur, however, we left it over to the students to decide who they would interview, and to arrange the interviews themselves, inviting a tutor for observation. This had a reasonable success, all groups found at least one person to interview, and some found
five of them. This way of doing reduces the work for tutors and distributes the stakeholders workload. This might be a way to sustain this course model in bigger classrooms. A good option to acquire partners might be former students who are now in industry and are applying requirements engineering themselves.

Before the course, the tutors have to make an initial planning, as if they were to do the requirements engineering themselves for the project at hand. This requires some understanding of RE in practice, that we hope any teacher has. During the course, tutors must gather every week to assess students advancement in the project, fine tune the coming week’s schedule and prepare corrective actions when needed. There is important communication involved with students as to guide them on a day-to-day basis. Clarifying and communicating expectations as the experience go is crucial in these settings. During sessions, tutors must be available for answering student’s questions, delivering just-in-time knowledge when needed. This requires that tutors master their subject quite well, as questions that arise from practicing in near-to-real settings might be far from what tutors may expect in classical exercise settings.

5. Discussion

Benefits: Although relying on informal evaluation, we believe that the main expected benefits from the case-based teaching style have been reached in our course instances. Students had a nice course and developed an idea of their future responsibility as designers, while tutors could use the setting for valuable research. Further, the costs were clearly under control, and to our opinion comparable to preparing an in-depth theoretical course with exercises.

Drawbacks: These courses are heavily dependent on various factors. While the outcome of classical courses is more controlled, here it is highly dependent on students, stakeholders and tutors. In particular the latter have to have an idea of RE in practice, and should be able to handle tough questions. They have to have some contacts in the industry, and be influential enough to get them accept an invitation to work with students. They have to have some project management skills, and flexibility in particular. Stakeholders, on their side, have to be interested in what is passed on to students, as they are not as effective as experienced requirements engineers. The TUM stakeholders’ interest in participating was also driven by finding new business ideas.

One issue is how close to industry settings we can actually get in such a case study. The stakeholders are real, but they certainly do not perceive the project as crucial for success as their regular projects. Further, the short time frame does only allow for a discovery of the main steps of a requirements engineering, not for an in-depth real requirements work. However, our students demonstrated impressive abilities to work in teams under short time frames, which is a frequent challenge in the industry.

The availability of stakeholders is a limiting factor, to both the number of students that can be handled in such settings, and the time spent by each student in contact with stakeholders. While we highlight a possible way to scale up, by allowing students to find their stakeholders themselves (some stakeholders are not rare, such as users having a smart-phone and potentially participating in car-sharing), we don’t know if this would be successful for a high number of students (over 40). However, the lack of stakeholders availability also reflects a real project situation.

Finally, we believe our course would not be as effective as a classical course for teaching more deeply specific hard techniques for the requirements engineer, such as UML or other modeling. In Namur, this is the subject of another course, that we reuse here without putting the emphasis on correctness of models.
Success Factors: Retrospectively, we tried to understand what made this course a success. The following represents our consolidated perception of the main success factors: 1. Freedom Students were encouraged to think by themselves about what to do and how to do it. There was no pre-defined solution, and students could mostly choose their techniques and tools, or even not to use any of them. The matter of importance was to criticize the process and the outcome. 2. Feedback All along the exercise, students were encouraged to submit partial deliverables. Tutors gave constructive feedback on deliverables without grading them. Tutors were available during sessions, and on other days as well, in case of any questions. Errors were more than permitted; students were judged less on the quality of the final deliverable than on what they could understand from their errors. 3. Real problem The cases were based on real-life problems, including trendy challenges (sustainability), required real creativity to find new solutions. While the problem and stakeholders are real, ensuring realism, there was not such a high pressure on the results as the real life would confer, allowing for safe learning. The emphasis is not on the details of some specific technique but rather on the ability to use them in a realistic setting. 4. Teams Teams of 3-5 worked well in that everyone can participate, and collaboration is rich as teams benefitted from mixing backgrounds. Team building session at the beginning of the course are a plus, certainly if students don’t know each other (coming from different faculties in Namur). 5. Fun We had fun during the exercise, as tutors tried to setup a relaxed atmosphere for allowing spontaneous interaction.

Threats to Validity: When we started designing our courses, each at our university, our objective was to set up a nice course for our students; it was not to make an experiment we could write a paper on. Incidentally, discussing together about RE teaching at a conference, we decided to jointly replicate and report about the course. After these three iterations, we believe that we have reached a certain level of consolidation, allowing to present this paper as a valuable experience report. However, as reporting was not our primary objective, even in the following iterations of the course, we lacked resources to collect the needed evidence for a formal analysis. Consequently, the report is mainly informal, representing the most important threat to validity of this study. We reported our perceptions, basing them on as many objective facts as possible. To limit the potential researcher bias arising from this, we stress this paper does not claim any personal invention from the authors. We simply report on using concepts from others that worked for us, and had no personal interest in showing a particular success in this paper.

6. Conclusion

In this paper, we describe our experience from three RE courses where students at two universities performed case studies in cooperation with real stakeholders. We confirm that this type of course challenges and improves skills and competencies in the students that are highly valued by industry. Both students and involved stakeholders enjoyed the course and benefitted from its results, as did researchers using the course as a near-to-real-settings lab. As, on top of that, the involved costs are reasonable, we strongly encourage all RE educators to consider including such a case study in their courses. Future work is, inter alia, to demonstrate the impact of RE on sustainability.

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References


