

Requirements Document

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Lab assignment Requirements Engineering



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60 1 Introduction

This RD is comprised of knowledge gathered in 4 weeks of Requirements Engineering for the Requirements Engineering class as part of the master education Software Engineering. We have condensed the acquired knowledge of four weeks into one document following the structure of our project plan, see Chapter 2. We revised this project plan based on feedback in
65 the second week session with Hans. In the elicitation phase we conducted numerous interviews, which are accessible on our portfolio website, see www.tomvanduist.com/master_se/re.

2 Project Plan

The project plan for the first four weeks is explained in this chapter. The goal is to discover some of the essential features that should be provided by the successor of Blackboard. We
70 base our project plan on the requirements engineering process, see Figure 2.1 [2] (chapter 1.1.6). This book identifies four phases of requirements engineering;

1. Domain understanding and elicitation.
2. Evaluation and negotiation.
3. Specification and documentation.
- 75 4. Quality assurance.

During the first week we will get familiar with the problem world, as described in the first phase [2]. We will investigate the system-as-is, ourselves, and ask users (students) about their experiences. We will work through the questions listed in the relevant section in the book. We will also compose a list of stakeholders, which we interview in the coming weeks.

80 Week 2 will revolve around the second phase: evaluation and negotiation. The goal of this week is to find all critical (business) goals of the stakeholders of the system. Why is it replaced? What is the relation to the mission and vision of the UvA (if there is any)? Why did the UvA use an education management tool in the first place? What are the goals of the students in relation to the tool etc. During this week we will interview remaining stakeholders,
85 to verify and add upon the information we gathered in the first week. We will also interview more students with prepared questions.

In week 3 and 4 we will try to answer the questions we deemed most interesting and essential to get a good successor of Blackboard. These can be found in Chapter 4.

Note that we conduct one round of the spiral model, see Figure 2.1. There will be some
90 backtracking to other phases (previous weeks), because some information becomes available after the relevant week/phase.

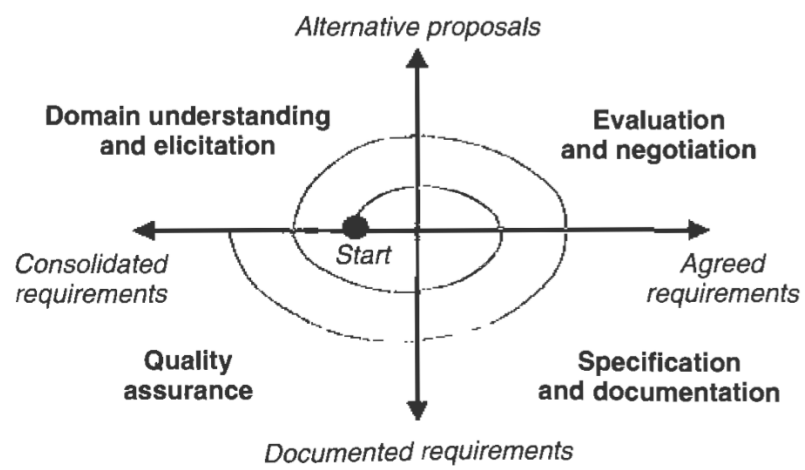


Figure 1.6 *The requirements engineering process*

Figure 2.1: Spiral Model of requirements engineering process

3 Domain Understanding

In the first week we focused on getting a better understanding of the domain in order to form a better understanding of the problems in the domain with relation to the goals, which we
95 will gather during the next phase.

3.1 Glossary of terms

student A person who studies at an university (in our case the University of Amsterdam).

teacher A person who teachers courses at an university (in our case the University of Amsterdam).

100 **UvA** University of Amsterdam.

Blackboard Name of currently licensed ELE by the UvA.

ELE Electronic Learning Environment. ICT solution where part of a course teaching and organization is moved to an (online) software platform. An example of an ELE is Blackboard.

105 **ICT** Information and Communication Technology. Mainly a Dutch term for **IT**, which stands for Information Technology.

3.2 Organization

The organization in which Blackboard is used is the University of Amsterdam (UvA). The UvA employs many different IT systems, some of them communicating with Blackboard. The
110 mission and (business) goals of the UvA can be found in Section 3.6.1. The ICT-department within the UvA has as responsibility to keep all the IT solutions up and running. Teachers using Blackboard have to request new functionality (in practice a request for a new module for Blackboard) at the ICT-department.

3.3 Goal

115 The goal of a requirement engineering project in a perfect world would be strife to find all of most important quality requirements for all relevant stakeholders. As stated in Contextual Design [1] a design process could always be further elaborated, so finding all and every requirements for all stakeholders is an illusion.

120 Because of this and the time constraints of this project, the goal will be limited to the following: *find a couple of the major requirements for the main stakeholder(s) by asking the right questions*. We believe this is measurable enough for the assignment given the time frame but

still enough of an abstraction given that we do not yet have a clear enough understanding of the domain at this time to make it more concrete without taking away from the achieveability.

3.4 Scope

We looked at the functionality of Blackboard. Different IT systems within the UvA that have some connection with Blackboard are not the focus of this study. Aggregated functionality of Blackboard includes:

1. Form groups, assign to groups.
2. Announcements
3. Share course related files (lectures, papers, assignments, etc).
4. Grades
5. Formative tests
6. Online cooperation
7. (A)synchronous meetings
8. Guided self-study

3.5 Stakeholders

- Users: Both students and teachers
- Management UvA
- Blackboard (company)
- ICT-department

3.6 Stakeholder goals

3.6.1 UvA

Taken from the core values of the UvA is the following:

Engagement for the UvA and its staff implies the age-old obligation based on a privileged academic position to use acquired knowledge and insights to play an ongoing, prominent and visible role in the social debate. This value also reveals that the UvA is committed to the maximum development of the individual talents of its staff and students. Additionally, the choice of this core value suggests a strong mutual involvement between students, staff, employees, study programmes, institutes and the institution as a whole. And, lastly, there is an important link between academia and society. The UvA is located in historical and modern buildings throughout the city of Amsterdam, thus making it an integral part of the city.

Important goals are:

1. The UvA is committed to the maximum development of the individual talents of its staff and students.[4]

155 2. The UvA strives for a strong mutual involvement between students, staff, employees, study programs, institutes and the institution as a whole.[4]

3. Evidenced-based ICT innovations are incorporated into the UvAs education policy.[5]

a) (Strategy): The use of Open Educational Resources as part of blended curricula will be one of the educational innovations implemented. ICT policy will be tailored
160 in part to support the education process.

4. A modular Lifelong Learning programme is developed.[5]

a) (Strategy): This programme will draw on the online courses in our blended curricula.

3.6.2 Teacher

165 Taken from the UvA goal and by talking to teachers.

1. Develop individual skills.
2. Convey knowledge to students.

3.6.3 student

The student goals still need to be confirmed by finding a relevant paper. As a result of our
170 elicitations we believe these are the broad goals of students.

1. Optimally develop one's personal and academic skills.
2. Obtain diploma.

3.7 Strengths and Weaknesses

Students: (Based on 3 weeks of interviewing)

- 175 + Possible to get mobile notifications through the app.
- + Central point of information access.
- + Latest schedule of a course.
- Hard to use in the beginning.
- Different structure per course. i.e. "We *have* to use it."
- 180 - Ugly.

We gathered no, or not enough, information about the other stakeholders to draw reliable conclusions about their perceived strengths and weaknesses of the system-as-is.

3.8 Domain facts

- 185 1. Formative feedback can help students improve their work.[3] *BB does not offer formative feedback, this is merely a responsibility of the teacher. ??.*
2. Should be clear link between learning goals (of a course) and the ICT solution. If the ICT solution is merely a means to reach a goal it will not improve learning. [3]
3. Teachers use ICT based on their own skills. This might undermine its effectiveness.[3]
4. ICT changes rapidly. (Moore's Law)
- 190 5. The availability of a tool does not determine its effectiveness. In its initial stages the focus is on how to use the tool, rather than using the tool for learning-promoting purposes. [3]
6. Research also rarely reports on technical issues or problems with equipment, yet these are what teachers find act as barriers to increasing the use of technology in classrooms.[3]
- 195 7. Media reports faster on trends than research can validate or discredit using that technology.[3]
8. ICT does not help increase pupils attainment.[3]
9. (Digital) instant feedback significantly improves student learning [7]
10. Advanced Blackboard functionality is almost never used. Adaptive rules 5.9% in 2014/2015. Progress warnings < 1%. [8]

4 Elicitation phase

During this phase we will try and answer some important domain questions (though we may not be able to answer them all) and update the information once we get new data.

4.1 What are the essential features of the Blackboard (or similar ELE) system for the users?

In order to find the essential features of the Blackboard system we have performed elicitations amongst both teachers and students. From these we have devised the following preliminary list of essential features:

- Teacher:
 - Publishing documents
 - Publishing assignments
 - Publishing announcements
- Student:
 - Retrieve relevant information/documents.
 - Hand in digital assignments.

We can distil this into a single feature list:

- Share documents.
- Hand in digital assignments.
- Publish announcements.

We wanted to quantify this data with the actual use as logged by the ICT department of the UvA, but our request for information has been rejected.

4.2 To what extend does the current Blackboard system support the UvA goals?

In order to answer this question we have divided it into two sub-questions. As the main goal of the UvA (see 3.6: Stakeholder goals) could be divided into sub-goals for its staff and students we have done the same with this question to make it easier to answer.

4.2.1 To what extends does the system support the goals of the teachers?

By reasoning about how teachers develop their skills, from personal experience by looking around in the UvA and talking to teachers we can answer this question for the staff:

- Teachers do not develop their skills through Blackboard, they develop their skills by performing activities related to their field. For example by developing assignments for students. Or by doing personal research, read papers, go to conferences etc.
- Only small portion (around 20 %) of intrinsically motivated teachers that use different, advanced tools, see [8]. Since the skills of a teacher determine the effectiveness of an ICT tool Domain facts, we can conclude that Blackboard does not improve the goal of the teachers and students. It can only help as much as teachers have the skills to use it. Therefore an ELE with advanced functionality does not improve the skills of teachers, but the other way around. The skills of teachers determines the functionality of the ELE for which it is still effective.

4.2.2 To what extends does the system support the goals of the students?

By talking to teachers we have answered this question for students:

- Students do not develop their skills through Blackboard because the system does not create *good* teachers. Students develop their skills through individual discipline and programs set up by competent teachers, Blackboard is just one of the many tools used by the teachers. It still boils down to the teacher himself to channel his knowledge. As we found out during the domain analysis if students use Blackboard because they have to (pass the course) it does not improve learning, See Domain facts.

4.3 Which type of usability problems have no impact on education?

4.3.1 What usability issues arise from using Blackboard?

From our elicitations with and talking to students we learned Blackboard has the following usability issues:

- Many clicks to reach the target destination.
- Convolutd User Interface.
- No generic structure for storing documents. Every teacher uses his own file structure.
- Tiny buttons.
- Non-intuitive user interface. Blackboard was difficult to use in the early stages (<2 months).
- Ugly, outdated design.

When asked how these usability issues affected the learning process of the students, every students said it didn't affect their learning process, but was merely an annoyance. For certain issues (No generic structure, tiny buttons, non-intuitive interface) they learned to adapt.

4.4 What characteristics of users are important to consider for the selection of a new system?

To answer this question we first set out to find different characteristics of users through our elicitation, focusing mainly on their study goals and use of resources to this end. What we encountered was not really what we expected. Obviously all students want to pass their exams and eventually earn a degree, but besides this most students want to develop specific skills, broaden or deepen their knowledge base; earn intrinsic knowledge to some degree. What we found was:

- Irrespective of the degree of intrinsic knowledge the student seeks, he uses other sources of information than those solely provided by their teacher (be it through Blackboard or other means).

So we found that irrespective of the characteristics regarding study goals of the student, he independently uses resources outside of the ELE to get additional information to help achieve these goals.

4.5 opportunities arising from technology

During the interviews we found out that students use communication channels not integrated into Blackboard. Named examples are Facebook, Slack and Whatsapp. These IT solutions were used to discuss answers to assignments, among others. If we were to implement these into the new ELE, we have to investigate their concrete effect on student goals, as stated in 3.6: Stakeholder goals.

The Intermediate Requirements Engineering report showed that teachers only use the basic functionality of Blackboard. We identified what basic functionality entails, which can be read in Section 4.1. The interviews showed that all students knew about, and used the essential functionalities. As already noted, students only use Blackboard, when their teacher uses Blackboard. We can hypothesize that if a teacher does not use the more advanced functionality (i.e. message boards), student won't either. Our interview data is not extensive enough to confirm or disprove this hypothesis. We also did not ask the right questions.

4.6 Organizational and technical constraints

The UvA consists of many different departments (Amsterdam University College, Department of Medicine, Department of Law, Department of Sciences among others). In the Intermediate Requirements Engineering report it is stated that there are significant differences in the usage of Blackboard among different departments. The diversity of education is one thing to take into account. Raquel Benbunan-Fich [6] identified two models of content transmission: the objectivist and constructivism model. The first is classified by the typical classroom example, where a teacher conveys knowledge to students as a one-way stream of information. For the latter, knowledge emerges through peer interaction, evaluation and cooperation. For each model there are different IT solutions. The first model relies more on sharing content, the second on communication channels (such as Slack). As mentioned before, students already make extensive use of communication channels without Blackboard.

For the new ELE we will assume that students who have to use the system to pass their courses, will use the system, even if the new ELE has usability issues. These usability issues can be of the same order of magnitude as the usability issues Blackboard has.

4.7 Summary of important findings

- The essential features of Blackboard are:
 - Share documents.
 - Hand in digital assignments.
 - Publish announcements.
- Blackboard does not intrinsically support the goals of the teachers and students.
- All types of students use different sources in addition to Blackboard to get information.
- Some usability issues do not affect the learning process of the students.

5 Evaluation and Agreement

In this chapter we will evaluate and negotiate our findings. On conflicting concerns an agree-
ment must be met which will be grounded in data gathered in the previous phases.

5.1 Does the new Blackboard have to contribute to the goals of the UvA?

As we found out when answering "4.2: To what extent does the current Blackboard system support the UvA goals?", we doubt if the current system has a notable contribution towards the main goal of the UvA and are not sure if such a system ever will, although this is hard to answer.

A different UvA objective states: *Evidenced-based ICT innovations are incorporated into the UvAs education policy* [5].

Tailoring the requirements of the new system to fit this objective might be an easier task to accomplish. Is this a good goal however? We think it isn't. It cannot be refuted - Evidenced-based ICT innovation showing what? - , therefore the goal is ambiguous. Our solution, whatever form it might take, can be easily transformed to satisfy an ambiguous goal by the nature of ambiguously. We can just interpret the goal in favour of our solution.

5.2 Necessary features

As we saw in 4: *Elicitation phase* the necessary features according to almost all of the users are *sharing documents*, *Hand in assignments* and *Publish announcements*. According to Richard van der Wurff's research only a small subset of teachers use the other functionalities of Blackboard. Also these teachers are the innovative users that use different tools next to Blackboard [8].

According to these findings we believe that a system where the core functionalities that all users use is supported, and all other tool use falls outside of this system would suffice for the stakeholder needs that we identified. Thus a system that supports the bare minimum of features would suffice.

5.3 Privacy

When choosing a tool that handles important data, such as student assignments or confidential communication between the student and the teacher, privacy comes to mind. What level of privacy the new ELE should offer is not something that we researched properly. But if teachers are allowed to use their own tools, next to the standard ELE, and this is encouraged by the UvA when choosing a simple ELE. Then this open policy could potentially conflict with the privacy standards, this could be solved through the governance structure. Only certain applications are allowed, or students must be given the choice not to use the tool.

6 Specification and Documentation

This section concludes our Requirements Document by listing the requirements that we found, next we state our vision for the successor of Blackboard according to these requirements and finally we argue why our findings are reliable or not reliable.

6.1 Requirements

According to the goals that the new system must adhere to we have created *goal contribution trees* [2]. We have subdivided each goal into sub-goals until each goal only affected one agent, these are the requirements. Thus the leafs of each tree is a requirement for his parent goal (unless stated otherwise).

6.1.1 Requirement: Share documents

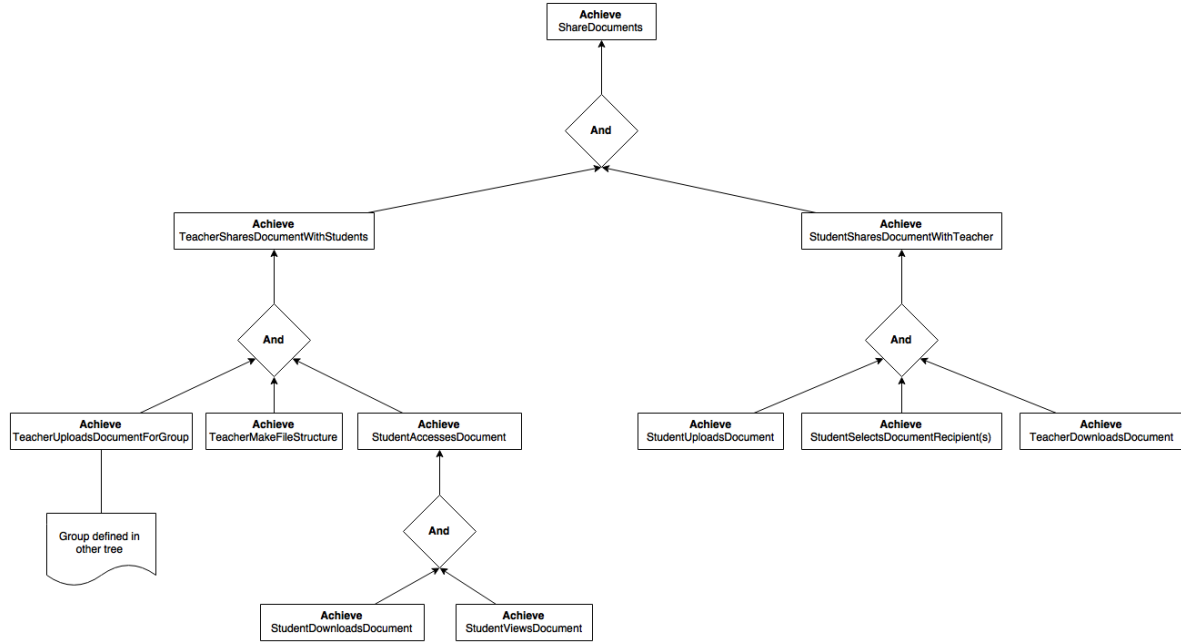


Figure 6.1: Share documents goal contributions.

Quick notes

- *TeacherMakeFileStructure*: We did not find that a different file structure negatively affects the goal of stakeholders. We therefore decided to keep this flexibility. When we enforce a file structure we limit ourselves in possible ELE tools, while this is not strictly necessary.
- These requirements can already be satisfied with a simple tool, see Section 3.8. During the domain understanding and elicitation phase we found that the amount of usage of an IT system determines its effectiveness. If the IT system is not used correctly it has absolutely no effect. We advocate simplicity.

6.1.2 Requirement: Hand in assignments

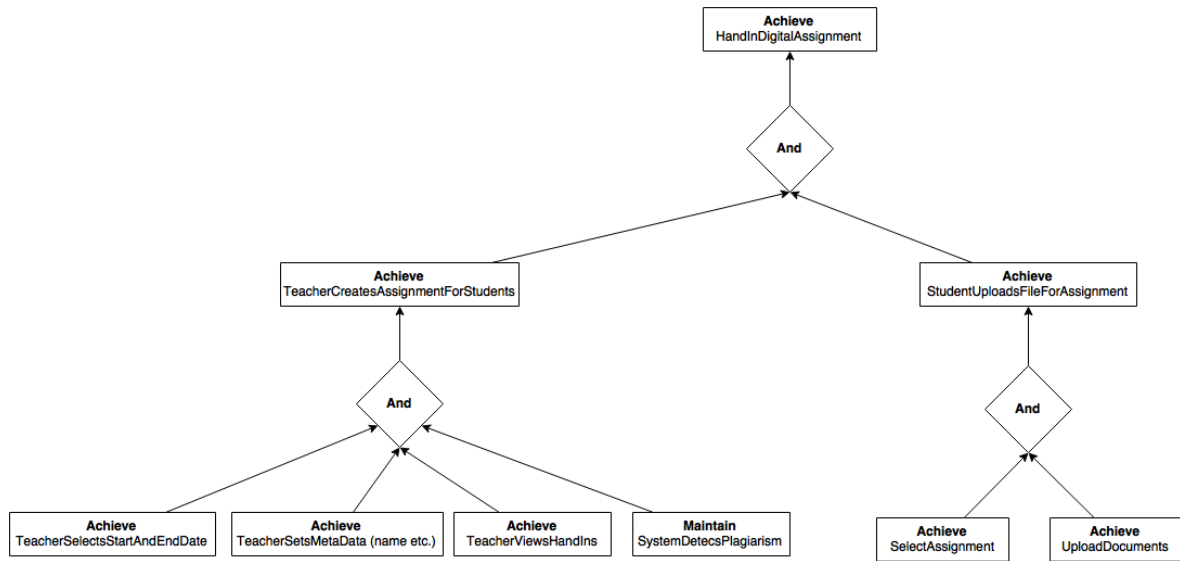


Figure 6.2: Hand in assignments goal contributions.

6.1.3 Requirement: Publish announcements

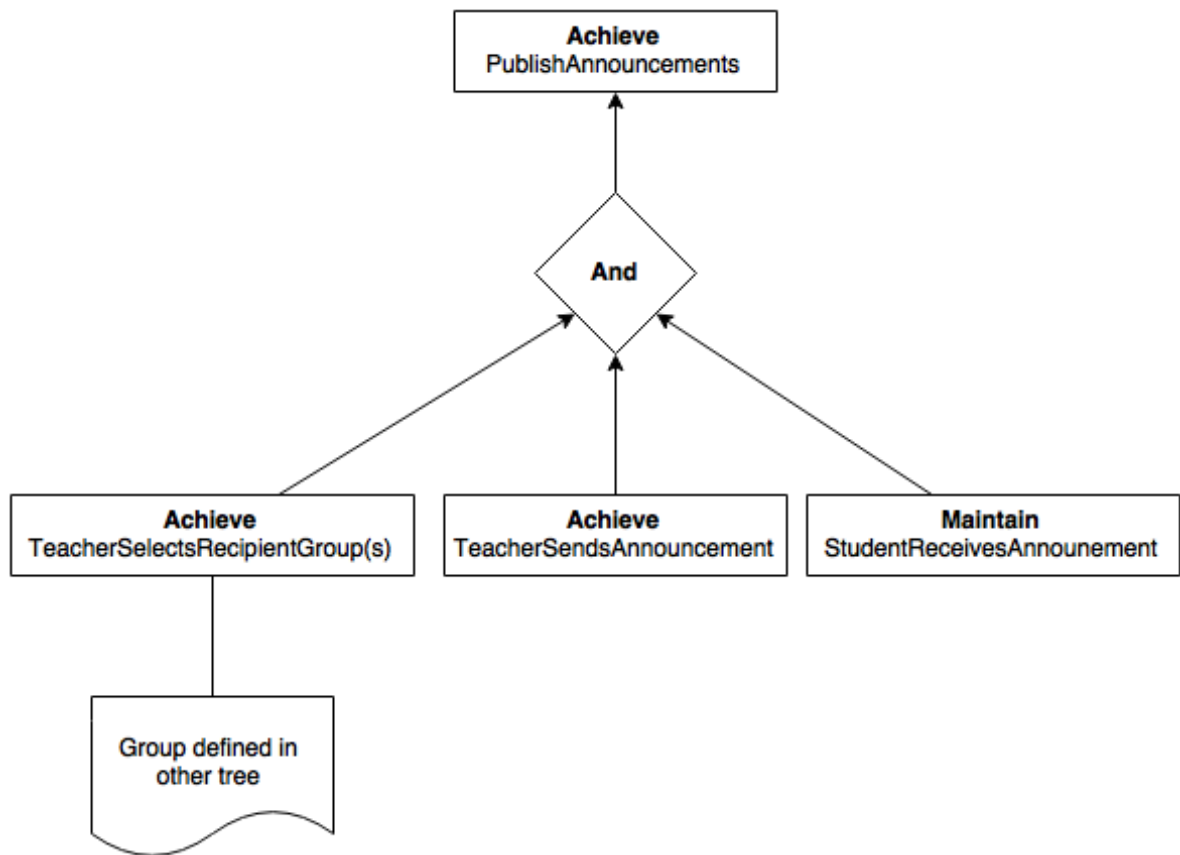


Figure 6.3: Publish announcements goal contributions.

6.1.4 Requirement: Manage student groups

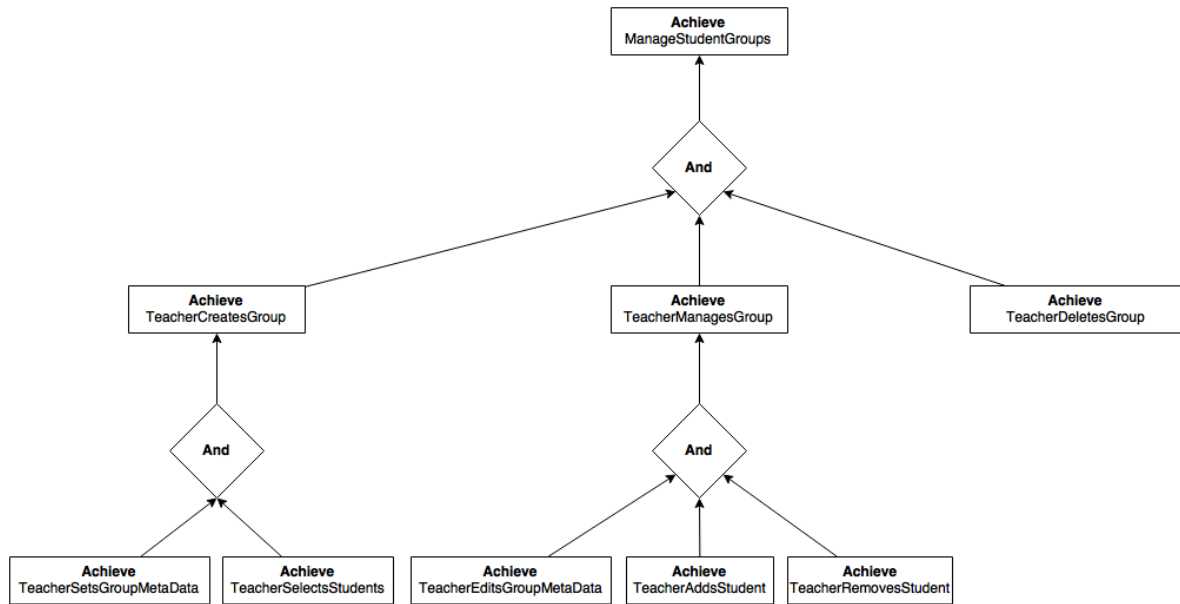


Figure 6.4: Manage student groups goal contributions.

6.2 Vision

According to our findings as laid out in this document we believe that the current Blackboard already offers too much functionality. As we saw in 4: *Elicitation phase* and in Richard van der Wurff's research, most users only use the bare minimum of functionality. Add to this the following facts from Richard van der Wurff's research:

- New ELE contract lasts a minimum of 5 years.
- UvA wants to transition towards blended learning, active learning, student-driven education and so forth.
- Many of these developments are still in its infancy and evolving fast.
- Because of this a lot of complexity has to be added (layers, modules etc.)
- The ELE must offer a *good usability* and *uniform* user experience.

We believe these goals are incompatible, complexity and usability. Also it is very hard to predict the future, many of the new technologies that the UvA strives to use in the future are not ready yet and try and create a system that caters to the needs of these systems brings on a lot of risk.

Therefore in our vision for the new ELE only offers the bare minimum of features. The features that almost all users use on a daily basis. Because of the simplicity of this system it *can* be very cheap and user friendly.

Any teachers that want to use innovative tools could do so at their own discretion, and any mature tools could then be incorporated into the governance structure regarding the use of the ELE.

6.3 Reliability

The sources of most of our information are the elicitations (unless stated otherwise) that we performed, but also our own experience, and talking to the users (students and teachers).

Because our sample size for these answers is really low compared to the number of users of the system. And both teachers and ourself are just talking about personal experiences and beliefs many of the presented facts that have the elicitations as source are not very reliable. We would be able. Also as we later learned from reading Thinking, Fast and Slow by Kahneman, people are not eager to open up and possibly embarrass themselves. So they might not let us know that they, for example, find Blackboard hard to use. As it might show that they personally do not have the skills to use the tool, which they can experience as embarrassing.

To get more reliable answers we could substitute the questions regarding usability by different questions, which are not directed personally at the interviewee, but are harder for him to answer. As Kahneman showed, in his mind the interviewee will (unconsciously) substitute the question by looking at his own experience (and of people around him), which is the answer that we are looking for.

In conclusion our findings are not very reliable because:

- Small sample size
- Only interviewed within one domain (again sample size)
- Biased interviewer
- Received abstract answers
- Based some data on own experience, and that of fellow students

We only learned later in the course how to avoid above examples. If we would have the time and resources to properly interview enough people, and quantify the data with proper research this would strengthen the reliability of the conclusion.

7 Blackboard intermediate report review

In this chapter we take some of the claims in the Intermediate Requirements Engineering report and state whether they are refutable, and if so, we give reasons how to refute them.

1. *Een goede digitale leeromgeving moet docenten helpen aantrekkelijk en kwalitatief hoogwaardig blended onderwijs te verzorgen en tegelijkertijd de werkdruk te verminderen:*

This claim cannot be refuted. How would you measure attractive and qualitative blended education? When do you meet your goal and when do you not?

2. *Om het daadwerkelijke gebruik van de DLO te bevorderen, is het noodzakelijk dat de DLO uitermate gebruiksvriendelijk is, en dat opleidingen de DLO nauwkeurig op de behoeften van hun onderwijs, hun docenten en hun studenten kunnen afstemmen:*

We refuted the need for a high level of usability, since this does not improve any goal of the stakeholders. While the claim itself may be true, it is not relevant.

3. *De komende vijf tot tien jaar zullen mogelijk grote veranderingen in het academische onderwijs aan de UvA laten zien: de opkomst cq groei van blended learning, activerend leren, student-gestuurd onderwijs, differentiatie in leerpaden, aandacht voor module-overschrijdende leerlijnen, kennisdeling onder docenten, en ruimte voor netwerken van lerenden. De nieuwe leeromgeving zal deze ontwikkelingen moeten faciliteren en stimuleren.:*

Richard's report shows that advanced functionality is almost never used. We showed that advanced functionality only works when you have teachers that can use it correctly, which is not the case. New technological advancements (tools) will not advance the skills of teachers who have no intrinsic motivation to learn these tools. Only a small portion of teachers will be able to use it correctly now, and in the future, so it is not worth the investment, and has no clear effect on the business goal of the UvA.

8 Recommendations

The following questions were not investigated due to time constraints. However, we believe these questions are very important due to reasons explained below. We provide suggestions on how to obtain the answers to these questions, such that the *Werkgroep Toekomst Elektronische Leeromgeving* can implement our methods and obtain the correct information, i.e. relevant to stakeholder and business goals.

8.1 Does Blackboard improve learning?

The question can be made concrete by asking: **What is the relation between Blackboard usage (in percentage) and student's grades?** *Werkgroep Toekomst Elektronische Leeromgeving* already has the Blackboard usage data. They simply need to combine this data with student grades (link course average grades to course Blackboard usage).

In fact, by linking average course grades to usage, we can even answer other important questions:

1. Does usage of advanced Blackboard functionality (e.g. Adaptive Rules) warrant an increase in education quality, measured by student grades? We can hypothesize that it does warrant an increase in education quality, and try to reject the null hypothesis.
2. Are there big differences between courses (average grades) when Blackboard usage is about the same, but the courses differ in being more constructive (focussed on peer interaction) or objective (classical lecture room idiom, teacher conveys knowledge as one-way stream of information), see [6].

Important to note is that we need to take into account the difficulty of each different course. We cannot simply compare the average grades of two courses since they will differ in difficulty. A remedy for this is look for courses that have an increase or decrease in Blackboard usage over the years.

8.2 What factors in education improve student learning?

ed. One important finding was that instant feedback contributes to student learning (higher grades). We did however not have enough time to investigate more factors that can increase student learning.

To answer the above question we need to answer to subquestions. Combining the information of both is the last step that should be taken. Ultimately, we want to know to what extent Blackboard is contributing to the teacher goal to improve him/her self (provide better teaching), and the UvA goal of better education (measured in student grades).

8.2.1 Does the usage of Blackboard save the teachers time as compared to organizing the course themselves (file sharing, group building, assignment checking for plagiarism, etc)?

475 How much time does a teacher not using Blackboard on course organizational tasks, as compared to a teacher using Blackboard? Can we identify patterns. One of the goals of an ELE is to reduce the workload of teachers. Therefore we construct the null hypothesis:

H_0 : Usage of Blackboard saves teachers 0% of their normal workload in hours.

480 H_1 : Usage of Blackboard saves teachers 10% of their normal workload in hours.

If we can reject the null hypothesis (there is a significant reduction in workload by using Blackboard) we can combine this finding with the result of the next question.

8.2.2 Will teachers who spent (relatively) less time on bureaucracy 485 improve student learning, i.e. perform activities in the *education improvement factors* set?

By interviewing find the activities teachers employ, and what extra activities they do when they have more time. Identify all the activities in the education improvement factors set.

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