Leaving the Comfort Zone:
A Change Process towards
Project-Based Learning in an International Master Course

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Abstract

Learning and work will never be the same again: Information technologies change our processes and human interaction, disciplines merge, and students from all over the world will be the future project leaders in global enterprises. We therefore combined two subjects, introduced information management technologies and change management to an international master class — and on top of that made the course itself an issue of reflection for the students. We used PBL both as an example for change and as a personal own experience they had to reflect upon.

We wanted students to learn about change management while watching their own change process, and to use information management models and social semantic web technologies for learning and teaching. They themselves experienced the change from traditional teaching during their former university training towards PBL in this experiment. We constantly encouraged them to reflect on their situation and change processes, and to share the impressions.

The master students had worked in projects in their work experience, but they did never consciously learn via a given project. They were typically high performers in a traditional teaching environment, but project-based learning (PBL) was new to them.

Interestingly, most students opposed project-based learning, although they were close to the completion of their university education and a life-long learning in project work was ahead of them. Our paper describes the setting and the result of our discussions and reflections with the students.

The results showed that their traditional learning and work experience dominated their attitude towards learning in PBL. They opposed teachers who left the authoritarian role of a professor; they opposed project work because it could risk their usually high marks. Interestingly, their work background did not help here, since most of them came from a very hierarchical structure with little responsibility.

Sharing information, learning in teams, and trust in teachers and the process were issues in our discussions with the students. We found little evidence that the nationality was highly influential. At least as influential were gender and past experience in their work life. We observed varying willingness to experiment and leave the comfort zone of passive learning.

We found that pointing out the change process the students have to go through is a must to avoid resistance from students’ side against the new way of learning. It helps them to recognize their learning process and progress even if they complain that the teacher did not “provide” their new knowledge.

1. Introduction

In 2005 we started a series of experiments with project-based learning at our software engineering programs, encouraged by the reports of [1]. The shift from teaching to learning is a slow process and we started with a bottom-up approach where single courses and programs change towards PBL. We aimed at changing the teaching and learning of individuals: teachers and students.

In our work with mostly first year bachelor students we found PBL well suited for a good start into university learning [2],[3],[4],[5]. Now we wondered how PBL works with students at the other end of their studies, when they already have a successful learning history and should be prepared for their work life.

So in summer 2010 we did a PBL experiment with second semester master students. Those students are close to the end of their university education. As outgoing students they need techniques for life-long learning, personal, social method, and professional competencies which are well addressed in PBL.

The remainder of this paper is organized as follows: In chapter 2, we will give a short introduction to related concepts of our experiment. Chapter 3 describes the Master course experiment organization and our expectations. Chapter 4 summarizes our findings, and chapter 5 gives a conclusion.

2. Our Perspective of PBL

The acronym PBL is used for “Problem-based Learning” [6] and “Project-based Learning” alike [7]. Boundaries are floating, e.g. sometimes a “problem” can be defined by a “project”. In our perspective, we concentrate on the following features:

**1.1 Student-Centered View**

The student’s learning process and outcome itself is the central issue rather than the teacher’s activities. Among many other concepts, the Bologna process [8] introduced the notion of explicit learning goals to our university. This shift from teaching to learning [9],[10],[11],[12], changes the role of teachers and students. Teachers are no longer explainers and presenters of material, but facilitators for learning situations, they provide material, structure, and feedback, they ask questions and encourage reflection on several levels [13],[14]. Students are no longer in the passive role of audience, but their actions are the main issue. Teachers need to know more about the individual student’s prior knowledge and mindset as the base for new knowledge.

**1.2 Motivation and Activation**

[15] found evidence that PBL increases motivation. Our previous research with freshmen students confirmed that project work motivates and activates students. When confronted with a real life project, they worked literally day and night [4],[5]. Interestingly, they did not feel that they learned, but they felt that they worked and produced a palpable result. They also felt responsible for their product. With students of higher semesters this shifts to responsibility for their learning as well.

**1.3 Teamwork and Assessment**

“Problem-based learning in teams centers around dialogic learning, and puts discourse and relationship centre stage” [16]. This is important because teamwork is the normal work situation in industry. Student teams tend to avoid the “storming-phase” [17] and take a shortcut to the final product of the team’s efforts. We find a “master programmer” who does all the work, while others “stay out of the way” [3]. Assessment of teams must take the team and its history into account [18], and constant reflection on the process helps to make the teamwork effects visible.

Students ask for goals and examples of what they should do, and especially urgently before assessment. This is a chance to guide their progress by formative examples, formative feedback and formative questions [13], [19], without leading them too tightly. In theory, the project is crucial, “but research demonstrates that in general the assessment tends to drive the students’ learning [20], [21], [14], [22]. The assessment should reflect the topics that are important in the process itself, as well as the professional methods and results [14].

3. Setting of the PBL Experiment

The international Master on Software Engineering and Management started two years ago and draws students from all over the world. Most of them have some years of experience in industry, while the university background differs from computer science to applied areas. Those students already graduated well from previous bachelor courses, adapted well to the program in Heilbronn and the unfamiliar country, culture and language. Now they were almost ready for work in industry after graduation.

The SE master experiment was situated in the second semester of the master program, before they start their master thesis. We combined two subjects in the second semester of the master program

* Change management (100% of 6 ECTS) and
* Information management (100% of 6 ECTS).

The class in summer 2010 included 8 students from India, Romania, Pakistan, Turkey, and one German. Four of them were female, four were male. None of the students were graduates of our own bachelor. Therefore they had no prior experience with our teaching style. They did not know us teachers from the first semester. Other teachers had introduced them to giving presentations and working on reports in small teams, which was new to most of them (with the one exception of the German student). Except one, they all had worked in industry for some time.

The changes we required from the master students were therefore different from those of the first year bachelors. The master students already had worked in projects could work on their own and took responsibility for their actions, but they did never consciously learn via a given project. They were typically high performers in a traditional teaching environment. To our surprise they did not consider their project work in industry as a learning experience, and project-based learning was completely new to them. In order to make the connection clear, we proposed PBL both as an example for change and as a personal own experience they had to reflect upon.

**3.1 Strategy**

We wanted students to learn about change management while watching their own change process, and to use information management models and social semantic web technologies and tools [23] critically for learning and teaching. They themselves experienced a change from traditional teaching from their former university training towards PBL in this experiment. We constantly encouraged them to reflect on their situation and change processes, and share the impressions. The following table shows our actions and expectations.

Table 1: Change Actions and Expected Effects

|  |  |
| --- | --- |
| **Action** | **Students change towards …** |
| Joint introduction to PBL  | Understand the roles of facilitators and students |
| Facilitate student presentations of subject content: change management and the social semantic web. | Confident presenters of material and possible application for the project understand the single topics in that context. |
| Students share content in a wiki | Expressing thoughts about the material |
| Teachers enhance the material in the wiki by posting questions and references to other aspects | Students learn from that example how to use this social platform in order to jointly come to a shared picture of the project |
| Students comment on wiki content and enhance connections between single topics and the courses | Trust each other and the facilitator |
| Students interview other teachers about their attitude towards PBL | Reflection on differences between traditional teaching and PBL for teachers |
| Students apply knowledge about CM to own experience | Reflection on students’ situation in PBL and their former traditional learning situation at the universities. |
| Students compose a requirements analysis for traditional and PBL teaching and learning | Use the social semantic web for sharing knowledge, discussing questions and learning  |
| Students worked in two teams | Combine the forces within a team |
| Students give presentations and write reports about the change from traditional teaching towards PBL for both teachers and students | Apply the own experience and the shared material to the project and produce a decision which models, tools and techniques are useful in which state of the transition.  |

We first introduced the idea of the course combination and explained that we would work in a cooperative way. We gave a joint short introduction and then announced that we would not lecture, but be their guides through the process. That was a new situation to most of them, but they liked the idea.

Since they first had to learn about change management, as well as about information management techniques, students prepared presentations of certain aspects in pairs. That was a familiar task. Presentations were held in class, teams worked mostly on their own and met on a weekly basis with the teacher for discussion.

We then encouraged them to use a shared wiki for the semester. The wiki contained the organization, the presentations, as a typical repository for material.

We next proposed to really collaborate in the wiki. We encouraged comments on the presentations and drawing connections from the findings to the application in the other course, and to their own learning situation. Since that was new to most of them, we also shared our thoughts, questions, doubts and new ideas, material in the wiki.

We jointly discussed the necessity for trust between the sharers of the wiki, and the benefit of doubt and questions, that drive the learning process more than the content of a subject.

Next, we introduced the PBL method in theory to them and encouraged them to comment and reflect on the PBL process in theory, as well as their own experience with the project. That was quite a challenge, because the master students now were at the same time experiencing PBL as students, and reflecting on the process and their own changes.

They slowly understood that they themselves were the project, and that we wanted them to reflect, understand and discuss the PBL approach as a change process. The following picture shows the structure of the experiment.

Picture 1: Structure of the Experiment



Students then worked in two teams: one discussed the teacher’s transitions towards PBL; the other team discussed the student’s transitions towards PBL. In the end we wanted two reports from those teams on the change towards PBL, one from the teacher’s perspective, and one from the students’ perspective, as well as the application of web tools for collaboration and learning in general.

4. Results

We expected our students to be advanced in teamwork and project work, and found that this is not necessarily the case. Those students understand the urgency of the competency based aspects of PBL, but they also strived for very good graduation marks and reacted badly if they felt that the teaching method might come in their way. Irritation and doubt was not what they wanted to experience in their last semester before they have to present themselves confidently on the job market.

Since the group was so small, we did no external observation, but discussed the process directly with the students, who also were observers in a way, and shared and used their own observations for the project. Students answered questionnaires:

* We used the obligatory, university-wide course questionnaire in week 12. The results were positive in both courses.
* In week 14 we used a similar questionnaire about social and personal on both single courses. The results were quite different. While the change management course was still considered positive for their learning and development, the information management part was considered not helpful. Two students did not think they learned anything relevant for their future work life. They stated that the teacher got sidetracked sometimes and did not make the structure clear enough.
* Learning outcome: The presentations, discussions and contribution on the collaborative wiki, and the final report were the results we graded 30:30:40. All students passed, only one with a less than good or excellent mark.

This experiment aimed at a much higher level of understanding than the bachelor experiments. University life is not novel to the master students, but teamwork and project driven learning was. We also required considerable reflection about what happened during the process. The reflections results were also the student project’s aim. The following table shows the results in contrast to our expectations.

Table 2: Change Actions, Expectations and Results

|  |  |  |  |
| --- | --- | --- | --- |
| **Action** | **Students change towards …** | **Results** |  |
| Joint introduction to PBL  | Understand the roles of facilitators and students | In the end they understood (but did not like it) | + |
| Facilitate student presentations of subject content: change management and the social semantic web. | Confident presenters of material and possible application for the project understand the single topics in that context. | As high performers, they had no problem with the material and its application, although they were irritated by the application to themselves | + |
| Students share content in a wiki | Expressing thoughts about the material | After some nudging, all of them did. | + |
| Teachers enhance the material in the wiki by posting questions and references to other aspects | Students learn from that example how to use this social platform in order to jointly come to a shared picture of the project | The wiki itself was not well enough suited, so we could not find out how the best benefits from such a tool. | 0 |
| Students comment on wiki content and enhance connections between single topics and the courses | Trust each other and the facilitator | They stayed reserved in their wiki contributions, but oral discussions became livelier. | 0 |
| Students interview other teachers about their attitude towards PBL | Reflection on differences between traditional teaching and PBL for teachers | They knew how to interpret the interviews and understood the CM models well. | + |
| Students apply knowledge about CM to own experience | Reflection on students’ situation in PBL and their former traditional learning situation at the universities. | They knew how to apply their own experience to the CM models  | + |
| Students compose a requirements analysis for traditional and PBL teaching and learning | Use the social semantic web for sharing knowledge, discussing questions and learning  | The wiki was not suitable for composing a result, so they switched to “table discussions” and a written report, sometimes neglect­ting the material already worked out in the wiki. | **-** |
| Students give presentations and write reports about the change from traditional teaching towards PBL for both teachers and students | Apply the own experience and the shared material to the project and produce a decision which models, tools and techniques are useful in which state of the transition.  | Written results were very good. | + |

We now discuss some aspects that were crucial during our experiment.

**Learning Outcome**

The master students wrote interesting reports based on their own reflection as subject and object of the PBL learning process [25], [26]. We teachers were happy with the results, but students seem to be insecure most of the time. We often could not transfer our own confidence in the process and the students to them. Even when we praised their work during the semester, they still were not sure about it. Students really produced new knowledge, according to the classical university idea as the place to create knowledge. Some were surprised by their good grades.

**Teamwork, Trust and Sharing**

In many discussions the students stated that the idea of working in teams was still novel to them, that the responsibility for their results was hard to bear in the open PBL process. They were not used to speak their minds and used the wiki very reluctantly for comments. Since they did not know us, the process, and the courses, trust could not be built up as much as we hoped.

We found, that they always referred to their prior university education, which had in 7 out of 8 cases very traditional teaching methods. When we pointed out that their work life in industry actually had contained teamwork, and responsibility, they acknowledged teamwork, but stated that there was always a superior manager who decided and took the responsibility. Some could not picture themselves in that role for the future, although as master graduates they possibly will be the responsible managers. That notion seemed to frighten them. All the female students said that they did not want to be the manager and blocked further discussions about it. This seemed to be a problem of gender, not of culture, since the women came from Asia and Europe alike. All had worked for some years in companies.

**Reflection**

Reflection on such a high level was a challenge. It was also a threat to the usual and safe way of performing. We teachers were often challenged to take over and relieve the students of their burden of thinking. We always answered that this is a master course which requires a certain level of independent thinking. Reflection on the own experiences with PBL while learning about it in theory was sometimes considered as sidetracking, see also gender differences below. Discussions about the relevance for their work life were stated “irrelevant”.

**Uncertainty Avoidance**

When we teachers said, that we did not know the outcome of the project beforehand, most students were terrified. There was no ready-made example they could compare their own work to. It was truly a new field for them. All of them were “...made nervous by situations which they perceive as unstructured, unclear, or unpredictable, situations which they therefore try to avoid." [27].

**Gender Differences**

Since the group was so small, we cannot generalize our findings, but the gender differences we found, were at least interesting. As stated above, the female students did not see themselves as persons in management positions. This is surprising because the master program is called “Software Engineering and Management” and aims at this position.

The teachers were female/male. The female teacher was criticized for “*unstructured teaching*” and “*sidetrack discussions*”, issues that result in uncertainty. The male teacher was praised for his “*openness*” and “*free teaching style*”. We had the impression that the students judged the same behavior differently for the male and the female teacher.

5. Conclusion

Of course, at the end of our experiment we are very much in the same position as our students who say, that in the end they “think they know what to do better the next time”.

In the end, it was very good example of a hard process that created an exceptional good project result. In this case, the students created completely new knowledge, and a lot of self-knowledge. They came across questions and doubts that usually are not an issue in traditional university life.

We were surprised about some students, who denied any expectations for responsibility in their future work life. Our whole master program aims at the management level competencies as required in a European or worldwide company. E.g. all students from Asia expected a return to a much lower situation back home. So the problem was not PBL method or traditional method, but the discrepancy between career patterns. Since our group was so small, we cannot state that this is a general pattern for different continents (another student from Romania joined the sentiment), but we will watch this effect more closely in the following years.

The currently running summer semester shows a different picture: we now have six German students, and five Asian students. The three teams work naturally with PBL. We did not make PBL a topic of their study, we just apply the method. We repeated the statement that the teams will produce something that we, the teachers, do not know beforehand, that they will truly explore new areas. No team was terrified, no team doubted our role, or, most importantly, they still are confident about their results and, of course, their grading. Furthermore, they readily accept their own responsibility for the quality of their results.

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