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Establishing Communities of Practice among Students and Start-Up Companies

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Abstract. This paper presents the concept and an empirical evaluation of the course "High-tech Entrepreneurship and New Media". The course design is based on socio-cultural theories of learning and considers the role of social capital in entrepreneurial networks. By integrating student teams into the communities of practice of local start-ups, we offer learning opportunities to students, companies, and academia. The student teams are connected to each other and to their supervisors in academia and practice through a community-system. Moreover, the course is accompanied by a series of lectures and group discussions. In this paper we present empirical findings and reflect on changes in the design of the course which took place between its first and the second instantiation. These design changes were based on the empirical evaluation of the first course and a deeper analysis of the role of social capital.

Keywords: Communities of Practice, Social Capital, Regional Start-Up Networks

INTRODUCTION

Engineering universities have a strong record in knowledge sharing with industries ranging from cooperative research projects to student internship linked with the engineering curricula. Start-up companies in the environment of technical institutes heavily benefit from the innovations made in research. Surprisingly, in German computer science the lab courses are not organized according to the model of engineering curricula. Since 30 years, instructors and students have developed an academic practice similar to the practice in the natural sciences. In contrast, many German computer science students are already practitioners in software engineering since they work as software developers for local IT companies often founded recently. German computer science faculties do not encourage entrepreneurship in general. So, even in IT-related start-ups interaction rate between entrepreneurs and academia is low.

This paper describes an attempt to establish an institutional frame between industry and academia to foster knowledge sharing. First, we wanted to draw on the existing practice of students in academic teaching, second we wanted to transport newest methods of software engineering into industry, third we wanted to get access to real world problems of companies to identify innovation potentials on both sides. So, we have developed a new course in computer science teaching which is based on the concept of computer-supported communities of practice. It is called "Entrepreneurship and New Media". Since 2001, we organize supervised student project work together with local start-up companies. The courses are accompanied by a series of lectures in which university lecturers and practitioners address topics related to entrepreneurship and the design of media. A community system is deployed to facilitate communication and document sharing between the different actors.

Besides the development of adequate technical functionalities to support the learning processes, the appropriation of the community system in the context of these innovative didactical concepts is a challenge. The combination of practice oriented education at universities and concepts of learning on the job within companies is a precondition of a successful integration of academic theory and industrial practice. Identity-building in communities of practice and the building of social capital are expected to enable a fruitful exchange between universities' experiences and companies' practice.

In the following, we first sketch our theoretical background. Then we present experiences with the course and its evaluation in two different years (winter term 2001 and winter term 2002). Between the two instances of the course a major design change took place to reflect the evaluation results from the first instance. In the last section we discuss the empirical findings and conclusions with regard to computer supported communities of practice between students and start-up practitioners.

THEORETICAL BACKGROUND

In the last decade constructivist theories of learning played an important role in the development of new computer-based learning designs (Duffy and Jonassen, 1992). In this understanding, learning does not mean the transfer of knowledge from a teacher to a learner, but rather the learner's permanent (re-) construction of knowledge, based on former experiences. Socio-cultural theories take learning as a collective process which is linked to specific contexts of action. Knowledge emerges in communities of practice by discursive assignment of meaning (Lave and Wenger, 1991; Wenger, 1998). Processes of social identification (Tajfel, 1982; Turner et al., 1987) play a central role for the establishment of common practice and a shared identity. To foster networks among student groups, academia, and start-up companies, the scientific discussion on social capital offers a relevant scientific context (Putnam, 1993; Cohen and Prusak, 2001; Huysman and Wulf 2004). Many authors found the concept of CoP helpful to understand and to support cooperation, knowledge management, and collaborative learning (e.g., Brown and Duguid, 1991; Osterlund and Carlile, 2003). Several case studies conclude that this is true even for computer-supported, virtual or distributed communities (e.g., Haas et al., 2003; Arnold and Smith, 2003). The theoretical approach of Communities of Practice (CoP) integrates identity theory, theories of practice, and theories of social structure and situated experience (Wenger, 1998). In their research on situated learning in working groups, Jean Lave and Etienne Wenger focus on common daily practice of group members, active membership, and in-group awareness (Lave and Wenger, 1991). The most important inclusion mechanisms concerning these communities are processes of collective learning and the production of shared meaning and collective identity. In this approach the social practice refers to explicit and tacit knowledge and competencies. It integrates language, tools, documents, symbols, and roles as well as conventions, norms, rules, perceptions, and assumptions.

In CoP, an individual's learning is inherent in the processes of social participation in CoP. Knowledge and learning in CoP are not abstract models but relations "between a person and the world" (Duguid, 2004, p. 8) or "among people engaged in an activity" (Osterlund and Carlile, 2003, p. 3). Individual learning in a CoP is mainly based on "legitimate peripheral participation" (Lave and Wenger, 1991). During the participation process, an individual might enter the community as a beginner at the periphery and then gain a more centered position over time by acquisition of cognitive apprenticeship. This acquisition process leads to an intensified inclusion into the social practice of the community. Learning is based on this process of inclusion of outsiders, becoming more and more insiders in the common practice. The communities of practice themselves can be seen as "shared histories of learning" (Wenger, 1998, p.86). The mechanism of (social) identification of individual persons in the social context of the community plays a key role for the formation of a community of practice. We can see that the CoP approach combines the "two sides of the medal" of community participation: The social practice of the community as a *collective phenomenon* and the identity of its members as an *individual* one. CoP theorists focus on both levels of communality and individuality. Thus, processes of community- and identity-building are central.

EXPERIENCES WITH LINKING ACADEMIC AND START-UP PRACTICE

Based on the theoretical foundations sketched above, we designed the course 'Entrepreneurship and New Media" as shown in figure 1. A major part of learning was supposed to happen by legitimate peripheral participation in the community of practice of the start-up companies. We intended to support processes of social identification and social capital-building between entrepreneurial practitioners and university students. The cooperation of students and practitioners to carry out a common real-world task should allow the establishment of a shared practice and therefore mutual learning. Projects were always related to one of the local start-up companies in the region. Therefore, the companies and the designer of the course developed the projects jointly. We intended to initiate Communities of Practice (CoP) between students and company practitioners in the project groups (cf. big circles in figure 1). By getting start-up practitioners engaged in the group work, a market-oriented perspective was integrated in the course work. Lecturers and instructors/ supervisors were thought to accompany the project work.

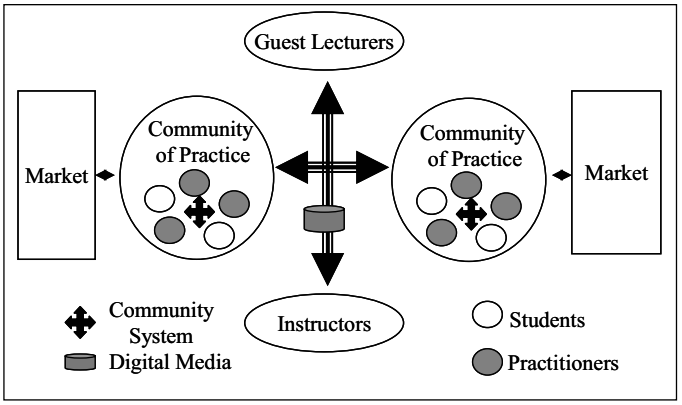

Figure 1: Course Design

Group oriented learning processes, especially among the student teams and between them and their academic advisors should be facilitated by a community-system. Thus, the instructors put task relevant learning materials on the community-system. Additionally, instructors were available for consultancy and supervision. Several review meetings supported the reflective processes of the students related to their tasks. Moreover, these reviews were supposed to work as forums for discussion among students and guest lecturers from industry and academia. While initiating learning processes among the students, the course design supported the knowledge transfer from academia to industry, as well. Discussions between students and practitioners were thought to be the starting point of learning processes in practice. We calculated 50 hours of student time for the course itself and 150 hours for the project lab.

In the following, we shortly describe the evaluation results of the first course and our conclusions for the design of the second one. Afterwards experiences and empirical findings of this second course are presented.

Although the first course (winter term 2001) was rated as successful in general, several shortcomings have been observed: The establishment of CoP between students and start-up practitioners was less successful. In our empirical evaluation we found the following reasons: the start-up companies were *very young enterprises* which had not established *a consolidated own practice*; the start-ups were *very small enterprises* with only few employees and therefore *very limited resources* to supervise the lab groups; the supervisors were *not very experienced* in organizing the course. Furthermore, *socio-cultural differences* between university students and start-up practitioners and *physical distance* between the start-ups and the university caused problems in communication and cooperation. Besides the observation that electronic communication makes peripheral participation in CoP more difficult, the community system (named CommSy; cf. Rohde et al., 2005) *was used not very frequently* by students and start-up practitioners in this first course (cf. Klamma et al., 2003).

According to these results, following changes were made to the second instance of the course (winter 2002): Start-up companies have been selected which were thought to have a *more stable software engineering practice*, and which had been founded earlier and therefore *had a longer history*, and *more employees*. *Bigger student groups* were established (each of the three groups started with six members); each lab group was *supervised by an academic tutor* therefore supervision of the project groups was intensified. Extreme Programming (XP) instead of Unified Modeling Language (UML) was used as *software engineering method*, because XP seemed to us more appropriate for short-term software development projects within smaller teams. The course was accompanied by six students from the department of organizational psychology which supported the lab groups by *intense coaching and training for presentation techniques*. *Four review meetings* were conducted during the second instance of the course (instead of two review meetings during the first one). The reviews were taped on digital video and analyzed by the psychology students to give the lab students *feedback on their review performance*. Finally, *another community system* (BSCW instead of CommSy) was deployed to the course participants and usage of this platform *was motivated by stronger demands* of the supervisors.

The overall learning experiences in this second course have been evaluated quite positively by the students. They mentioned the following factors:

- working on practical real-world problem solutions,
- the cooperation with real partners from start-up companies,
- the cooperation in teams,
- practical experiences with presentation techniques in the review sessions,
- and the method of extreme programming (XP).

However, we believe that we have not yet exploited the full potential of our concept. In the following more detailed results of the evaluation are presented. All reported results are taken out of 25 semi-structured interviews with students, company practicioners, and academic tutors and supervisors) that lasted between 60 and 180 minutes and have been recorded and transcribed afterwards. The reported empirical findings represent condensed interview statements (and observations during the course).

CoP between students and company practitioners

As in the first instance of the course in winter term 2001, the establishment of CoP between students and the company employees was limited again. A *real participation* of students in the companies' communities of practice could not be established. In case of one company, due to the very intense engagement of the company founder, a very good relationship between the entrepreneur and students emerged. The entrepreneur confirms a good atmosphere but is disappointed with regard to the work result, because the competences of students did not fit his expectations. On the other hand, the students and the instructor stated that the task definition was too fuzzy to solve the problems in time. A second lab group showed a different picture: Here the result of the work was very successful while the personal relationships between students and the entrepreneurs were not that good. Fluctuation in the personal of the start-ups and physical distance limited the participation in the company's practice. Furthermore, the entrepreneur behaved like the leader of the group. Another lab group met with their start-up supervisor only two times during the course. He was part of the management of the company and had not time enough to show up more frequently. But the students understood his limited resources and sent him

written reports on their work progress weekly. Nevertheless, all students stated that they were very satisfied with the course and that they had learned a lot.
This can be seen as a hint that – according to the presumptions of Social Identity Theory (SIT) – processes of "generalization" and "accentuation" (Tajfel, 1982) are working within the initiated CoP: Amongst the student "in-group" phenomena of social identification occurred, while between students and entrepreneurs (as "out-group" members) identification is less likely. Therefore, community-building of members of distinct social groups with different cultural and historical experiences faces specific problems of understanding and needs advanced coordination efforts. The economical presumption that the students work for the entrepreneur as a customer, may be an additional barrier for CoP building processes.
The role of the *method change* has to be investigated further on. Extreme programming (XP) was introduced by the course designers to have a method at hand which is known to be more suitable for short projects with small development teams than UML and the unified process. Most of the students were very pleased with the method itself but the difficulties with the applications of all the XP rules were obvious. In case of urgency, students ignored programming principles and returned to "good old hacking" approach. The companies were very interested in the XP approach because their established software engineering methods proved to be even more underdeveloped than in the projects with the students. A CoP-aware software development method is still an open issue. As XP rules demand the on-site customer and team oriented programming, this could be a possible starting point to integrate XP as a software engineering method.
To sum up the interview results, we can see that limited resources (both persons and time), spatial distance, cultural differences, and incommensurable expectations still hinder the establishment of CoP between university students and company practitioners.

CoP within the lab groups

The establishment of a common practice was quite successful within the lab groups since all computer science students showed only *slight differences in their competencies*. All participants underlined that the *close cooperation* in the labs was one of the main learning effects. They expect that the established cooperation and relationship will last longer than the course.
The *group structure* in the project labs was developed self-organized and described as non-hierarchical. Some of the students and one of the tutors stated that it would be better to establish a formal leader of lab groups to draw decisions and coordinate the process. In this regards, the *role of the group supervisors* has to been researched carefully.
One of the major design changes in comparison to the first course was that the groups in the second course had a *distinguished supervisor*. The supervisor was responsible for establishing the contact between the group and the start-up company, for the facilitation of meetings, for the allocation of rooms, lab places, software and books, and for the consultancy of the groups in daily work and around reviews. The implementation of such concepts depends deeply on the changing role of university level supervisors. They are challenged by the intensity of temporal and emotional engagement as well as by the needed professional qualification. By monitoring the three different supervisors we can observe that they understood their role in different ways. For further studies on the interplay between teachers and learners in university CoPs our theoretical setting can be used as a framework.
Training for presentations techniques was introduced as a new module into the course. This was appreciated very much by the students. The social ties between the students in the group and the psychology students developed very intensively. Some of the students turned out to be very good presenters. So, the offering of training for presentation techniques is not only very attractive and sometimes also proved successful for students but also helps in shaping CoP by additional common practice and further identity-building. In the next years we want to have also computer science students from the last years to become mentors for the groups to give new students the opportunity to meet real experts (apprenticeship learning)

Technological support by the cooperation platform

We assumed that group-oriented learning processes can be facilitated by a community system. In our case, the instructors put project relevant learning materials into the community system. Additionally, instructors were electronically available for consultancy and supervision. The lecture series and review meetings supported the reflective processes of the students related to their tasks. Discussions between students, lecturers, and practitioners were intended to be a starting point of learning processes in practice. The course's time schedule contained fixed meetings, review sessions, workshops, and a tentative list of lectures. As a technical infrastructure, a community-system (BSCW) was deployed to the project groups. The system supported cooperation within and between working groups. Lecture and project materials have been published regularly on the net. In order to find these materials, the system offered various options for retrieval. Programming tools like a source code management system (cvs) and various editors have been installed to support community-oriented work settings.

Contrary to the first course, the community system was *used very frequently* by all groups and students. From the beginning of the lab, the instructors enforced the use of the system in the tutorial and the reviews. In the tutorial one of the first tasks was to fill in personal data and to upload a portrait. Therefore, the first use of the system was already manipulative and the barrier to upload and to exchange materials was lowered. In comparable teaching situations, when students are not asked to change information in the system, the use of the system is more passive.
Furthermore, the lab groups were bigger and the start-up practitioners used the system more intense than in the first course. All interviewees evaluated the usage of the community system as *very positively*, in fact we have got the strongest positive reactions referring to the community system and the presentation techniques. Of course the bigger project groups affected the more intense usage of the community system.
The community system was used for up- and download of documents, for discussions in forums, for co-authoring of documents, for annotations, and for awareness information. For planning activities and negotiation on meetings, other media like phone and e-mail were used instead of the cooperation platform.
Interviewees named *some shortcomings* of the system: They missed *features for synchronous communication* like chat. The up- and download of documents was evaluated several times as too complicated.
Furthermore, the *introduction process for the community-system* has to be designed carefully to reach a mission critical use of the system during the course and later on. Barriers in using the system were lowered by the first guided steps to use the system. Consequently, later use was very intensive extending the use of the system far beyond the timeline of the lab course (especially for downloading materials not stored elsewhere like videos taped in the review sessions and personal information about other lab members). Based on the good experiences with the introduction process we have codified the process and use it for a community-oriented continuing education portal.

DISCUSSION

Socio-cultural theories of learning stimulate the design of practice-based courses in computer science. The results of the evaluation have shown that both networking on a technical and a social level offer new opportunities for university level education. Especially the work on real-world problems, collaboration in teams together with partners from start-up companies were evaluated very positive. Following a first instance of the course the didactical design was modified considerably according to evaluation results. By a more precise selection of start-up partners, larger lab teams, coaching of the lab groups by tutors, and increased motivation to use the technical community-system, collaboration and therefore the establishment of a common practice within the lab groups have been encouraged.
The computer support for learning CoP causes new duties and requirements for academic supervisors. Establishing of CoP needs developed *social competences in fostering trust and team spirit*. This observation corresponds with the theoretical assumptions of the social capital approach (cf. Cohen and Prusak, 2001).
Furthermore, additional engagement of students of organization psychology, certain trainings (e.g., presentation techniques), and the conduction of more review meetings, led to a better evaluation of the second instance. In the first instance of the course in 2001, design flaws, cultural as well as professional diversities, and imponderableness of reality limited the success. Although the second instance of the course in winter term 2002 was redesigned, again we did not succeed in establish a common practice between academia and industry within the scope of the course. Most important barriers for the establishment of CoP between university students and start-up companies are limited resources (time and personal) and cultural differences. Especially the differences in cultural background and different historical experiences in the two distinct groups of “students” and “entrepreneurs” might make processes of social identification more difficult and therefore successful community-building less likely. Generalizations within “in-groups” lead to reinforcement of perceived similarities, while accentuation between members of different “out-groups” increase perceived differences (cf. Tajfel 1982). This perception of *intra-group* similarities and *inter-group* differences might hinder the establishment of CoP between members of different group and should be taken into account with regard to the design of supporting conditions for the establishment of communities of practice.
Moreover, according to the social capital approach the establishment of CoP between academia and regional industry depends on a culture of mutual trust (cf Putnam, 1993; Cohen and Prusak, 2001). Therefore, mutual learning of university students and regional company practitioners needs social capital which is built by common experiences and shared practice. So our approach will need more instances to build a sufficient level of trust and social capital in regional networks between university and industry. Both establishment of CoP and building of social capital *need time* to emerge (cf. Lave and Wenger, 1991; Cohen and Prusak, 2001). Thus, the limited time frame of a course taking place during just one single term (3-4 months) limits the opportunities for successful initiation of CoP between students and company practitioners. On the other hand, repetition of the course should establish social capital and CoP between academia and regional industries.

The personal reputation of the supervisors from the university in the entrepreneurial networks has been leveraged by the courses, e.g. they are included into information exchange networks and are invited to start-up related events like business plan competition, and company fairs. In the meantime, many joint supervisions of master thesis work and joint presentations at different fairs document the successful cooperation between local start-up companies and the university. Further development of university structures is needed but also new potential for universities is offered by networking with local industry and life-long learning activities within continuing education. This established cooperation structures and a culture of mutual trust can reinforce the opportunities for further lab course cooperation in the future. Many instances of the course in the following years allow us the do slight modifications in the design of single elements of the course and to study the effects.
Nevertheless, good personal relationships and therefore rich social capital was established between *some* students and practitioners. We cannot answer the question, whether self-organized and non-hierarchical structures or the existance of a groupleader would better support the building of social capital within the lab groups. In all lab groups learning mechanisms of legitimate participation have been proved successfully. Especially the students reported on high intensity learning while creating a common practice in the lab groups.

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