Supporting Communities of Practice in Applied Computer Science Studies

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ABSTRACT

The authors discuss the experience of a longitudinal study 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. So far, the course has been conducted three times at RWTH Aachen and the University of Siegen.

1. COMMUNITY-BASED LEARNING IN APPLIED COMPUTER SCIENCE

The course “High-tech Entrepreneurship and New Media,” now in its fourth year of existence and held at two German research universities, is the result of the unhappiness of the authors with classical and “new” e-learning teaching efforts in applied computer science at German universities. Among others, we made three observations that we want to address here: 1) Even though many students worked as software developers in local entrepreneurial and established companies, their practice was not reflected in university teaching at all. In singular cases the work led to successful joint diploma thesis projects and excellent job offers. Our idea was to establish a course that stabilizes the reflection of student practice and to move the newest ideas of software engineering from the university into practice. 2) Local high-tech companies, founded mostly by university graduates, were only loosely linked to their birth-giving universities. Compared to US universities, the level of interaction between academia and industry is too low. The innovation potential and the needs of the companies are not addressed in a sufficient way. Our main idea was to offer entrepreneurs a platform to reflect about their experiences, to sensitize students for entrepreneurial activities, and to let students work on real-world problems instead of fabricated lab examples. 3) The way new teaching technology is introduced leads to disappointing results in computer science. Often technologies only mimic classical teaching methods or mask the pedagogical disorientation in applied computer science between the curricula of the natural sciences and engineering. Our idea was to apply socio-cultural theories of learning and identity building [1; 11; 17—19; 21], following our enquiries of US entrepreneurial education and networks around the MIT (Massachusetts Institute of Technology, Cambridge, MA) area, and suitable collaboration tools to small connected groups of computer science students working on real world problems in local companies.
Because we rigorously documented and evaluated the course from its early days until now, we have a huge amount of data which, for several reasons, we constantly linked to the applied theories. On the practical side, we re-designed and adjusted the course in reaction to the analysis made and the overall dramatic change in the German university teaching system (Bologna process). On a theoretical side, we tried to overcome our naïve understanding of socio-psychological theories [3; 4; 12], especially communities of practice [2; 10; 20], and to formulate a more realistic understanding of shared interactions and shared cultures in groups, community and networks [6; 15]. The course design and several evaluations were reported in various places [8; 9; 13; 14]. Therefore, we will only introduce this topic very briefly. In this paper, we primarily want to reflect on the long-term effects our study’s ramifications may have on students, our teaching practice, the entrepreneurial networks and technology.

2. COURSE STRUCTURE AND IMPLEMENTATION

In the course, several groups of computer science students each work on a concrete project task for a start-up company. The courses are accompanied by a series of lectures in which university lecturers and practitioners present topics relevant to entrepreneurship and media. The cooperation of students and practitioners in carrying out a common real-world task should allow the establishment of a shared practice and, therefore, mutual learning. Group-oriented learning processes, especially among the student teams and between them and their academic advisors, ought to be facilitated by a community system. Thus, the instructors put task-relevant learning materials on the community system. Moreover, it was supposed to work as a forum of discussion among students and guest lecturers from industry and academia. The system supported cooperation within and between working groups. Additionally, it has been used as an archive for lecture and project materials.

In the first meeting, the students interested in the course were introduced to the basic concept of this type of courses; the tasks were presented briefly and project groups were formed. The students then chose one of the presented project tasks and formed appropriate working groups. Following this, students took an intense two-day tutorial on software engineering methods, project management techniques and other relevant issues. The students had meetings with their start-ups in order to gather information about their objectives, projects and working methods. The project groups and tutors compiled and agreed upon concrete project aims for the execution of the practical tasks, and a realistic project plan that was to be examined in the first review. With regard to the accompanying lecture, speakers from academia and practice rotated. The students got perspectives from management consultants, venture capitalists, software developers, and personnel specialists, who supplied topic-referred empiric reports and were available for discussions and critical inquiries. In the reviews, the project groups mutually presented each other their results and discussed the further procedure together with the lecturers and experts. These review sessions also served to exchange experiences and offered the possibility of one group benefiting from the progress and findings of another project group. At the end of the term, students, lecturers, and entrepreneurs had a final meeting. The project results were presented by the project groups and discussed.

3. EVALUATION METHODS

The authors follow the idea developed by Gerry Stahl that community-based learning should be analyzed at the intermediate level of small groups of individuals within the community [16]. Therefore, we mainly observed the performance of the students within the groups. The materials were created, collected, and analyzed by advanced students of psychology under the supervision of a trained psychologist. We used different qualitative methods for the enquiries: 1) the lecturers composed several lecture analyses, which stated progress, discussion with
students, and other characteristics. For extern lecturers, these protocols were composed by university members; 2) explorative semi-structured interviews with students and supervisors from academia and industries were conducted. All interviews have been recorded with DAT-recording and fully transcribed. In the evaluation, the answers were transformed into a table categorized by the role of students and academic and entrepreneurial supervisors. The interviews have been analyzed descriptively; 3) interaction within the community-system was recorded, as was email-exchange between students and their cooperation partners in the start-ups; 4) as part of the final arrangement and subsequent to the presentation of the project results, a 45-minute open discussion took place between students, lecturers, and cooperation partners from the start-ups, where students especially were asked to give feedback concerning the concept and structure of the lectures. The course of discussion was recorded.

4. COMMUNITIES OF PRACTICE (CoP), SOCIAL IDENTITY, AND SOCIAL CAPITAL IN ENTREPRENEURIAL NETWORKS

To find evidence that our ideas had overcome the observations we noted in the first section, we compared our empirical analysis with the analysis we made while studying the entrepreneurial teaching and networks around MIT in the United States. Our recent research disclosed four types of networking mechanisms in the entrepreneurial scene around the MIT Entrepreneurship Center [5; 7]:

- Type 1: Matchmaking events like informal beer-and-pizza meetings or formal dinners to reduce risks of contacting possible business partners.
- Type 2: Social families such as shared dormitories, classes and research labs (peer group effect).
- Type 3: Personal reputation networks for economic action gained through personal expertise and experience.
- Type 4: Inter-organisational relations between start-ups, the university, and venture capital firms by means of intellectual capital management.

These four types of networks are not independent from each other. For balancing lock-in syndromes, transactional openness, value injection, trust, and solidarity all four kinds of social networks are needed. If we assume that the situation in the Boston region is far better than in Germany, and if we assume that we can improve the situation locally by fostering learning among students and among other members in the network, we can analyse what our impact was and is. We have reported elsewhere about design flaws and practical problems in the course and how we dealt with them. Here, we want to concentrate on the question: Did the students learn how to network?

We know from our study of entrepreneurial networks in Boston that newcomers have only faint ideas about networks and networking, but experienced players know how to make use of social capital in the networks. The CoP between the students can be compared with peer group effects found in the MIT study. Students within the groups build up social capital (or not) leading to relationships beyond the scope of the course. Still, the lab students do joint work in other contexts like course homework or master thesis work. We can monitor that the students still use the community system, especially for downloading materials not stored elsewhere, like taped videos of the review sessions and personal information about other lab members. Some of them have the same cultural background, but we can also observe cooperation between students from different countries but the same year. The group structure was developed, self-organised and described as non-hierarchical. Most important, the barriers for the establishment of a CoP between university students and start-up companies are limited resources (time and persons) and cultural differences. The differences, especially in cultural background and historical experiences, between the “student” and “entrepreneur” groups
might make processes of social identification more difficult, and therefore successful community-building less likely.

Nevertheless, good personal relationships and rich social capital were established between some students and practitioners. Self-organized and non-hierarchical structures supported the building of social capital within the groups. In all groups, learning mechanisms of legitimate participation proved successful, especially if the students reported on high-intensity learning as part of their collaborative practice in the groups. In particular, a Thai student in the third instance of the course at RWTH Aachen was asked to prepare her master’s thesis in computer science for the very same company with which she did the course project. Moreover, her mate was also able to get a thesis topic in the company. In such situations it is hard to analyze to what extent the reputation building process of the course has contributed to the final result. We see this as an indicator that we were successful in establishing networks of reputation in the region (type 3).

The personal reputation of the supervisors from the university within the entrepreneurial networks has been leveraged by the courses. The supervisors are included in information exchange networks and are invited to start-up related events like business plan competition, company fairs and so on. In particular, the contact between the course supervisors and the local university entrepreneurship center from which lecturers were invited to present in the course lecture series helped to establish stable relationships and social capital within the reputation network of the high-tech/new media cluster (type 3).

The events are part of type 1 networks, which foster initial matchmaking and reduce risks of cold calls by opening informal meeting opportunities. Seldom, if ever, do computer science master student visit these events. Most of the attendees from the university are PhD students or alumni. This is very different from the situation around MIT (add to that the fact that the number of events is a magnitude higher in Boston). The use of social capital in this network type is thus limited. To overcome this situation, students should be motivated to visit these events on a regular basis.

The fourth network type is very different in the US and in Germany, due largely to different legal regulations concerning intellectual capital and a different venture capital culture. Intellectual capital issues were raised selectively in the course, but it never approximated the signature of a non-disclosure agreement like it was usual to do in the entrepreneurship lab at the MIT Sloan School of Management. Furthermore, the start-up representatives never discussed seriously with the students the role of intellectual capital and the possibilities of an actual start-up. Neither side was very experienced in these topics due to the non-existence of a comprehensive entrepreneurship curriculum at the university. No real money was on the table, thus the use of intellectual and social capital in this network type was not comparable to the situation found in Boston. But both the handling of intellectual capital and the venture capital culture has changed dramatically during the past several years in the direction of US-type regulation. Intellectual capital handling by the university has become much tougher over the last year, and always includes royalties for university inventions made in such courses.

To conclude, we can say that the type 2 and 3 networks are being supported by the course directly but because of regional differences the support for type 1 and 4 networks can be leveraged in the future. This is important because type 1 and 4 networks can prohibit members of type 2 and 3 networks from social and cognitive lock-in situations. First, we provide a general openness of the network for newcomers. Second, we ground actions into reality. To follow the careers of students we need to install a long-term monitoring system which allows us to keep track of the student’s development. This should be a function of the community system that is in place.

5. REFERENCES