Project-based Learning with *CommSy*

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ABSTRACT

Project-based learning has long been an important element in teaching informatics topics. This is because educational teamwork is comparable with the work in multidisciplinary teams common in the IT industry, and thereby allows students to acquire social and methodological competence in addition to professional competence. Groupware systems are increasingly used to support communication, coordination and the creation and handling of documents in such settings. In our paper, we present a didactic concept we have applied to a reasonable number of educational cooperative projects over the last few years. We describe how electronic media have become an integral part of our concept and we introduce *CommSy* a web-based application, designed specifically to fit the needs of project-based learning. Further, we discuss some episodical evidence as to how the design principles helped the project teams and whether or not the teams felt the system adhered to the principles discussed.

Keywords

Project-based learning, learning communities, key competences, community system, CommSy

INTRODUCTION

Current work practice not only, but especially in the IT industry is characterized by a strong emphasis on cooperative work in small multidisciplinary teams. At the same time, special knowledge (or "professional competence") becomes obsolete more rapidly and the ability to acquire the skills relevant for a specific project "just in time" grows in importance. Therefore, social and methodological competence gains importance compared to professional competence. Obviously, those competences cannot be learned individually in lectures or traditional seminars, but require practice and being engaged in a real-world context. We address this problem by offering educational projects to our students with a didactic concept that focusses on authentic work practice. These cooperative projects allow them to acquire the beforementioned three key competences in an integrative manner.

The shift in media use and availability as well as the affinity to electronic media grounded the use of software support for educational projects. By adding electronic media to our didactic concept, students can learn how to use computers to push their work and to communicate with their fellow project members. Also, with most students being "part time students" (working a lot beside their studies) and a large amount of students having informatics as their minor, our organizational setting suggests itself to the introduction of software support into our didactic concept. It is obvious that there are a number of software products (e.g. Lotus Notes) that could help (e.g. Armitage et al. 1998). On the other hand most of the products make inapropriate presumptions and many of them are overcrowded with functions. Therefore our solution is a web-based community system which has been designed in an evolutionary two-year process to meet exactly our didactic principles and thus optimally supports our educational projects.

In our paper, we will first describe our understanding of project-based learning the addressed goals and methods used. We then present the current situation at the University of Hamburg and how this fits with our concept. We illustrate this with examples from courses on information systems, software-engineering and human-computer interaction, courses we held over the last few years. Software support for project-based learning is introduced by gathering requirements derived from teaching goals. Our evolution of that support is then outlined. From the experience we gathered in our courses, we derive design principles that computer-support should conform to for the course to be successful. Finally, we introduce *CommSy*, an innovative web-based software that has been designed specifically to support our didactic concept.

PROJECT-BASED LEARNING

Ever since the seminal work of John Dewey (1966), project-based learning has been promoted as an important didactic method by educationalists in the tradition of the international and the German reform pedagogy. Project-based learning allows students to gain first-hand, authentic experience which cannot be offered in lectures or traditional seminars. In projects, students can learn how to engage in real-world problems, and they are required to cooperate with their fellow students. Educational projects are also similar to the work in multidisciplinary teams

often found in the IT industry. The work of these "nomadic hordes" is only partially co-located and part-time "virtual", i.e. potentially asynchronous and geographically separated. Social theories of learning (Wenger 1998) argue that learning and doing are strongly related and thereby support the idea of project-based learning. In delimitation from the single-person-projects often found in schools and colleges, we promote group-projects. This adds the necessity of communication and encourages social processes for all participants.

Teaching-Goals

Project-based learning allows students to acquire competences on different levels. They can acquire the following three key competences:

- *Social competence:* Students learn how to take an active part in cooperation with others and to organize their work. A team structure has to be established and team communication learned. They need to become acquainted with their fellow project members, grasp their perspectives and establish a shared understanding of a problem. The students have to take responsibility for their actions and adopt certain roles within the team;
- *Methodological competence:* includes techniques for identifying problems, gathering relevant information, rating available data, time-managment, writing, presenting work results, and so on;
- *Professional competence:* refers to knowledge in the subject area of a course, e.g. usability engineering, software engineering etc., and knowledge in the application domain, economics, pedagogy, or journalism for example.

Together, these competences constitute the ability to deal with the dynamic environments students have to cope with in their future work in academia or the industry. They learn to solve problems identified in cooperation with others. Furthermore, educational projects are an environment in which students acquire professional competence out of their own motivation and not because they are forced to reproduce knowledge in a test. The learning process has its own significance to the students.

According to Gudjons (1998), two tasks are central to project-based learning:

- *Communication* plays a major role, because successful communication is the basis for all social interaction. That is coordinating team-work, negotiating positions and responsibilities within the team, sharing one's own perspectives on a given problem with other team members, and so on.
- The *handling of working material* (mostly "documents") is important, because a proper selection and rating of information sources is the basis for any informed decision made within the project. The presentation of work result in the form of new working material (e.g. reports) are the foundation for further project work.

The ability to use a varied spectrum of different media to communicate and coordinate work within a project team is one major aspect of social competence. Students learn to choose the right medium for a specific communicational need, to select the medium which fits a given situation best, and how to express their intent within the selected medium. It is vital for students to get the chance to learn how to use electronic communication media during their studies, because electronic communication is central to the day-to-day work of project teams in practice and because electronic communication is in many ways different from traditional means of communication, especially "live" talks.

The handling of working material is both scientific and professional work. Different working material is used by the students during their project work: they start off with a stock of preselected (by teachers) books, papers, videos, excerpts from newspapers etc. to help them get their bearing in the problem area. While working, they add their own references to this pool. Additionally, students produce new working material: minutes of meetings and other documentation of their work, presentations, software-prototypes, technical reports and (much) more. By working with a substantial pool of material, students learn to appreciate the usefulness of different sources of information for their work process. By introducing electronic media they need to adapt these materials to the new medium and can tap new resources, gaining additional knowledge.

Teaching Methods

Our didactics for project-based learning is based on Dewey's educational philosophy. More concrete, our teaching methods are similar to those described by Bastian and Gudjons (1994, 1998). The following principles form the basis of our didactic concept:

- *Cooperative construction of a task:* Together with the students, we construct their tasks cooperatively within a broad area given by the subject of the course. For the project to be educationally valid, the tasks must be chosen carefully: It should generate a lasting interest in the students and teachers, not only a short-term enthusiasm. And it should be both enjoyable and of practical relevance (Gudjons 1998). Finally, it must be demanding and provoke the desire for more information, it must "lead the mind out into new fields (Dewey 1933)."
- *Teamwork:* The students work on the chosen task for the whole term. They organize their work processes themselves, and they have to thoroughly document (how they arrive at) their findings. Usually project teams are formed in groups of three to five students, to work on different aspects of the task. Teamwork therefore happens on different levels: the assigned task needs to be related to the project as a whole, a shared understanding of the problem has to be established and communicated to the other teams. Responsibilities within the team must be assigned and each task is split into smaller subtasks for efficiency. Time management is a major topic wihtin this process consisting of asynchronous communication, fixing dates, and establishing transparency.
- *Plenary sessions:* Scheduled weekly meetings include plenary sessions. These are used to handle organizational tasks and to reflect on the work process as well as for invited talks on relevant topics, for teching basics, and for presenting preliminary findings. At the end of the term, the project group presents its results (as a product) to a larger audience of interested faculty members and students. A product in this context can be anything from a paper- or software-prototype to a research report written by the students. Presenting (intermediary) results fosters a process of mutual teaching and learning among the students (Brown et al. 1993).
- *Coaching the learning process:* As teachers, we take on the roles of "coaches." Our job is to set the conditions and to give impulses to the project work. For example, we support the construction of a suitable task, help project teams organize their work by reviewing their work processes, or supervise critical situations by giving hints on how solutions can be found.

For each project, these principles have to be worked out to get a good teaching concept. A (broad) subject has to be chosen, that gives room to the interests of students and teachers and allows for relevant work, one or more application domains must be selected as a context for the project, gripping speakers have to be invited, a pool of books and papers must be chosen to get students started and so on. During the term, plenary sessions must be coined out to address the current state of project work: problems within project teams can be discussed in the plenary, but that is not always helpful and we often decide this "on-the-fly" together with the team. Often, it becomes necessary, to present background knowledge on a very specific topic, this can be done by providing additional references to literature or by inviting a specialist on this topic. We found that student projects are very dynamic and often students can not wait for the weekly plenary to receive support, so that coaching a project requires us to be within call for the students during the whole week.

Bridging Concept and Reality

The University of Hamburg is a two-term university. A term is a half year period: 14 weeks of lectures are followed by twelve weeks of exam preparation. In this general setting, project-based learning has a long tradition in the Department for Informatics. During the term-time, students participating in a project normally meet once a week for four to six hours to work on their task. We encourage students to invest at least the same amount of work outside the scheduled times, running up to ten or 15 hours of work per week. Between 15 and 25 students participate in a typical project, one quarter of whom are students from other faculties than informatics: economics, geography, journalism, pedagogy, psychology, social sciences, etc.

The interdisciplinary mixture of students in our classes, the high number of part-time students and the geographically dispersed site of the University over the city of Hamburg call for flexible forms of communication within and without the class. Setting up project teams working on different but related topics requires an even more complex coordination and a richer communication process. Coordination thus becomes a key issue in our educational projects. In order to support the organization of the team process, we integrated various groupware tools into our didactic concept.

SOFTWARE SUPPORT FOR PROJECT-BASED LEARNING

We have outlined the principles of project-based learning as our didactic principles. We pointed out, that two tasks are central to project-based learning: Communication and the handling of working material. Our organizational setting requires the support of these tasks with a software tool. Therefore, we now derive requirements for such a software tool, describe how software support developed over time in our educational projects, and then present *CommSy* as a new solution for computer-support in educational projects.

Software Support Requirements

Software used in an educational project should support the central tasks of project work. Therefore it should provide a means of computer-mediated group communication, to allow students to discuss their topics without the plenary sessions. An asynchronous means would be better than a synchronous, because the participants in our projects generally do not work on the project the same time due to their other classes and their jobs. Information that should be shared by technical means are a list of the relevant literature (some preselected by the teachers, some found by the students), announcements (news and upcoming events, like team meetings, plenaries, and relevant lectures), and working material, like minutes of team meetings, technical papers, prototypes, etc.

We also require a software tool to be easy to use. Easy access must be ensured in order to avoid that problems using the software draw more attention than the actual project work with the software system as a communication media. Students should be able to take an active role in the project without having to overcome technical barriers. Following internet standards is the most suitable, because the client software is available in every operating system “out of the box.” Therefore, no elaborate installations need to be made, and in consideration of interdisciplinary projects, web technologies facilitate the access to the software because internet use is simple, to a certain point standardized, and experience of it is widespread.

The software support should promote the users’ initiative in such a manner that it becomes transparent to other users of the system. It can do this, i.e., by not permitting anonymous contributions. In this way, assignment can be made to a particular person, and confusion arising from anonymous or automatically generated, unrelated contributions will be avoided. Personal initiative should be enhanced through easy, free and unlimited use. And building up a team structure should not be restricted by the design of the software system.

Software Support Evolution

Together with our colleagues, we applied the described didactic concept (including computer-support) to a large number of projects on different topics during the last years (see table 1). These projects received a positive feedback from participants and were successful in our and the students’ opinion. Feedback gathered in plenary sessions and semi-structured interviews indicate that software-support strongly contributed to the success of the projects in terms of know-how on computer use and using computer as a knowledge generating medium.

Computer support was first introduced in our projects by starting with simple email as a tool for coordinating work outside plenary sessions. We summarize the drawbacks we observed as follows: a lack of transparency due to incomplete recipient lists, missing persistence making it impossible to recur on topics already discussed, and no shared project history.

To overcome these problems we moved to a mailing list (majordomo) which helped a lot in terms of the above problems. Unfortunetely we discovered new problems: exchanging documents with a mailing list may lead to overcrowded mailboxes ("quota exceeded"), administrating a mailinglist is unpleasant (access via mailtop client), students felt uncomfortable writing to a list, members of the project did not realize a group context at hand, and discursive topics could not be handled well within that medium.

We addressed most of the problems by introducing a free web-space. A standard webserver in conjunction with a shared unix directory were used. Documents could be placed in filesystems and were instantly available to the group. In addition to that, the webspace could be used for public presentation of the project, bringing in a marketing component. Nevertheless, new problems came up due to the fact that each project needed a significant amount of time to establish rules for using the public and private space. No structure was available at the start and using ftp and unix filesystems made it hard for students from other disciplines than informatics. The creation of HTML-documents and their administration (versioning, naming conventions, keeping overview pages and links up to date etc.) added another barrier to the use of the website. To sum up, the number of problems solved and problems added was nearly even the same.

From that point on we evaluated a number of integrated solutions in parallel. We used Lotus Notes and Swiki (Guzdial et al. 1999) in some projects and considered BSCW, Hyperwave, and Teamwave Workplaceas well. These integrated tools—integrating database, structure, algorithms and dynamic web pages—were easy to use but did not solve the conceptual problem. Although customization is necassary, the tools offer an overwhelming amount of functions and do not relate to the problem domain (licences may become an additional problem in commercial co-operation contexts), and application had to be done on a proprietary system. Due to their technical complexity, these software systems threaten to superimpose the learning process with technical issues. On the other hand, a simple webspace, even in combination with mailing-lists or newsgroups, does not enable an adequate support for project-based learning.

To better support our didactic concept with a software tool, we developed the web-based system *CommSy* as a suitable solution and found that it fits our needs more adequately in quite a lot of projects.

CommSy – a Web-based Community System

CommSy stands for *Comm*unity *Sy*stem and is a web-based system to support communication and coordination in project groups. Schatz (1991, p. 88) introduced the notion of an electronic community system:

> *"An electronic community system is a computer system which encodes the knowledge of a*

Year	Project Title	Subject	Tool
1997	Enterprise Integrated Information Systems	Information Systems	Lotus Notes
1998	Software Support for Cooperation	CSCW	Lotus Notes
1998	Software Development in Organizations (Bleek and Mack, 1999)	Software Engineering	Webspace
1998	Object oriented Software Development	Software Engineering	Webspace
1999	Workflow Management Systems	CSCW	Webspace
1999	Intranets and Knowledge Networks (Bleek et al., 2000)	Information Systems	CommSy
1999	Object oriented Software Development	Software Engineering	Webspace
2000	Distributed Knowledge in Software Development	Software Engineering	CommSy
2000	Interface Design	HCI	Swiki
2000	Intranets and Virtual Communities	Information Systems	CommSy
2000	Object oriented Software Development	Software Engineering	CommSy
2000	Serviceflow management	CSCW	CommSy
2000	12 independent Projects at the International Women's University, Project Area Information	Information as a social resource, interdisciplinary	CommSy
2001	Useware-Design	HCI	CommSy

community and provides an environment which supports manipulation of that knowledge."

CommSy has been designed to overcome the disadvantages of the above considered solutions; it has been developed in an evolutionary design process (Floyd 1993) and tested in various educational settings at the Department for Informatics, University of Hamburg since May 1999. We describe *CommSy* here as exemplifying a software system that meets our requirements for supporting project-based learning. *CommSy* addresses our requirements as follows:

Easy individual use

Enabling individuals to use *CommSy* in an easy way is a prerequisite for any project member to actively engage in the project work without having to overcome technical barriers. We achieve this by:

- *Straight functionality: CommSy* holds an adequate range of functions. Users are not confronted with an excess amount of functionalities like in other groupware (e.g. Lotus Notes). For example, the heading 'Events' is restricted to a small group-calendar rather than a powerful, personal date-assistant.
- *Simple structure:* Across the whole system, *CommSy* is structured on three levels. The first level is the Homepage of a *CommSy* with all "headings" visible and accessible (see figure 1). The second level is represented by the overview page of each single heading (see figure 2), which lists either all items of one kind or shows an additional option to sort the items (in the discussions forum the different discussions are listed, in the section 'References' shelves are shown, where you can put references on). On the third level an item is shown in detail (see figure 3). The different headings all have a very similar dialogue structure. Once it is understood it serves for all the others.
- *Simple layout: CommSy* has a simple, repeating layout for all headings. To ease learnability, text is preferred to icons, this has the additional advantage that *CommSy* is fast even when connected via a slow internet access and thus avoids unnecessary obstructions for the user.

A major requirement identified was that the chosen system must be accessible with a commonly available web-browser (no matter what version or operating system), to ensure that everybody involved is in a position to access the system. Therefore, only basic HTML is used and the pages of *CommSy* are sufficient for W3C standards. The most common browsers like Microsoft Internet Explorer and Netscape Navigator were tested, others were reported to work properly in this setting (e.g. Opera, Lynx, iCab, and customized browsers provided by ISPs). In addition we also reduced demands for high-speed internet connections in designing a system without major graphics or fancy layout features. Therefore home access was possible at any time.

Transparency in cooperative usage

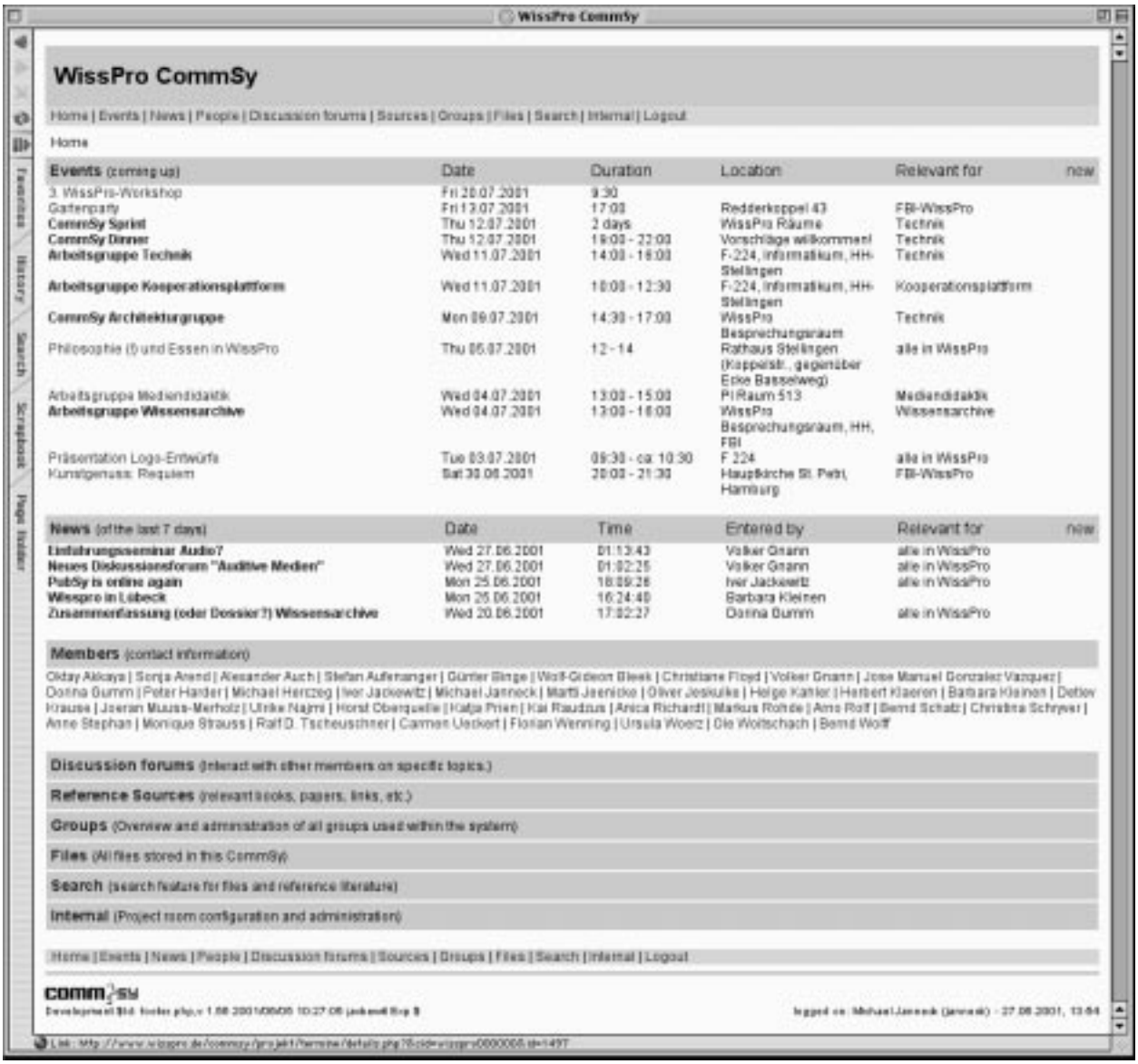

Figure 1: A CommSy Homepage.

CommSy gives special emphasis to user communities rather than individuals. We do this by:

- *No anonymous access: CommSy* is exclusively accessible to members of a certain group, who need to register before entering.
- *No anonymous items:* Due to the authenticating procedure, each user's name is filed in the system, automatically saved with every item this person creates and later presented together with the item.
- *No concept of roles:* Ownership is the sole access right in *CommSy*. Only the owner of an item may modify or delete it. Apart from this rule, every member of a *CommSy* is allowed to do everything and everybody sees everything. There is no distinction between students and teachers. Users can be sure that they get the same presentation as everyone else, thereby grounding communication on a common basis (Clark and Brennan 1991).
- *Group identification:* Every *CommSy* can be customized to help build a group identity. This is done by offering color selection, choosing a name for that specific *CommSy*, and preselecting a subset of available

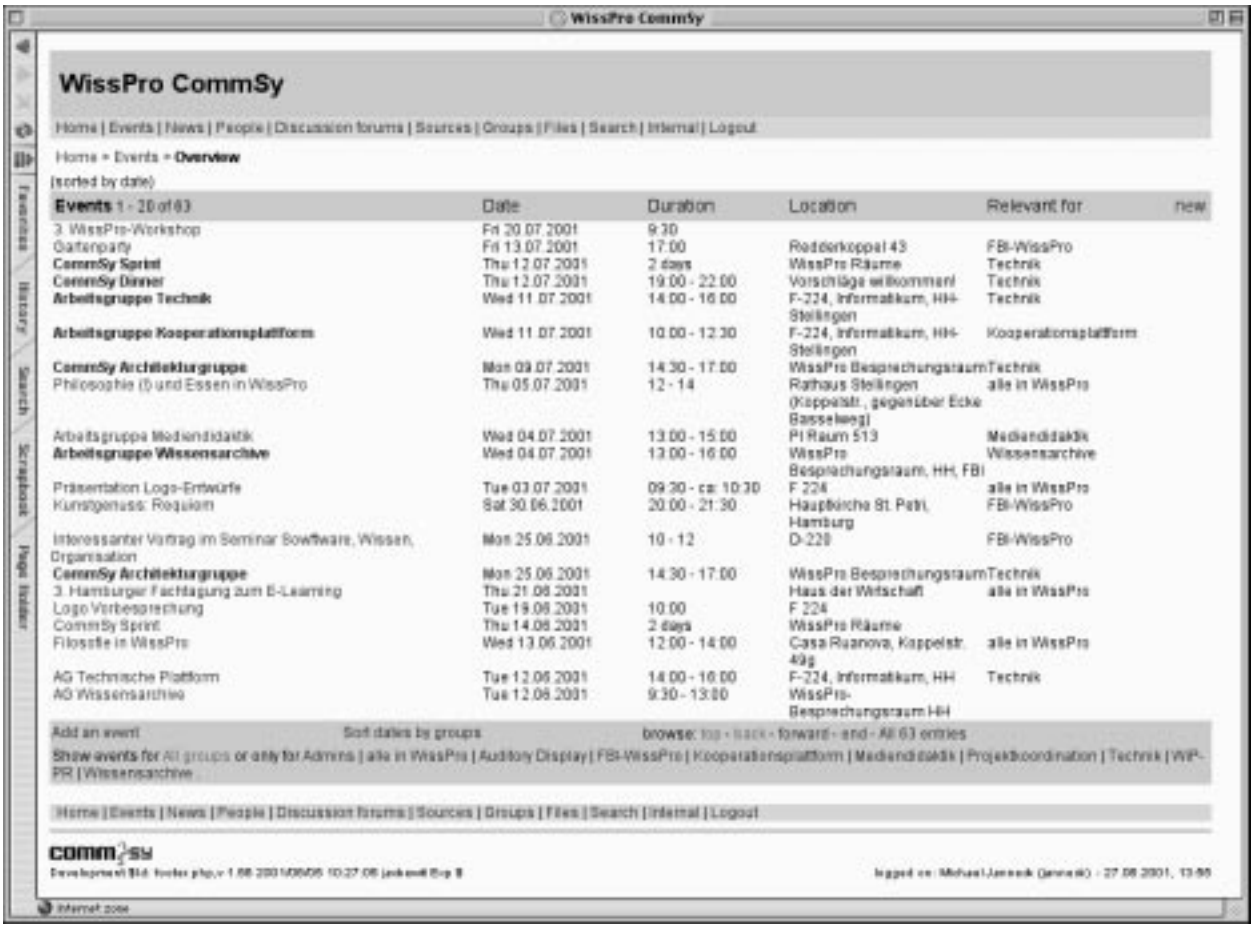

Figure 2: A CommSy Overview Page.

functions. All settings have the same appearance for all members. Color has been observed to be an important criteria in finding group identity.

By that, *CommSy* reflects social manners we promote in day to day interaction with our students, like self-responsibility and commitment, within an electronic communication media.

Support for communication and organizing the project

CommSy supports communication within a project group in multiple ways: News and events can be announced, annotations can be made to every item in *CommSy*, in a discussion forum, specific topics can be discussed, and each member of a *CommSy* has a personal homepage to present him/herself to the project group.

Every member of *CommSy* can post events or news that may be of interest to the whole project group or a specific project team. Authors can assign items relevant to only a project team by simply making reference to existing teams. Up-to-date information is displayed on the Homepage of the system. By selecting a specific heading, an overview of all former items under this heading is displayed and can be used as an archive.

Besides posting announcements, *CommSy* offers multilateral communication by allowing all members to annotate all existing entries. This can be done for different purposes, for example, to present a book review, provide an agenda for a meeting, bring in more details for a news entry or provide an additional hyperlink for any entry. For more controversially threaded communication there is room in the discussions forum. This is a variation of usenet newsgroups, except that in *CommSy* every member may open a new forum instantly.

An indirect support for communication is supplied by the headings ‘People’ and ‘Groups’. Under the heading ‘People’, members have a small “homepage” to present themselves with their name, a picture and their contact information, for the others to look at. This contact information helps establish communication outside *CommSy* as

Figure 3: A CommSy Detail View.

well. In the section ‘Groups’ every member may establish new project teams and join existing ones. Thus, the interests will be indicated and the structure of the project becomes transparent.

We consider a tool which covers all communicative needs in university teaching as neither feasible nor desirable. Therefore, *CommSy* supports project-based learning only in an asynchronous manner. It does not serve all possible communicative purposes, but specific ones. In our experience, it therefore is necessary that additional technologies are provided to support the project work. The use of additional technologies also fosters the competence to deal with a set of communication media. In our educational project we explicitly stimulate the students to use email, phone or direct conversation and to reflect on the respective media use.

Support for handling working material

There are three means for handling of working material provided by *CommSy:* Files can be attached to almost any item (news, events, groups, annotations, discussions, references, etc.), a simple reference manager supports the collection of relevant literature, and a group-editor is available for cooperative writing of HTML documents.

With file attachments, *CommSy* supports the handling of text documents as well as other multimedia files. It is used mainly for exchanging preliminary working material, by attaching them to a event, where they are needed or to a news item. A search mechanism is provided for quick access to all items stored in *CommSy.* At present, a simple full text search is offered because so far there has not been a request for a more sophisticated search tool.

Under the heading ‘References’ all members can enter information on books or papers, CDs, videos, hyperlinks, etc. which they consider relevant to their common work. Given this possibility, the educational project as a whole and each project team gathers a shared list of relevant references. By attaching a file to a reference, even the original text (e.g. in PDF format) can be made available to the group (Bleek and Mack 1999).

CommSy not only supports submitting “foreign” documents like those mentioned above, the members of a project also have the possibility to create their own HTML-documents within *CommSy*. For this purpose, there are ‘Workspaces’ where teams can jointly write documents asynchronously. This is a good way to present preliminary results to the project.

The distinction between communication and handling of working material is more an analytical approach for didactic purposes. Each designed section combines communication support with a capability for handling working material. For instance, a thread in a discussion group is first of all a means of communication. A completed discussion thread can be regarded as working material for a decision-making process. On the other hand, each attached file is a means of communication as well.

DISCUSSION

Our experience shows that teaching informatics topics leads to best results by doing educational projects. Introducing software support in these projects is a significant intervention in learning processes. Nevertheless, developments in work life and progress in communication technology demand changes to make educational projects more realistic and allow for new experiences. We argue that the design of teaching must reflect these demands and the needs and necessities of the new work life. Software needs to fit the culture and setting established in organizations. A software support introduced in teaching must therefore address the needs identified concerning the didactic concept and at the same time give an impression of state-of-the-art technology.

The here introduced web-based community system *CommSy* supports different types of communication and different ways of handling working material. The types of communication supported are shaped by the ways and the variety that has been observed in the field of application. As a design principle, *CommSy* offers a means for developing different kinds of communication within the range of the tool: information like events, news, and references can be announced and discussions are specially supported. Individual headings are especially designed with respect to their needs. In addition to that the design principles are a recurring theme within all areas of the application. Users can rely on certain information and handling features to be present at all times. This is important to let students get easily acquainted with the software. Examples are the annotation function or the file attachment feature, which can be used for every *CommSy* item.

The sole availability of a software tool does neither automagically result in the sensible use of the software nor any use at all. Even though the organizational background suggests the introduction of software support, not all students (and teachers) get instantly used to the new possibilities. In our experience, software introduction and the need for continuous moderation are essential tasks during whole project time (Orlikowsky 1992; Bleek et al. 2000). It is important to negotiate conventions of software use early within a project. This is eased by the given structure of *CommSy*, but still one has to decide, for example, how often project members want to read new items: once a week, every second day or more than once a day, or in which file format (MS Word, RTF, PDF, HTML, etc.) documents should be attached so that all project members can easily read and write them. For teachers it is very important to adhere to the negotiated conventions and to encourage the students to do so, as well. In addition to those group-decisions, each member has to individually judge the relevance of one's own items. E. g.: is a news important enough to be displayed on the first page of a *CommSy?* The variety *CommSy* offers, corresponds to the goal of our didactic concept.

During the projects we offered to students during the last two years, we found that *CommSy* is indeed a significant enhancement of our didactic concept. Students reflected much more on their communication practice. It was quite common, that new conventions were invented by them. Often, the discussion forums within CommSy were used in a very creative way: as task list, voting tool, and faq-list among others, thereby showing that the students acquired the competence to fit a given tool to their special needs. Also, the project work was pushed ahead, because students head access to the working material of their team colleagues earlier, and access to the (preliminary) results of other project teams allowed for a broader insight into the subject area of a project. The work with literature received more attention, because all references were instantly available to all students without a big effort; it was thus attractive to add new references to the pool. To our surprise, the coordination of appointments did not happen within CommSy very often. Most of the time, students fixed dates during the weekly plenary or via phone and then simply announced the event. We see this as another evidence that they learned to use the communication media that fits their communication needs best.

CONCLUSION AND FUTURE WORK

In this paper, we have shown our understanding of a software that supports group work in project-based learning. And introduced CommSy, The outlined principles and functional scope are the key to the success of *CommSy*, the software we implemented to prove our understanding. Project-based learning is particularly important, because of the current work practice in IT industry and academia. These work practices demand for social and methodological competence in addition to professional competence. The requirements that have been identified for *CommSy* guide to several freedoms or possibilities relating to communication and handling of working materials for the members of an educational project. These possibilities imply that the members must learn to make use of these freedoms. They are free to try many different ways of using CommSy, but they must learn reflect on their use of electronic media an thereby acquire indispensible practice in electronic communication.

In this paper we did not consider a number of fields relevant for project work in conjunction with software support. These fields are ‘a special paedagogic concept for a certain topic’ and ‘software implementation’. The later is also part of the teaching and therefore also relates to the first field. A special paedagogic concept is not presented in this article although we have developed some and participated in a number of settings. These concepts strongly depend on the topic teached and the environment available. We feel that each of those concepts needs too much space as to be able to present it within the same paper. The implementation of groupware and especially a web-based community system can be of research interest on many informatics levels. We do qualitative research on our own projects on the software engineering and the software usability level. The implementation of software can also be viewed on the organizational level.

We are intending to support project teams that do not only consist of students and teachers but include staff from adjunct companies. Thus, offering the possibility to have even more realistic projects in university teaching and expanding the project teams from university to companies. First experiences made in real life projects offer optimistic outlooks. Technology used in teaching has to pay attention to available resources like hardware as well as people and infrastructure. We have experienced a huge amount of infrastructure work that was not anticipated and not recognized by others. We will work on ways to describe this kind of work and its effects on the success of the introduction of software systems in educational settings. Plus, we work on technical support, like concepts for providing application service. Finally, we will work on ways to evaluate the success of different system designs for an educational setting in order to empirically validate the theoretically deduced design criteria for *CommSy* described in this paper.

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