and where also special attention can be made to some interesting development or problem.

Each group will interact with the real users of the IT solutions and the result at the end will include a project diary of findings, and how they were dealt with, as a complement to the documentation of the produced prototype as well as guidelines for further development.

THE COURSE COMPONENTS

Ethics

Ethical considerations will be elicited and discussed throughout the project. Attention will be given to the enhancement of ethical competence, i. e., designers' skill to take into consideration cultural issues, ethical variation, in design decisions [16]. This component is intended to be incorporated into the project.

Cognitive psychology

The main focus of this component is the cognitive perspective on human-computer interaction. Basic insights in fundamental aspects of cognitive and perceptual psychology are given in the lectures and applied in the project. Lectures will cover the following topics in cognitive psychology:

- Perception - basic physiology.
- Vision - gestalt principles, constructionism.
- Pattern recognition - objects and words.
- Attentional theories.
- Memory - working-memory, constraints, semantic versus episodic memory, sensory memories
- Reasoning – problem solving, decision making.
- Knowldege – organisation, representation, mental models

Social Psychology

Social cognition, group dynamics, group influence, and work and productivity are areas that will be covered in the social psychology component. In general, this component concerns the impact social surroundings have on the ways in which people view themselves, how people relate to others, how they behave, and how they organise their work activities, and how they learn to use information technology tools.

Social cognition covers issues like perceiving others and understanding oneself. Group dynamics is about communication in group settings, including groups that are virtual, cross-cultural, or of mixed sex. Issues like prejudice, stereotypes, conflict, and peace-making will be dealt with in relation to group dynamics. Group relations is about leadership, cooperation, work organisation, and project management. The work and productivity section will examine effects of stress, affect, and creativity. Educational and competence development issues are very important for optimal use of information technology and have to be focused on early on the design process.

Language and language interaction

Language is of utmost importance in all interactions. This component aims to give both orientation and insights about social functions of language, and the relevance this has to the use of IT. The section covers some central issues and notions within socio-linguistics. These include variations in language due to social and geographical factors, "register" and style, communicative competence, language interaction and equality, language and identity, and spoken language versus written language.

AN EXAMPLE PROJECT: COURSE TIME TABLING

At Uppsala course time tabling is done in chunks of ten week periods, where each week is scheduled individually. The clients for this project were the two secretaries that do the time tabling for five different engineering programs. In the course of this project, the students found out that:

- They needed to discuss with the boss of the secretary.
- That they needed to address the anxiety for being made redundant and in general the work situation for the secretaries.
- That they needed input from teachers, departments, as well as, students to understand the context and ambitions for course scheduling.
- To find out how other relevant institutions handled the situation.

One outcome of this project was an improvement of the Microsoft EXCEL environment the secretaries used, but the main result was a report on how to enhance the process of scheduling courses. This proposal was presented to university officials and a plan has been established to implement most of the suggestions. The students had ample opportunity to practice communication skills and it was obvious that the success depended on the ability to take in the whole "picture". Understanding the different demands from different groups made it possible to present a balanced solution. A large portion of the solution contained technical aspects, but they were presented in a context with motivations based on the different considerations that had been identified during the project.

Some comments from the students:

- This is the first time in my education when I've been asked to do interviews and think from several angles.
- The project was very different from other projects in my education and also the most educational.
- It was unclear how the linguistic component fitted with the rest of the project.

PEDAGOGIC TACTICS

Experience has shown us that our main tools — or levers — are the students' own characteristics, e.g., that they like to make things work, that they are assessment-driven [6], that

they are usually articulate (not to say opinionated) and polite, that they tend to respect people who make things happen effectively in the 'real world'. Hence our tactics in this course are geared toward using those fundamentals as leverage on the pedagogic problems. Three key problems (or imperatives) shaped the design of the course:

Conveying importance

The course's attention to the 'greater system' has to be non-trivial; it is too easy for a 'soft' course to be marginalized in a largely technical curriculum, for the treatment of multi-disciplinary course material to be superficial (and forgettable), and for students to treat such a course less seriously than they would a technical course. The problem is to demonstrate the importance of non-technical issues, and to put them on a par with technical considerations. Hence, these concepts must be shown to be crucial, relevant, and usable. The project-based format of this course was a response to that problem; it puts communication, analysis, and evaluation in the 'critical path' through practical application and assessment.

Example tactics:

- Students crave technical success, hence, make communication essential to 'technical' success; arrange projects so that they fail without proper communication.
- Swedish students tend to be polite. Hence, tie the project to 'real' people.
- Teach by example; call in colleagues from other departments and engage in discourse.
- Students are assessment-driven. Hence, make the non-technical content a significant part of the assessment.
- Students respect achievement. Hence, use domain experts.

Integration

The course is inherently multi-disciplinary. It was decided early to rely on domain experts for the different components, in part to give the students access to the best sources of information, in part to expose them to the different 'voices' of discourse in the different disciplines, in part to foster the spirit of collaboration. But this brings the need to integrate disparate components and perspectives and to demonstrate their relevance and tractability within the CS perspective. The use of a CS lecturer as the principle teacher and the use of multi-disciplinary discussions with domain experts based on students' own work during the project are responses to this problem. Example tactics:

- Students tend to discard un-used information. Hence, require them to *continue* to account for the different topics in their reports.
- Students tend to be self-interested. Hence, use their own work as examples to fuel discussions.

Relating theory to practice

It is necessary to deliver key concepts, but students often have difficulty building the bridges between theory and practice. The course responds to this problem by requiring students to put theory into practice in their projects, to re-visit and use the material from the theoretical part of the course throughout their project work. Example tactics:

- Making material 'concrete' can help consolidate understanding and reveal relevance. Students are captivated by projects; they are driven to make something 'run'. Hence, make a substantial part of the course project-based.
- Draw projects from the 'real world'.
- What does this have to do with CS? The material must have importance and relevance, not only in its own right, but also within the technical perspective. Hence, use a CS lecturer to provide continuity and framing.

CONCLUDING WORDS

This is a course with a wide range of possible and suitable components. It was designed in collaboration with the domain experts from other departments, who specified their own components. Although interface and system design are used as key devices in the course, this is not a course on interface design nor on system design. It is specifically a multi-disciplinary course intended to place technology development in its social context. No compromises have been made with regard to the technical content, and yet the course promotes non-technical skills and issues as crucial to effective technology development. In particular, it provides opportunities to exercise the ideas through realistic practice and provides valuable experience in interaction with non-peers as well as peers.

Integration

Given the breadth of the course and the disparate sources of input, integration has been a major concern. We believe that the project-based format, with its weekly multi-disciplinary discussions, will provide a fusing of the components and a tailoring to 'suit' our students. Overall responsibility for continuity and for framing within the CS perspective lies with the Department of Computer Systems.

Relevance

The format is designed to motivate students through experience of real work situations. It uses the students' own orientation to making things work and meeting assessment criteria to encourage them to attend to non-technical issues by putting communication and multi-disciplinary analysis in the critical paths of development and assessment.

Communication

It is necessary to the success of the project that students communicate with a variety of people, and that they integrate and present the substance of that communication.

The course itself sets an example for collaboration and discourse among disciplines.

External relevance

The project should not be viewed as an isolated experience, but as part of a continuing collaboration between the particular environment and the university. There is a growing demand for using IT in most settings, but there is often little support, either in terms of money or of training/education. We hope that the collaboration projects will lead to improvements, both in the short and more substantially in the long run. Our students should gain respect for the needs and knowledge of their clients, and the clients are empowered by the students' work, either because the students can help address IT needs, or because the personnel improve their own understanding of their IT needs and the cost-benefit trade-offs through the interaction.

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