

Challenges with Teaching HCI Early to Computer Students

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ABSTRACT

The introductory course on human-computer interaction (HCI) and usable systems, taught early for the computer science and computer engineering education programs, has suffered from bad course evaluations. To investigate the students' beliefs and values in relation to the subject matter and the course, focus groups were used. The results indicate challenges with a lack of maturity and motivation among the students and that they wrongly perceive the subject matter as trivial. An approach for dealing with the challenges in the form of a course re-design is presented and implemented. The evaluation of the new course showed that it worked well and was greatly appreciated.

Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]: Computer science education

H.5.2 [User Interfaces]: Theory and methods, user-centered design

General Terms

Human Factors, Design

Keywords

Education, human-computer interaction, usability, usable systems

1. INTRODUCTION

The introductory course in human-computer interaction (HCI) and usable systems taught to computer engineering and computer science students at Linköping University in Sweden has been somewhat of the black sheep among the HCI courses taught at the department. The course has suffered from course evaluations ranging from around average to very low ever since a university wide electronic course evaluation system was introduced in 2004. Since teachers have come and gone, the situation before that is unknown. From 2004 and onwards, several different examiners have been involved in the course, without succeeding to give the

course a real boost. This has led us to believe that there are some fundamental problems with the course and/or the subject matter. In order to get a clearer picture, and get back to basics, knowing that HCI is a pedagogically challenging and fast moving field [4, 5], we want to investigate what kind of expectations the students currently bring into the course and what view they have of the subject matter as such. In other words, to uncover their fundamental beliefs and values, which are known to be of great importance for course design and evaluation [7].

Our approach is to observe students discuss their beliefs and values among themselves in focus groups. That way we hope to reveal some tentative answers for how to re-design the introductory course on usable systems into a good and well appreciated course, as well as to give inspiration for other teachers struggling with similar challenges.

This paper describes the focus group sessions and their results. It also describes the successful implementation of a new course, based on the lessons learned.

2. BACKGROUND

The introductory course on HCI and usable systems is taught to first year computer science students and to second year computer engineering students. For both education programs it is taught in parallel with other courses. The total number of students taking the course each year is roughly 100.

A set of five introductory lectures are given, basically following the structure of the first half of [1], which is the textbook used in the course. The lectures are complemented by a group project, as well as a set of class exercises and seminars. The group project is very practical in nature and consists of a re-design of an existing interactive system where the students practice techniques such as paper prototyping, contextual inquiry, interviewing, and user evaluations in a realistic context. The class exercises focus on giving the students opportunities to practice a set of methods and techniques under teacher guidance and is a complement to parts of the group project. The seminars consist of a set of tasks that the students prepare in advance and which are then discussed in a group format with teacher supervision.

Grading has been determined by a pass/fail grade on the project as well as on individual tasks discussed at the seminars. For a higher grade a selection of exercises from the course book had to be completed and handed in.

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3. INVESTIGATION METHOD

3.1 Focus Groups

The focus group technique aims at bringing out the perceptions, beliefs and values of the participants. Since this is exactly the purpose of the present study, this technique fits well. It differs from a group interview in the sense that the idea is to observe the participants discuss amongst themselves with the moderator being there in the role of a facilitator for the discussion. Hence, it is not a question and answer session between the interviewer and the interviewees.

The discussions are supposed to be focused on a central topic, which is normally presented at the start of the session to get all participants staying within the focus.

Traditionally the focus group technique has been used primarily in market research, but has steadily gained importance in other fields such as psychology [3] and educational research [6].

3.2 Participants

This study is based on two focus groups. One group consisted of junior students fresh out of the course on usable systems. The other group consisted of senior students who had taken the introductory course on usable systems a couple of years ago and also taken a project-oriented follow-up course on development of interactive systems. The reason why we also included a group with senior students is that we were interested to see in what way their perspective differed, and how they would look back on their experience with the course.

The recruitment for the group with junior students was done with recruitment e-mails sent to the mailing list for the course on usable systems a few weeks after the course had finished. As compensation all participants were offered a cinema ticket. Five students indicated their interest in participating, of which one did not show up, which left us with a total of four students.

The recruitment of the participants for the second group with the senior students was done through a follow-up course in which the author was teaching at the time of recruitment. A few minutes were set aside in a project group meeting, and the author presented the idea of the focus group session and asked for volunteers. Seven students indicated their interest. However, due to difficulties in scheduling a suitable time, we were left with a group of three students.

3.3 Organization

As initial focus, we presented an overhead slide with a graph indicating the course evaluation results. Based on the slide the participants were informed that we were working on improving the course on usable systems and that we needed input from the participants to help us. The participants were also briefed about the role of the moderator, and that all opinions and thoughts were welcome and that we were particularly interested in hearing the participants discuss among themselves. The participants were informed that the discussions would be recorded and they gave their consent.

Each focus group session lasted roughly an hour and a half.

3.4 Topics

As a guide for the moderator (the author), a set of questions were prepared in advance for each group:

- What's your view on usability?
- How easy or difficult is it to construct a usable system?
- Will knowledge on usable systems be of value for you when you start working after finishing the education?
- How do you think the industry works in order to ensure usable systems?
- What's your view on the course on usable systems?
- What's the most important thing you learned from the course?
- What prevents the course from getting a really good overall course evaluation grade (i.e. becoming a good and appreciated course)?
- What are the most important changes for improving the course?

3.5 Data Analysis

There are several ways to analyze qualitative data from focus groups (e.g. [3]). Since we aimed at using the topic questions more or less as a backup we decided to analyze the data with an open mind, and not use the topics as a direct way to structure the data, but rather to form themes based on how the discussions actually proceeded. But of course, the structure will be biased by our preconceived topic list as well as the knowledge the author has of the problem and the subject matter.

More concretely, the analysis proceeded as follows. The author listened to the recording of the session and took detailed notes on statements and interesting quotes. These notes were later analyzed in detail and grouped into themes. After that the notes were arranged into brief paragraphs aiming to capture the main essence of the notes. When possible, each such paragraph was illustrated with one or several direct quotes from the discussions. All text was then translated from Swedish to English.

4. INVESTIGATION RESULTS

We now present a summary of the participants' view on HCI and usable systems as subject matter and on the course itself, as expressed in the focus group sessions. The findings are structured according to the themes discovered in the data analysis.

4.1 Group 1 – senior students

4.1.1 Theme: Student profile

It was noted that the course is early in the education, which means that many students are not quite ready for the course. They have a tendency to be fairly immature in their study manner.

“Students that early in the education don't read anything unless they really have to.”

Generally the students seem to lack experience of usability and usable systems. The programming experience they have is mainly about underlying functionality and not on user interfaces. The students are also not used to the way of working in the course.

“It is probably the first course where you read text compared to learning formulas and programming languages.”

4.1.2 Theme: Course characteristics

The course is obligatory while being far from the nucleus of the education, and can be seen as less relevant compared to other courses running in parallel.

“If you're a [computer engineering student] you want to produce code.”

Most other courses the students have taken are felt to be very strict compared to this course, in the sense that most questions posed in the other courses have a clear answer (e.g. a mathematical proof), while questions posed in this course are more general in nature and have more vague answers that depend on the context etc. HCI as a subject matter is not an exact science which is difficult for the students to accept.

4.1.3 Theme: Perceptions of the course

The course was perceived as fuzzy, and most topics brought up were trivialities and common sense and mostly a repetition of things already known. The methods and techniques covered were seen as unnecessary, and concepts such as personas and paper prototypes were not taken seriously and regarded as techniques not really used in practice.

“If you haven’t encountered [the usability] problems yourself you believe that you can solve them the same way you have always worked.”

4.1.4 Theme: Expectations of the course

The course has a bad reputation of being fuzzy, easy, and not give much back to the students. Also, the students are not prepared for the way of working in the course.

“Somehow you study computer engineering to avoid having to read big books and write reports, it’s a bit like that.”

4.1.5 Theme: Views on usability

Usability is seen an important concept, used in the industry today, if not to a full extent. The techniques brought up in the course are probably relevant for the methods used in industry.

4.1.6 Theme: Lessons learned in the course

The lessons learned in the course concern more or less unimportant details rather than any form of overall understanding.

4.1.7 Theme: Pedagogical challenges

It is important to get around the students’ perception of the subject matter as something trivial and to get the message through that one has to practice and develop a skill.

“At that moment you don’t understand that you need to practice this and actually practice and get into the way of thinking and get into it.”

It is also a matter of finding stimulating and challenging tasks that let the students develop.

“One has to get away from trivial issues to more reflective issues.”

4.1.8 Theme: Suggestions for improvement

To get around the problems with lack of motivation one could try to connect it better to the industry, e.g. through “real” projects and clients, or with other student groups acting as clients. One could also include guest lectures from industry etc. One should also justify the aim of the course more clearly, especially the fact that the subject matter is easy to grasp but that one has to develop a skill rather than a deep understanding, which is difficult and requires hard work. It would also be positive if the usability concept could be introduced already in the very first courses on the education program, to better prepare the students for the nature of the subject matter. It is also important with examples and exercises that the student can relate to, e.g. by evaluating a

program done by the student earlier. Then you would get a comparison between designs based on intuition and designs based on methods brought up in the course.

“I believe that feedback to something one has done before would be very rewarding, and realize that for me this was very intuitive but someone else may not understand at all what I have done here.”

More strict requirements on reflection and connections to the course literature for hand-in exercises and seminars is a good idea.

“Unfortunately computer engineering students are notoriously lazy and don’t read anything if they can avoid it.”

Another pedagogical touch is to let students work individually on tasks and afterwards show an alternative solution which they then can relate to. This way they can see the limitations of their own solution and get a better understanding about their own skill level and about the size of the design space and the problem space.

4.2 Group 2 – junior students

4.2.1 Theme: Relation to other courses and education programs

The course is far away from other topics in the beginning of the education. This goes for content as well as the form of the education with seminars etc.

“[The subject matter] is very different from everything else we have studied.”

“[The course] is like a cloud outside and doesn’t connect back to the other courses.”

The form of the education with seminars and discussions are seen as strongly connected to the philosophical faculty and their educations. This point of view, together with a common jargon among the students of the technical faculty which is looking down on the philosophical faculty, gives a negative impact.

4.2.2 Theme: Perceptions of the course

The lectures are important as a complement to the course book, but there is no specific recipe for a successful lecture, a lot depends on the lecturers’ enthusiasm for the subject.

“The lectures give a chance to inspire [...] and awaken an enthusiasm for the subject.”

However, they must be well structured, and it must be clear how to interpret and use the issues brought up. Otherwise there is a risk that students see the lecture as trivial.

“Now it felt like if you had understood PACT¹ and gone through these 13 points you’re done.”

The project got started a bit too early which meant that the students did not have the right knowledge from the lectures and class exercises. The division of the project into separate parts could have been clearer, which would also have made it easier to tie everything together at the end. Now it felt like the different parts of the project were pointing in different directions.

¹ PACT stands for People, Activities, Contexts, and Technology, and is a framework for analyzing systems from a usability perspective [2].

“A lot of the [guidelines] were trivial but nonetheless there were people who didn’t make use of it in the project.”

As for the report of the project work, there was a sense of an unclear aim. The examination form with separate hand-in exercises for students wanting a higher grade led to a shift in balance in some project groups where some of the students decided to prioritize the hand-ins over the project work.

The seminars did not work well. They were perceived as vague and small and their purpose did not come through.

“It would be good to define the purpose with the seminar and have a goal of what we should have learned after the seminar.”

The requirements on the seminars were far too low, and it seemed like the course staff did not take them very seriously either. To get the seminars to work there must be requirements on the students to demonstrate true understanding and an ability to connect their discourse to the content in the lectures and the course book. This must be applied to all students present at the seminar, so that no one can slip through.

“If you want the seminars to be meaningful they must be made more difficult.”

“Only some had to talk and others got away with nodding and looking the seminar leader in the eyes.”

“You can write anything and still get a pass.”

“Skim the book, write the text, two hours, and you’re done.”

4.2.3 Theme: Expectations on the course

One expects a fuzzy and bad course, which is consistent with general rumors of the course.

“People said this was a fuzzy course.”

4.2.4 Theme: Views on usability

The subject of usability and usable systems is perceived as fuzzy but still interesting and definitely of importance in a future professional career. As such, it is important to get at least a peek into the subject matter, to be able to relate to it and other professions, e.g. interaction designers, which may be part of future work teams.

4.2.5 Theme: Lessons learned in the course

The perceptions of lessons learned from the course vary greatly among participants. This includes experience of project work, a certain insight into usability thinking and knowledge of a toolbox with techniques for development and evaluation of usable systems. It is seen as unreasonable to expect to get much further, given that the course runs so early on in the education.

“I think it is unrealistic to get second year students to understand the depth of partly how important it is and partly to learn all details in this.”

4.2.6 Theme: Pedagogical challenges

The course must be made more fun and bring up the interest for the subject matter. One difficulty in this is that the students do not produce a “finished” product which they can be proud of and “see” if they have done it correctly. Instead they land with a prototype that cannot be used for real, together with a more or less fuzzy evaluation.

The subject matter feels simple and trivial and the students believe that they already know all they need to know about

graphical user interfaces because they have done something related at one time or another.

“Everyone has done a home page, everyone has done a little GUI and thereby believes themselves to be able to do interfaces in the same way as everyone believes that they can write a book just because they can write.”

“People don’t take this subject matter seriously, people think everyone can do this.”

Because of this there is a challenge of getting the students to understand that they must develop a skill in using the techniques and methods covered in the course, and to understand that a method can be used in both good and bad ways, and to critically reflect on the use of the methods.

“One doesn’t view this as a profession [...] because everybody can do it to some extent.”

To give the course a broad scope without turning everything into trivialities, while providing at least a glance into the depth of the subject matter is yet another important challenge.

4.2.7 Theme: Suggestions for improvement

The course should be made stricter with clearer task descriptions and evaluation criteria. This goes for the seminars, the project report and the hand-ins. The requirements can be raised on the course as a whole, especially for the seminars, where corrections could very well be requested from the students. The seminar tasks could be graded on a scale and replace the optional hand-ins for higher grades.

The learning in the course should be lifted and made more explicit. What does progression mean in this subject area? How is the course related to other more advanced courses? These questions should be lifted and be made into a theme that follows the course throughout, and not just be mentioned in passing at an introduction lecture.

The class exercise on paper prototyping should be adapted to also facilitate 3-dimensional prototyping, e.g. hand scanners in food stores, to be more relevant for the projects where 3D is important.

5. NEW COURSE DESIGN

Based on the investigation results a new course was created. The design of the new course was based on the following insights:

- The students need to create something that works, and not end up with “dumb” paper prototypes.
- The students need a focus on technology and issues that they feel related to.
- The students need a sense of realism, with projects or assignments connected to real and ongoing projects.

To add a sense of realism, we decided to connect the course activities to an ongoing research project on technology support for meal planning (see e.g. [1] for a description of the system). The students work in pairs, and as a first assignment, they have to evaluate the current prototype of the meal planning system, which is a desktop application. They are given the choice of using heuristic evaluation or usability testing. The evaluation results will be documented in a report.

The second assignment for the student pairs is to port the desktop application to a handheld device, such as a smartphone. This

involves an exploration of the design space and the special characteristics of small devices by sketching, followed by the construction of a paper prototype, which the teacher gives feedback on. The reasoning behind this assignment goes back to the issue of working with modern technology that the students can relate to. Handheld smartphones are currently an example of such technology.

The third assignment is to implement a high fidelity prototype that can be used, but that may simulate some of the functionality. The idea behind this assignment is to have the students end the course with a positive sense of having created something that really works.

The three assignments are supported by a series of lectures similar to the lectures given in the course that was analyzed in the focus group study, and also brings up user research.

Grading is done by averaging the numeric grades assigned to the initial evaluation report and the grade given to the high fidelity prototype. Grading criteria are made explicit in advance.

6. EVALUATION

The decision was made to first try out the new course format in a smaller scale. Hence, we chose the course on usable systems for second year students of the education program on innovative programming. This new course had been struggling the first time it ran, and had only around 20 students, which would facilitate evaluation and ongoing feedback from the students. The course was taught in the new format in spring 2009.

After the new course had been taught according to the format described above, the students filled in the traditional online course evaluation questionnaire as a summative evaluation. On a scale from 1 to 5, the course was given the overall grade of 4.5, based on ratings by 62.5% of the students. In comparison, the previous version of the course for the innovative programming students received an overall grade of 2.09. In other words, the new course was a great improvement. In fact, the 4.5 rating is an all-time high for all courses taught at the innovative programming education program (since the program's creation in 2007).

7. LIMITATIONS

The focus group literature indicates that a group size of 6-9 participants works best. Our two groups consisting of 4 and 3 participants respectively fall short of this. The main risk with having a too small group is that the breadth of opinions expressed is limited. On the other hand the participants in small groups tend to become more active and involved. The reasons for our small groups were purely practical. Even with our incentives of movie tickets for participants, we could not find more students from our target population willing to participate.

Results from a focus group study cannot be generalized to be representative of the entire student population (e.g. [3]). Our purpose however, has been to uncover how at least some of the students reason and to learn from the discussions among the students themselves. Also, the fact that we have run a focus group also with senior students having experienced follow-up courses means that we have broadened our perspective.

The new course has only been taught once, and for a different education program. It is thus possible that the good overall grade could be partly due to a novelty effect, that could wear off over

time. However, the magnitude of the improvement in the course evaluation is a very good sign.

8. CONCLUSIONS

The focus group discussions have uncovered a multitude of interesting challenges for teaching HCI early for computer students. We hope that our summary of these discussions can serve as inspiration and guidance for other teachers struggling with similar course design issues.

Our re-design effort represents one successful approach of overcoming the challenges. In terms of learning goals, the new course structure has emphasized HiFi-prototyping over initial user research. This decision is somewhat controversial given the importance of user research in development of usable systems. The rationale is that given the challenges of teaching a subject matter that is far away from the interest of the students, and the impossibility of covering every aspect of the subject matter in depth, it is better to make a compromise and focus on the parts that the students like the most. Introducing the subject matter in a nice package, so to speak, and thus at least increasing the chance of raising an interest for the subject. The students can always complete the missing pieces in follow-up courses, as long as we manage to attract their interest initially.

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