Reflections on Teaching a Mandatory HCI Course to Computer Science Undergraduates

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ABSTRACT

We report on challenges that we encountered in teaching Human-Computer Interaction (HCI) to undergraduate computer science students. One of the main challenges we experienced is that students seem to come in with negative preconceptions about HCI as a discipline. We discuss how the problem goes beyond disinterested students and is multifaceted and connected to larger societal issues and their relation to perceptions of different scientific disciplines. We aim to start a dialogue with the HCI community about the connection between HCI education and the perception of HCI as a discipline.

KEYWORDS

Human-Computer Interaction, education, teaching practices, challenges.

INTRODUCTION

We agree with many other educators that it is a good idea to have a mandatory introductory HCI course in undergraduate computer science curricula, but this can also bring about difficulties. In this paper, we discuss challenges we experienced with teaching a mandatory HCI course to undergraduate computer science students and provide an analysis of potential underlying reasons for these challenges. What we contribute to the symposium is insights regarding our specific experiences, for instance,

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HCI COURSE: STUDENTS

For the past two years, we have been teaching a full-semester (10 ECTS [6]) introductory HCI course to approximately 130 second-year undergraduate students coming from two programs of study in our department. The majority of the students are enrolled in computer science while approximately one sixth of the students study IT product development.

The computer science education at our department originated in the Department of Mathematics and has a strong focus on both theory and mathematical aspects as well as more applied topics. The IT Product Development education shares core foundational courses with the computer science program such as programming, databases, and algorithms and data structures. In addition to these courses, which are shared with the computer science program, the IT Product Development education also covers topics in design such as design theory, physical design, user experience, and social and aesthetic interaction.

While our introductory HCI course is mandatory for both groups of students, in this paper, we mainly discuss challenges we faced with negative attitudes towards HCI within the cohort of computer science students.

Sidebar 1: The students participating in our introductory HCI course.

how good intentions and established teaching methods are not always enough to reach students and meet learning goals. What we hope to gain are shared experiences from other educators who may have had similar experiences, or others who may have insights on how to address these challenges.

In their position paper for the preceding EduCHI workshop at CHI 2018 [30], Roudaut et al. [25] identify challenges concerned with defining an HCI curriculum and convincing both students and institutions that it is necessary to know and teach HCI. In an earlier paper, Åberg [1] similarly discusses negative attitudes towards HCI as a discipline. We contribute to these existing discussions, drawing from our personal experiences in teaching an undergraduate introductory HCI course in a computer science department. We provide more information on our course in Sidebar 1–3.

Throughout this course, we have struggled with students' negative attitudes towards HCI as a discipline and its merit as a core part of the computer science curriculum. While the problem may appear to simply be caused by students' attitudes, upon additional reflection, we suggest that there are actionable steps to take at the institutional level, as a community of HCI educators, and at a societal level. We outline our analysis of the problems at these three levels throughout this paper, followed by a set of possible solutions.

AN INSTITUTIONAL CHALLENGE: STUDENTS' CURRICULAR EXPECTATIONS

At an institutional (or perhaps departmental level), we experienced that computer science students seemed to be taken aback by the fact that HCI was a mandatory part of their curriculum. While we may blame students for not examining the curriculum thoroughly enough before signing up, students' expectations are also shaped by the branding of the education. For instance, our department's website places great emphasis on mathematics, algorithms, efficiency and security. While the latter two topics are closely linked to user interfaces and to understanding users' practices, a student that is just about to begin their academic career is unlikely to perceive it this way. Given these expectations, the HCI courses may be seen as less relevant than other "core" courses.

In a focus group study examining challenges in teaching HCI to computer engineering students, Åberg [1] makes a similar observation. Åberg also quotes a student stating that studying computer engineering is a choice based on a desire to "avoid having to read big books and write reports" [1, p. 5]. We have encountered similar expectations on the part of our students, many of whom decided to stop reading the textbook after a few weeks. This may be due to a misconception of the education as a vocational programming school rather than an academic computer science education, which could again have to do with branding. Society's view of programming skills as the way to get ahead in the competition for jobs may be why some computer science departments emphasize programming, algorithms, and software development in their branding, which may inadvertently de-emphasize other academic subjects and skills within computer science such as HCI that are also core to the education, as evident through the CS2013 curriculum guidelines [13].

HCI COURSE: CONTENT

Our HCI course corresponds to a large extent to the *HCI/Foundations* course that is outlined in the ACM CS2013 curriculum guidelines [13]. We provide the students with an overview of HCI as a discipline and introduce them to core HCI topics such as user-centered development, usability measures, usability heuristics, cognitive models, design principles, evaluation, accessibility, and social aspects that inform interaction design.

The course also covers smaller parts of the ACM CS2013 suggested courses *HCI/Designing Interaction* (e.g. paper prototyping), *HCI/Programming Interactive Systems* (e.g. modern GUI libraries), *HCI/User-Centered Design and Testing* (e.g. heuristic evaluation), and *HCI/New Interactive Technologies* (e.g. multi-touch and sensors) [13].

The textbook we use for the course is the sixth (global) edition of Shneiderman et al.'s "Designing the User Interface" [27].

Sidebar 2: The content covered in our introductory HCI course and its relation to the ACM computing curricula.

Furthermore, the increased attention given to HCI, User Experience (UX), and Design in the IT Product Development education (see Sidebar 1) may lead computer science students to distance themselves from these topics, perceiving these as belonging to the "alternative" education that they did not choose to study. This perceived distinction may further legitimize negative attitudes towards HCI.

Students' expectations are also affected by their older peers [14, pp. 64-65]. We have observed a "passing down" of opinions, and thus expectations, toward courses in our department. For the HCI courses, the consensus tends to be that these are the courses that "we do not like". Åberg [1] likewise describes how general rumours of his HCI course as being "fuzzy" influenced students' opinions. During our course, this preconceived negativity combined with dissatisfaction with topics and assignments grew into a collective negative mentality towards the course, with both lecturer and teaching assistants at times experiencing rude remarks and messages from some students.

But what are these miscommunications and opinions rooted in? Students' expectations and the opinions perpetuated by older students are closely connected with more general views on HCI and on so-called "soft" sciences, as we will elaborate on in the following sections.

A CHALLENGE FOR HCI EDUCATORS: THE BRANDING OF HCI

There is a tendency for HCI to be perceived as superficial and about "prettifying" software. Perhaps as a result, it is also sometimes perceived as inconsequential, outside of as well as within academia. This stems from an overly simplified understanding of HCI as being mostly about usability and UX design, likely having to do with UX design being the most visible HCI work in industry. Due to this, HCI is perceived by the computer science students as not worth learning if you are not aiming to be a UI/UX designer — something that Åberg [1] also notes.

Roudaut et al. [25] also remark how the connection between design and HCI associates HCI with art, which in their experience makes it hard to argue that HCI is a valid research discipline and thus necessary to teach with the same care as other subjects. We are similarly under the impression that many of our computer science students do not find that HCI has anything to do with their discipline — as mentioned earlier, HCI courses are perceived to be less relevant than other courses.

The fact that older students cultivate a negative attitude towards HCI also ties in with a general prejudice against the humanities among students in our science and technology faculty, which again reflects a trend in society where "hard" sciences are valued more than "soft" sciences. Åberg [1] likewise notes a tendency among students of the technical faculty to look down on the philosophical faculty, with which some of the students associate his HCI course. This perceived contrast and conflict between the humanities and "hard" sciences is a core part of the problem, especially for a discipline like HCI, which is built on contributions from both "soft" and "hard" sciences. This problem has two sides: The students misunderstand what HCI is and the students view "soft" topics in a negative light.

HCI COURSE: CONTENT (CONTINUED)

Throughout the course, students apply the techniques and methods in a group course project. In line with the SIGCHI HCI Curriculum 1992 guidelines [11, p. 30], our course has a major project that requires students to "work on design, implementation [...] and practical evaluation methods with their artefact", with "a major goal being the realization that user interfaces are demonstrably imperfect and can be improved" [11, p. 30].

In particular, the project takes students through the design and development phases of creating a mobile application with the Android platform. After an initial prototype has been completed, the students conduct a heuristic evaluation of their peers' prototypes, after which they revise their design and move to the implementation phase. The goal of the course project is to give the students a practical toolbox of user-centered design techniques that they can employ in their further education and careers. Students are taught and get to practice methods such as paper prototyping and heuristic evaluation in smaller practical exercise classes.

In the last half of the course, the majority of the time is spent implementing the prototype which is assessed both with respect to the quality of the user interface and the quality of the implementation. The iterative user-centered design process and the technical aspects of creating a mobile application can be seen as a "natural complement" [11] to the software engineering course that both groups of students take in the same semester.

Sidebar 3: The topics covered in the course and the group project.

A SOCIETAL CHALLENGE: THE PREFERENCE FOR HARD SCIENCE

There seems to be a favoring of natural sciences over the humanities in society at large, as reflected by dropping student numbers in the humanities [12] and less funding for research than in the natural sciences (e.g. [20, 26]). Debates around hard and soft science (and quantitative vs. qualitative approaches) have also taken place within HCI [4, 17, 18, 23], due to the interdisciplinary nature of HCI. There are many reasons for this, which are beyond the scope of this paper to explore. We limit ourselves to relating our experiences connected to this preference for hard science to those of other HCI educators, followed by a brief discussion of how this is connected to perceptions of gender.

Roudaut et al. [25] refer to the false-consensus effect in which people believe that others will behave like themselves and experience the world in the same way as themselves [24]. According to Roudaut et al., this makes students overlook the value in activities for understanding users' needs. Our experience is similar, in that students do not see the value in the techniques being taught and hence do not see the need to spend time practicing them. This is problematic since certain HCI skills require dedicated practice [25]. Åberg's students found the topics covered in their HCI course to be "trivialities and common sense" [1, p. 5], also resulting in a lack of dedication. Åberg cites the term "fuzzy" being used to describe his course and remarks that HCI is not an exact science "which is difficult for the students to accept" [1, p. 5].

HCI suffers from some of its topics being relatively easy to express and explain on a basic level but requiring much practice and reflection to truly understand. Examples include design guidelines or heuristics (e.g. Nielsen's usability heuristics [19]). This may also be the case for other disciplines involving "soft" topics. We suspect that for some students (and part of the general public), these "softer" topics are perceived as simple and straightforward and hence of lesser merit. A way in which we can clearly see societal structures reflected in our students' opinions is when they argue for the superiority of hard sciences over soft sciences by comparing employment rates [9] and prospective salaries [5] of technical majors and humanities majors.

The paragraphs above provide examples of the consequences of this perceived difference between the disciplines and their relative merits. Moreover, it has been demonstrated that there is a connection between the perception of certain professions and disciplines in general and the gender with which they are associated [3, 7, 16, 29]. It is our impression that many students see HCI as a discipline for women, with the implication that it is less valuable than other areas within computer science. This coincides with views that " hard" sciences are associated with men [3] and ties back to the interdisciplinary nature of HCI and how this causes it to be perceived as less of a "hard" scientific discipline (and hence possibly as more female).

Another issue relating to gender is that because of the negative perceptions of HCI in the department, students might be hesitant to express an interest in HCI. Based on informal conversations with female

students, we observed that some female students felt that by expressing an interest in HCI they were conforming to the stereotype of HCI as a female discipline. Margolis et al. [14, 15] note that women in computer science have difficulties identifying with the male hacker stereotype and with an all-consuming attachment to computing, a sentiment often reinforced by male computer science students. Women may therefore lose interest in the subject and confidence in their abilities. When the general student population does not consider HCI to be a core part of computer science, this may further strengthen the feeling of not belonging among female students who are interested in HCI.

SOLUTIONS AND SUGGESTIONS

In this section, we discuss suggested solutions from prior work that may help to address these challenges, and present additional suggestions based on our experiences. We discuss solutions at the level of computer science curricula as well as at the institutional level. Finally, we briefly summarize the greater societal challenge that we find our challenges as HCI educators to be symptomatic of.

Solutions at the Curricular Level

Åberg [1] suggests tying projects to industry so that students work on real projects. With a similar motivation, we allowed students to choose their own topic for the large course project. We experienced that there are risks to this strategy, as students' lack of interest in the course leads many of them to apply only minimal effort, leading to many central aspects of the course being glossed over. We attempted to amend this by introducing rubrics to the course in its second run. Our intention was to make it easier for students to know what was expected of them (trying to counter students' perception of the course as "fuzzy"). Many students, however, seemed to perceive it as a way of nitpicking on details in their work.

One seemingly obvious way to get computer science students more interested in HCI could be to focus on more technical and mathematically-oriented aspects of HCI in the curriculum, to spark an initial interest in HCI by tying it to what students already understand and appreciate. This could make results more tangible for students and help them perceive HCI as a part of the computer science education. However, adapting the the curriculum in this way would mean leaving out other important aspects like user-centered design, qualitative understandings of the use situation, or ethical aspects, simply because many students are not interested in them.

Students' bias against "soft" sciences may be addressed by providing them with the psychological background for why knowing about HCI will help them create better technological solutions. One example could be teaching them about the false-consensus effect. However, this may also risk being perceived as "defending" the course from the get-go, giving students the impression that justification for HCI is necessary.

Solutions at the Institutional Level

Efforts are being made at the institutional level in many universities. Examples include the introduction of ethics courses for computer science students at multiple universities in the US [22, 28], or the University of Oxford's "Computer Science and Philosophy" program of study [21]. Margolis et al. [15] suggest that one way to show that there are multiple ways of being a computer scientist is to have an undergraduate concentration in HCI. While we sympathize with this idea as a way to encourage appreciation of HCI as a valid field of study, we are concerned that it may confirm the preconception that HCI is not part of computer science. Furthermore, the fact that the suggestion is presented as part of a discussion on women in computer science may inadvertently perpetuate the stereotype of computer science being geared towards men and HCI towards women.

That students in our department focus on prospective employment rates when discussing the other faculties shows that they judge disciplines by their market value [14, p. 64]. Since part of the issue for HCI is a devaluation compared to other areas in computer science[1], making students understand the scientific merit of the discipline may be helpful. Initiatives may well be needed that foster the students' understanding of the university as an academic institution as opposed to merely a channel to employability [2, 8]. One initiative that has been implemented in our department is a research-focused track running in parallel with the ordinary undergraduate curriculum, in which interested students can seek enrollment in their second year and become affiliated with a research group if they continue to perform well in their studies. An issue with this extracurricular track is that students sign up at their own initiative. With mathematics and algorithms being perceived as core to the computer science curriculum while topics like HCI are considered peripheral, students who do not consider mathematics or algorithms their main strengths or interests may be discouraged from signing up. We suggest that when such well-meaning initiatives are implemented, it should also be considered how they may neglect certain topics, influence students' perceptions and/or perpetuate existing biases.

[1]Grudin [10] notes how decreases in research funding for AI were often accompanied by increased funding and blossoming of HCI research.

HCI in The World

Some issues faced in teaching HCI are part of larger cultural and societal issues. Some of the solutions discussed above may be helpful in changing students' views on HCI, but other issues need to be addressed at the level of HCI as a discipline and at the societal level. Currently, it falls on HCI educators to convince students that the discipline is about more than merely "prettifying" existing technology. As a challenge to the HCI research community, we suggest that we need to continue to ensure that society at large understands the merit of and historical contributions made by our field. Every step along the way means that more of HCI educators' energy can be spent evoking students' interest and strengthening students' skills rather than battling prejudice.

ABOUT THE AUTHORS

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CONCLUSION

While we wish to contribute to efforts that directly further HCI education, we feel that challenges in communicating the merits of HCI as a discipline should not be ignored. We are aware that these challenges may manifest themselves differently for other HCI educators (e.g. with some programs leaving HCI courses as electives) and we see value in sharing and reflecting on different experiences, which we look forward to doing at the symposium. The efforts put into designing curricula, exploring teaching methods and designing courses deserve a supportive foundation and the duty to achieve this foundation goes beyond those in the community directly involved with teaching. Our experiences are closely connected with general challenges for HCI as a research discipline and should be addressed by the whole community. The views expressed in this paper stem from a combination of the authors' collective experiences as HCI educators in different roles, in multiple institutions and countries, and from our own experiences as students being introduced to HCI. Our experiences are likely biased by our curriculum and the cultural context, and we expect that the experiences of others vary greatly. We look forward to learning about different approaches and experiences of fellow HCI educators.

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