Teaching and Learning HCI Online

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Abstract. This paper presents the experience of designing and launching an online HCI certificate program. The program was opened in March 2011 and it is currently in its fourth edition. It is a one-year certificate program addressed to practitioners and people working in user experience related fields. The data collected about our students confirm that there is a need for formal HCI education in these sectors and that students enroll in the program to formalize their knowledge acquired on the ground and to deepen it. Taking into account the two main user profiles of online learners (executives and hobby), the program only has "executives". Student satisfaction level on previous editions are very positive and we are currently applying an informal user-centered design approach to the design of the program that helps to refine it iteratively.

Keywords: Education, training, curriculum, online education, teaching, learning, user-centered design.

1 Introduction

Human Computer Interaction (HCI), User-Centered Design (UCD) and User eXperience (UX) are growing both in terms of educational offer and professional demands. Universities and other educational institutions perceive HCI, UCD and UX as critical disciplines [1] and therefore in the last ten years, HCI curriculum [2] is present in the portfolio of an increasing number of educational institutions. At the same time, the education arena is being pushed by audiences, technology and innovation into online environments. In 2013, more than 30% of enrollments in higher education were in online formats and almost 90% of public four-year universities and colleges offer online courses. Furthermore, most education institutions (65%) now say that online learning is a critical part of their long-term strategy [3]. Besides, the disruption of the MOOCs has placed them as players in the future of online learning, with big name key institutions, accreditation programs in the works, and increasing popularity among online learners.

Human-Computer Interaction (HCI) is becoming ever more important as a means of achieving competitive designs, and as a growing field of employment for IT graduates and others; such as psychologists, graphic designers and other professionals with a background in humanities or liberal arts. HCI focuses upon how to best design interactive systems that are both productive and as pleasurable to use as possible by their intended end-users, and is the study of how users interact with computer technology [4 -5]. This paper mainly refers to HCI but the term is used widely, including User-Centered Design (UCD), User eXperience (UX), interaction design, usability and other related terms of the field. Currently HCI is commonly used in the context of academic research, however, UX is being used increasingly in the professional practice and on the job market.

HCI is facing many challenges. On the one hand, as a discipline, must be up-to-date with technological advances and with methodologies. On the other hand, more professionals and practitioners are needed to meet the increasing pace of technological products. Also, HCI practitioners should be kept up-to-date as the field is increasingly becoming more multidisciplinary. Consequently, HCI education community and educational institutions should be in a position to offer up-to-date education and training that include state-of-the-art design processes, tools and methodologies for students and professionals with different backgrounds [6].

The following sections present a deeper insight on the aspects of HCI education and the main contribution of this work: the process of design and launch a full online HCI program. The paper is organized as follows: Section 2 provides an overview of HCI education. Section 3 describes the design process of a HCI Certificate Program in a fully online university. Section 4 presents the experience of launching the program and the lessons learnt. Finally, the conclusions drawn from the work and the discussion are summarized in Section 5.

2   HCI Education

The HCI community has always been very committed with the challenges of teaching and learning HCI. Therefore, a lot of work has been done through conferences, workshops, papers and reports. From the beginning of its activities, ACM SIGCHI [2] took HCI education as one of its priorities. A working group on education was created and it has been working on the challenges of HCI education that emerged over time. Thus, through mailing lists, papers, meetings and workshops, the community has been working on topics such as: the need to teach and learn HCI, the need for a shared curricula, the need to incorporate the disciplines to HCI field, and the need to update and adapt processes and methodologies to technological advances and interaction styles.

The ACM Curricula for HCI [2] was the result of a working group sponsored by ACM SIGCHI that set out the basis of the field and became the reference for HCI courses in following years. It had a big impact that affected not only education, but the field since it included one of the most used HCI definitions.

Many experts, practitioners, teachers and researchers were committed to HCI education. Thus, names like Donald Norman, Terry Winograd, Ben Shneiderman, Jenny Preece, Alan Dix, Jonathan Lazar, Yvonne Rogers, Julie Jacko, Elizabeth Churchill and many others are closely linked to the state-of-the-art of HCI teaching and learning. Also, other international and local associations, as well as practitioners, researchers and educators have also worked with a special focus around HCI education. As an overview, below we highlight some of its milestones, achievements and contributions.

The first academic books on HCI to highlight were "Designing the User Interface" [7] by Ben Shneiderman and "User Centered System Design: New Perspectives on Human-Computer Interaction" [8] by Norman and Draper, published before the SIGCHI Curricula. In 1994, Jenny Preece et al [9] published "Human-Computer Interaction" which is considered as the first textbook in HCI. In the new edition, the authors updated the content and the title as "Interaction Design: Beyond Human-Computer Interaction" [10]. Also, Alan Dix et al. [11] wrote one of the classic books, "Human-Computer Interaction".

There are several important contributions and projects related to HCI education. Recently, Churchill et al. [5] presented the results an ongoing project to identify the elements that shape todays HCI education and the challenges for the future. One interesting aspect of the work is that it takes as its starting point the need for a comprehensive global study. So far, the field of HCI had been very U.S./English-speaking centric. The study also shows that HCI field is global and should take into account cultural differences everywhere and analyses one of the biggest challenges of teaching HCI: the rapid evolution of the field. In the report, they have stated that according to their survey participants and interviewees call for some form of unity or consensus; there is a desire for "a unified theoretical perspective" and "a common curriculum".

Another research by Lazar et.al [12] addressed the challenges of keeping the HCI education up-to-date and mentioned the approaches that they have successfully used. Under this, they mentioned the four major areas of HCI education as rapidly changing technology, new design methodologies and student involvement with users, and balance of theory and practice. For rapidly changing technology, it is important to teach students about the HCI issues for handheld and wireless devices. Also, being up to date with governmental laws, guidelines, and rulings that affect usability and appropriate evaluation methods for distributed systems. For new design methodologies, it is needed to adapt established methods of user-centered design and evaluation to new products. Also, it is important to understand social interaction issues, apply new approaches for participatory design, use appropriate techniques for students to experience a design process and structuring of team projects for maximal learning. They also highlighted the importance of student involvement with users, as it gives students the experience of working with real users, understanding the challenges, needs of users and service-learning approaches to HCI courses. Finally, balance and theory of practice relates to the different courses that should be followed by students in order to maintain a balance between theory and practice in HCI education.

According to Thimbleby [13], HCI subject needs to be successful in the world: it needs practitioners who understand, apply and contribute to the subject. Therefore, the focus should be on pedagogy as a proper part of the discipline. HCI is concerned with how people learn to use complex systems effectively. He also mentioned that a lot of HCI is fun, but a lot of it is crucial, both for manufacturers to stay competitive, and for users to stay safe. Many issues in HCI can also be presented as reflections on how it is taught. When it comes to the way of teaching HCI, students could be engaged with the enormous impact that HCI can make to the quality of life around them and to teach them about learning. HCI itself is well-suited to this "metateaching," as one of its core concerns is user learning.

Digital and network technologies create new opportunities and challenges for teaching and learning. However, less attention has focused on teachers' experiences of and attitudes towards teaching HCI online. Preece and Abras [14] have mentioned several challenges of teaching HCI online such as (i) developing relationships; (ii) showing enthusiasm; (iii) balancing time versus activities; (iv) and creating and managing meaningful design projects. They have identified the solutions to the above which points in the direction of the need for creating an online community of learners. At the same time, teachers have to contend with students' motivation and satisfaction. In this case, feedback plays an utmost important role.

Another proof of the growing relevance of HCI is that Massive Open Online Courses (MOOCs) related to this discipline are also available. However, online education in HCI started way before the commencement of MOOCs. According to Daniel [15], the first MOOC was arranged in 2008, and contrary to most current instances, it was based on the philosophy of connectivism and networking, lifelong learning and distributed content [16]. Some of the popular HCI courses offered online can be noted as the Stanford HCI Course, arranged by Scott Klemmer [17] in Coursera launched its third instance in April, 2013 and the course opened to the public by Alan Dix [18] in early 2013. Both of these are open access courses, but with different focus and methods.

The work presented in this paper takes place in Spain, therefore it is interesting to present the situation in relation to HCI. The field was mostly promoted from higher education institutions and from local associations such as AIPO [19] and the local chapter of ACM SIGCHI and UPA [20]. The development of educational resources, the organization of conferences to build community and stimulate scientific research and dissemination were important initial work. AIPO also promoted the first master's program in Spanish-speaking language. Currently, there are several universities and educational institutions that offer HCI and UX programs and courses, conferences and meetings have increased in number and frequency, leading to the creation of an active community.

3   Certificate Program Design

This work takes place at the Universitat Oberta de Catalunya (UOC, Open University of Catalonia)1. It is a fully online higher education institution with a community of more than 50,000 students and more than 3,000 teachers. Teaching and learning mainly take place in a virtual learning environment that integrates independence (asynchronous communication) with interaction (connectivity) to overcome time and space constraints.

There is a team of HCI researchers and lecturers at UOC with previous experience in teaching specific courses in HCI, usability, information architecture and interaction design on undergraduate and graduate programs. Also, some open initiatives have been designed and launched such as ucdgame.org [21]. Overall, the purpose of the activity was to promote a better understanding of a good design process by demonstrating the importance of understanding and focusing on the end user. Taking into account this background, in 2009, the Open University of Catalonia decided to include a one year certificate program in HCI in its program portfolio.

3.1   Design Process: Using UCD to Teach UCD

To conceptualize the program, a process was launched to determine how the program should be and who should be the audience addressed. To do this, a user-centered design process was followed. As a first step, an investigation was planned involving the "users" of the program: students, teachers and employers. Some initial requirements were given by the university's educational model: the program had to be fully online and asynchronous. Also, there was a time requirement: the program should be completed in an academic year.

The research was conducted with the aim to discover relevant information about the program in terms of user needs, wants and expectations. The research activities included a focus group with 8 participants that covered teachers, UX practitioners and national and international students. Also, 11 interviews were conducted with experts from both academia and companies. In addition to that, a benchmarking study was elaborated to include the existing HCI education and training programs at that time. Finally, the job market and job offers were studied in order to identify the competencies deemed important by employers and companies.

The analysis of the data collected in the research activities provided important insights: the program should prepare students for a professional orientation, the goal was to form practitioners and the focus had to be on user-centered design (the full process as opposed, for example, to just usability). This was a common finding where the three actors involved agreed (students, teachers and business employers). Also, it was found that there was a strong need for online HCI education since it allows for current professionals to acquire new knowledge and the HCI job market is growing fast. The program needs to be aligned with industry market and professional practice. It is interesting to mention that, at that time, there were not many higher education

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1 http://www.uoc.edu

institutions offering HCI online programs and neither were specific courses such as current MOOC initiatives. Taking all these into account, an HCI online program was an opportunity, but it also posed unique challenges: there was the need to identify and define online teaching and learning strategies that took into account the intrinsic characteristics of HCI and UCD education. Also, based on the research the program should include, integrated along with UCD, the three main elements of HCI: technology, people (human factors) and design. The courses on the program should be skill oriented rather than content oriented because some contents change over time, mainly due to technology advancements, but basic competences and skills needed for UCD projects keep effective over time. Therefore, one of the goal was to provide skills for learners so they can keep up-to-date after graduating. Related to student engagement, some elements need to be taken into consideration: promote knowledge exchange among peers and with teachers with ongoing engagement with course content and activities that take advantage of the multidisciplinary approach of the field.

3.2   Program Definition

The academic design of the program was carried out iteratively, evaluating and discussing the structure of courses and its contents with employers and experts. Both companies and teachers from other universities participated in the discussion and evaluation. In the last stage of the design process of the program a visiting professor from Georgia Tech [22], with experience in the design of HCI educational programs, was invited to work for three months with the UOC team. The work during the visiting position was useful to validate the proposal in terms of definition and design.

From the educational perspective, the definition of the program considered especially: competence skills, contents, activities and assignments. Student engagement in activities and assignments is key to avoid dropout. From the HCI perspective, state-of-the-art methodologies and techniques were important elements to include. However, we wanted to avoid a frequent mistake: putting all the attention on methodologies losing view of the big picture. To avoid this, we decided to explicitly include the concept of process. Thus, each methodology has a context and must be used within a process that provides meaning and a more general perspective, taking the user and his experience as the ultimate goal.

As a result, the program structure follows the main stages of the user-centered design process and is set around four main sections: introduction (fundamentals), user research and requirements, design (including information architecture, interaction design and prototyping) and usability evaluation. Six courses were defined: two including the fundamentals, one for each UCD phase and a final project: 1) Introduction to HCI, 2) Design. People. Technology, 3) User Requirements: Research and Analysis, 4) Interaction Design, 5) Usability Evaluation, and 6) Project.

"Introduction to Human-Computer Interaction" provides a general view of UCD process and its associated with the phases and main methodologies. Also provides the main and basic concepts of HCI as well as an overview of the different terms and concepts. "Design. People. Technology" takes into account the three main elements of

HCI (design, people, technology), and provides recognition and facilities for participants with previous experience or knowledge in any of them. On the one hand, specific content and activities are provided to students with a previous knowledge level. On the other hand, collaboration and mutual criticism are encouraged in order to develop skills related to teamwork and HCI multidisciplinarity. "User Requirements: Research and Analysis" is a course that provides competences to understand and learn about users from a 360 degree perspective, so the user requirements are gathered, analyzed, documented and communicated effectively to other members of a multidisciplinary team. The main goal of "Interaction Design" course is to introduce students to the principles and methods of information architecture and interaction design including, labeling, navigation definition, card sorting, wireframing, prototyping and interaction design paradigms. "Usability Evaluation" course was conceived to provide professional-level knowledge about usability evaluation and show the importance of evaluating and measuring the usability of interactive systems, taking into account the advantages and disadvantages of the different methods. The final project makes students work on a real case project through a user centered design process. The project takes into account all the activities done on the other courses and providing a common goal for all the small parts. This is a way for students to personalize the program through a personal project.

In most programs (such as the HCI Master's offered by Carnegie Mellon [23]) are required as set of pre-requisites to ensure that they have all the knowledge required for an HCI practitioner. Being an interdisciplinary field, students should also have a basic knowledge of the other disciplines - mostly, psychology, technology and design. In order to include this important knowledge, we decided to include the course on "Design. People. Technology". It is a course in which students learn about the 2 disciplines they are less familiar with.

These courses are organized in two specializations that are offered as a whole and individually. The first specialization includes the introduction to UCD and user research. The second covers design and usability. The project is only done by students that are enrolled in the whole program.

4   Data from the Students

The program was launched in March 2011. Since then, 103 students have been enrolled in the certificate program courses: 50 have completed the full program and 53 have completed the specialization about design and usability evaluation. This enrollment data has proved us that design and usability are much more well-known concepts that user research and user-centered design. Our goal when designing the program was to offer students a holistic view of the UCD process and how the methods and phases intertwined. Although specializations can be taken separately, we actively convey the importance of doing the full program.

The average age of the program participants is set around 33 years old, being the oldest one 44 years old and the youngest one 23 years old. In relation to gender, 42%

of students are women and 58% are men. This data about the age and genre of our students is consistent with the average UOC student. As part of the user-centered design tasks undertaken by the Learning Technologies Office at the UOC, we have applied qualitative and quantitative methods to develop our students' personas [24]. We started user research studies in 2005 and since then we have consistently found that our students can be classified into two groups: the "executives" and the "hobby". Our "executive" profile is the persona we call Jordi; a man in its 30s that usually is enrolled in Computer Science or Business programs and that wants to advance in his professional career. Our "hobby" profile is a woman - we called her Martina - around her 40s, married with children. She studies, Humanities or Psychology and enjoys learning. Her main motivation is to learn and to enjoy the process. Despite these two different motivations, we also know that all our students, in the end, want to pass the courses and get a certificate. Lately we have seen an increase in younger and older students that enroll in our programs. We have also carried out user studies with them and the results were that the younger students behave like the "executives" and the older students like the "hobby" profile.

To learn about our students and better adapt the learning activities of the HCI program, we designed an online survey to be responded at the beginning of the program. We have gathered a total of 48 responses and besides the element of the age (the youngest is 23 years old and the oldest is 44 years old), their responses to the question about motivation to study the program place them all in the "executive" profile. None of them replied that they were enrolled in the program for learning as a hobby (Table 1). This means that we have attracted the type of audience we had envisioned when designing the program. That is of professionals that wanted to increase their knowledge in the HCI field. It is surprising however that the most of them are already working in the field with occupations such as: product manager, UX analyst, art director, web designer, web developer, graphic designer, etc. It is also proof that most UX practitioners are self-taught since it is a new field and also HCI education is fairly recent; specially outside of the United States.

Another aspect that was important to us is the background knowledge of our students. We wanted to reach out to a multidisciplinary audience to also show how several disciplines and knowledge is required for the practice of HCI. The main background of the respondents was designed but there is also a mix of previous studies (Table 2)

Table 1. Learners' motivation on the program

32,6%	I have a UX related job and I want to get a diploma
10,2%	I am interested in UX and want to learn more about it
16,3%	I want to expand my knowledge and improve my resume.
0%	Learning is a hobby and I found this program interesting.
26,5%	I have long been interested in usability, accessibility, interaction design, etc. and want to learn more
14,2%	Other

Table 2. Learners' previous background

49%	Design
24%	Technology
8%	Psychology/Human Factors
18%	Other

The background of the students also shows that HCI and the program attracts professionals from different fields (mostly technology, psychology and design) and is, as it should be, a multidisciplinary field. An interesting element that we still need to include in the program is the teamwork with students from different profiles. However, being a one-year online program it is not an easy task since most of our students work full-time and choose our program because it does not have constraints of time and place. Making them work in groups implicitly places some of these constraints.

We also wanted to know their knowledge and experience on HCI (Table 3). Coherent with their backgrounds and current job positions, most of the respondents are experts on "graphic design"; they are confident with "programming/coding" and "user experience" and are learning the most common HCI concepts and methods: "usability test", "contextual inquiry", "user experience", "focus groups", "quantitative methods". Our students also express several levels of confidence on the most well-know concepts of HCI: "usability test", "heuristic evaluation" and "focus groups" for example. The answers regarding "quantitative methods" and "statistics" show a lack of knowledge in this field that should be addressed either prior or during the program. This is an aspect still pending to be resolved. On the other hand, our students are not familiar with newer terms in the field (design thinking or Internet of things).

Table 3. Students with previous experience with HCI/UX elements and methods

	None	Heard about it	Learning	Confident	Expert
Usability test	2	**29**	**49**	14	6
Heuristic evaluation	31	18	24	25	2
Contextual Inquiry	31	24	**35**	6	4
Focus groups	22	**39**	**29**	6	2
Quantitative methods	24	**39**	**29**	6	2
Graphic Design	2	24	20	14	**39**
Human Factors	22	**39**	24	6	8
Statistics	4	**49**	22	20	4
Programming / Coding	18	27	18	**29**	8
Design thinking	**33**	29	20	16	2
Internet of Things	**39**	43	18	0	0

Table 4. Preferred UX areas, ordered by interest

1st	Interaction Design
2nd	Usability
3rd	UCD Project Management
4th	HCI Fundamentals
5th	User Research

Table 5. Preferred application areas, ordered by interest

1st	Mobile devices
2nd	Personal Computer
3rd	Cross-Device Interaction
4th	Experience Design
5th	Product Design

In the survey, we asked the themes that were of most interest. Overall, all 5 elements are relevant to our students with Design and Usability being the most attractive; which is consistent with the enrollment data we showed previously (Table 4).

The survey also included two questions to provide feedback on the design problem the program would focus on. One question was open-ended and the other provided a few options of interest (Table 5).

Most students mentioned that they did not know yet in which design problem to focus for their individual projects and the second most common response was to design taking into account the ecosystem of a service/product; that is web and mobile and physical aspects. Taking that into account and also the orientation towards a practitioner's approach, we decided to use the design problem of the CHI Conference Student Design Competition. Although the timings of the CHI project and our project do not match, it is still an interesting experience for our students to work on problems that the HCI community considers relevant. It also allowed us to provide a focus on a theme as opposed to a device; giving our students a broader space to work with.

As a complement to the online courses of the certificate and also as a dissemination activity, we annually organize a face-to-face User Experience half-day conference. This conference is a way of promoting networking among HCI professionals in Barcelona, a space to acquire new knowledge and be aware of new tendencies and also all the videos of the talks generate content for the program. Tying the program to outside activities that do not require much extra time for our students - the CHI Student Design Competition and the UX conference - is important to ensure that the program is up-to-date but also feasible for our "executive" student profile. For this purpose, we carefully select the theme of each year and the audience is growing annually:

- 2010: The User-Centered Design Process - talks focused on the different steps of a UCD project - 66 participants
- 2011: The relationship between Innovation and UCD - talks from these two approaches - 102 participants

- 2012: Tangible interaction - talks about the internet of things and large interactive devices - 110 participants
- 2013: Designing for mobile apps - 160 participants

Students also complete a satisfaction survey sent to all students enrolled in any of the university programs. This survey aims to collect information and measure five key areas through 45 questions. These areas are: program design, learning materials and resources, tutoring and teaching, virtual learning environment, and the university in general. The overall satisfaction around the HCI program is very positive, and evolved from 4, reaching a 4.4 out of 5. Students, especially value the knowledge and skills that they develop along the program and the learning resources provided. In addition to that, they like the educational model and teaching style. However, student satisfaction varies slightly depending on the edition of the program and therefore some data is biased towards one area or another. Also, it is interesting to notice that satisfaction with the virtual learning environment (virtual campus) has a lower value if compared to other programs in the survey. This is because the subject field students learn in the HCI program makes them more demanding about the design and interaction of digital tools and environments.

5   Conclusions and Discussion

The program was launched in 2011 and the experience has been positive in terms of student and teacher satisfaction. Like we did for the initial design of the program, we try to apply a user-centered design philosophy to the evolution of the program. Therefore, getting feedback from tutors and students as well as being up-to-date with the evolution in technology and the HCI field and education is key to improve the program. In this sense, at each edition we update the focus and theme of the learning activities. For the last edition students worked on the design of apps. We need to find a balance between the newness of the focus and its place on the job market. It cannot be too innovative, that is too far from our students' current work environment.

We have also identified an important element to reconsider that is the terminology used to name the program and some courses. Currently, employers and prospective students do not use the academic term "HCI" but the term UX and its variations. Also, because we would like for our students to enroll in the full program to get the best of it and learn about the whole UCD process. The title of the program is a small but important element because one of the main aims of the program is to prepare participants to professional practice and, consequently, the terminology used should match what is used in job offers. This change of name for the program also goes with a reassignation of the credits for each course. With the goal of providing our students with the main UCD/HCI knowledge, at some point we have crammed too much information and being too ambitious in the amount of knowledge that a one-year online program for professionals can include. As a result, we have decided to place the focus on the theoretical foundations as well as getting practice with the main methods. We would like to address the missing skills and competences through crash courses - for example, in prototyping or statistics.

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