Learning by practice in HCI classes – strategies to improve Computer Science students' careers

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ABSTRACT
The paper reports on the long experience of HCI classes offered to Computer Science students at the University of Salerno. The role of group project work is emphasized as a consolidated means to bridge the gap between academy and industry. However, over the years we have come to understand that better results can be achieved both in terms of students' productivity (career duration) and quality if classes on other disciplines are scheduled together with HCI classes and students can work on joint project proposals. Although, it is too early to assess the validity of this strategy, the initial effects are promising.

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HCI education strategies.

ACM Classification Keywords
K.3.2 Computer and Information Science Education.

CONTEXT
My experience in teaching human computer interaction dates back to 2000. At that time the Teaching Board of Computer Science agreed HCI topics should be taught to undergraduate computer science students, even if it was only in 2002 that the title 'Interazione Uomo Macchina' was assigned to that course. It was an elective course and someone thought it was hazardous, with learning outcomes including terms such as 'usability' or 'affordance' which could be hardly understood by students. Today we can state that was instead a wise choice. Software companies have progressively become aware of the importance of HCI competencies for a computer scientist, and the number of students enrolled in the 48 hours HCI course have grown every year reaching an average of 156 students in the last four years, compared to an average of 74 in the preceding 4 years. Besides a written test on HCI fundamentals, students are judged for a group project work they are supposed to carry out during the course. Many former students have reported to me that their knowledge and skills in this area have been much appreciated in their workplace and have been crucial for their internal career. The growing interest in the area led us to offe,r since year 2010/2011, an advanced course on Human Computer Interaction and Software Usability (HCISU) for graduate master students. The course is a 72 hours course tackling advanced concepts related to the phases of usability engineering process, from user requirements specification to design, development and testing. In particular, the following topics form the syllabus:

- Benefits of 'user-centered' development of a software system and the fundamentals of usability engineering.
- Ethnographic studies and contextual inquiries as tools for understanding the context of use and the collection of user requirements.
- Scenario-based approach to the design of iterative user-centered systems.
- User-centered technologies to support the principle of universal design.
- Development of user-centered multimodal and multi-user systems in the domains of ubiquitous computing and collaboration through artifacts. issues of usability engineering specifications for those systems.
- Empirical methods of usability evaluation.
- Usability engineering in practice: The role of usability specialists in the development team - Standards of user interfaces - Ethical issues that affect usability.
- Universal design and accessibility.

It is again an elective course, presently, included in the curriculum of Information Systems and Software Technologies and in the curriculum of Computational Intelligence of the master degree in Computer Science. The distinctive aspect of that course is the experience students gain in the field of empirical usability engineering, meant to complete their skills as usability specialists. As for the undergraduate HCI classes, the group project work has a major role in the final exam.

CONTRIBUTION
Over the years the contents of the HCI syllabus for undergraduate students have changed vigorously, leaving

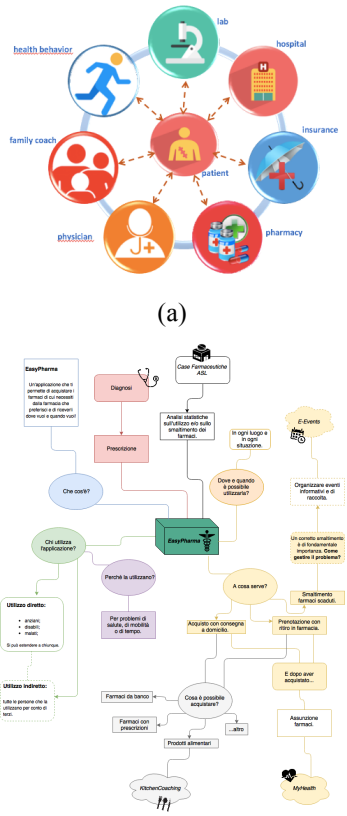
unchanged only the traditional core topics suggested by IEEE/ACM Computer Science curriculum. The challenge for academics who teach this discipline is to update contents so as to hold pace with the evolution of information and communication technology and the consequent societal changes. The core topics provide a sound theoretical foundation but their concrete adoption in interface development processes and techniques stems out of times and strongly depends on technology at hand and on how user get transformed by that technology. Based on that idea, every year I choose a theme for the group project work, which reflects some emerging challenges in the area of user centered design. Students form groups of 3-to-5 people and make their proposal for a project addressing a problem related to that theme. Table I lists the themes tackled in the last 4 years, the number of group projects and the number of students who chose the HCI course, which is, as already mentioned, an elective course.

Year	Theme	#Group projects	#Enrolled students
2016/2017	People empowerment	44	217
2015/2016	e-Inclusion & Assistive Technology	25	105
2014/2015	e-Heath & Self management of chronic diseases	27	113
2013/2014	Emergency management & Collaboration	38	190

Table 1: Data on students' project work in last 4 years.

Every theme may require specific learning materials to be provided to students besides at least two lessons focusing on relevant HCI design implications. For instance, in 2014, the theme was 'Emergency management & collaboration', so the design of collaborative interfaces was in the focus and the specific issues related to multi-user interaction were illustrated through a number of case studies. Some of them were taken from the specific domain of emergency preparedness, response and management while others were successful collaborative systems from other domains. The idea was to enable students to identify emerging challenges that they would like to address in their project work.

The project work has the benefit that students can learn new contents and practice them directly, with the effect of raising their motivation to study. Moreover, as it happens for other courses of the Computer Science program, they are able to experience some important aspects of team work, with project milestones corresponding to 4 distinct course assignments. However, a recent investigation on the reasons of delayed students' careers has revealed that in some cases the project workload on one course (typically, HCI, Software Engineering (SE) and Mobile Computing (MC)) has led students to abandon other classes of the same semester and postpone the corresponding exam, being fully involved in the project work at hand. In order to contrast that phenomenon, last year the Teaching Board has agreed to schedule the three courses of SE, HCI and MC for the same semester so as to allow students to make joint project proposals for at least two of them. The HCI course was attended by approximately 130 students and the number of joint IS-HCI projects were 19 out of 44, involving a total of 62 students, and the number of joint HCI-MC projects were 12 out of 44, involving 39 students. The SE-HCI joint projects and some stand-alone projects carried out by students who had gained the SE credits before were judged the best projects, also in terms of documentation and of group final presentation.



(a)

(b)

Fig. 1 The joint project work done by students of the advanced courses in HCI and DB Systems of the master program in computer science – (a) A digital knowledge ecosystem in the healthcare domain and (b) the conceptual model underlying the mobile app 'EasyPharma'.

During the last semester, a similar experiment was also performed with first year master students attending the course of HCISU. The 27 enrolled students were given the chance to work on a joint project with the course of Advanced Database Systems (ADBS), which tackles emerging topics in the area of data management and of knowledge source. Each group was supposed to build a wide conceptual model, where the proposed interactive application is only a portion and is used both to share contextual information about the user and to derive knowledge from the surrounding digital ecosystem. Figure 1 illustrates the conceptual model underlying a joint project work done by master students of the courses in HCISU and ADBS in the healthcare domain. The mobile app 'EasyPharma' supports chronic patients in retrieving medications when needed and in disposing expired medications. The conceptual model also relates the app to the applications 'MyHealth', 'e-Events' and 'KitchenCoaching', developed for the same digital knowledge ecosystem by other 3 groups of students. All groups completed the joint project work by the summer session of exams and most of them passed with the highest marks.

LESSON LEARNED

From the reported experience, the following lessons are learned.

- Interest in HCI discipline has grown over the years and the high pervasiveness of computer systems in people everyday lives motivates students to learn its foundational aspects for their future professionality. Practical experience on group project work is crucial gain appropriate HCI design skills. Some students report this is appreciated by software companies.
- Although it's too early to analyze the effect of combining the project workloads from different courses, the results of the last semester are promising. As for the undergraduate program, the apparent effect of the described change in the course schedules is twofold. First, more than 70% students who regularly attended HCI classes were able to pass within a sufficiently short time the two exams for which they put joint project efforts. Second, knowledge on SE methods and techniques produced higher quality project works. As for master students, they were able to experience the value of a sound usability engineering process on the design of a digital knowledge ecosystem built around individual users. The same project was proposed for the ADBS course, where they could successfully experience data warehousing techniques to analyze data coming from multiple sources and derive customized information delivered through usable interfaces.