

Learning Approaches for Teaching Interaction Design

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ABSTRACT

The paper focuses on investigating some of the challenges of teaching interaction design. This analysis is based on two pillars: a series of learning theories that can be used to inform the paper topic and a set of interviews with design practitioners who were previously enrolled in a third level education program aimed to prepare them for this profession. The findings suggest that both teaching and practicing design require good coaching, practical experience together with a thorough understanding that can occur through reflecting on experience, and not at least access to community of practice that can enable successful communication, both with the coacher and the peers.

Keywords

Interaction design, theories of learning, reflection in action, collaborative project design.

1. INTRODUCTION

Fundamentally crafts, design-related occupations rely nowadays on both academic training and specialized knowledge but tend to lack a unified set of structured practices, formal training or continuing professional development programs. Such aspects together with standards for performance competency and code of ethics have transformed a craft-like occupation such as medicine into a profession [16].

It has been acknowledged that in addition to academic training, interaction design requires skills acquired through practical experience from attending design practitioners [9],[11],[13],[21],[24]. The increasing need to bridge the gap between theory and practice or academia and industry explains the amount of efforts made to unfold the craftsmanship dimension of design and better articulate the practitioners' knowledge in codes of best practices. Such codes would facilitate the acquisition of practical skills in industrial settings, and more importantly, through becoming an integral part of the academic training. In this way, the efforts deployed for improving teaching design can reap the benefits of bringing the craft of design practice closer to professional standards.

The next section highlights three main perspectives of design: as a craftsmanship, profession and taught discipline, where the latter aims to provide a link for bridging the nowadays gap from learning and teaching design to practicing it. The subsequent section outlines several teaching and learning approaches that can be harnessed for improving the process of teaching interaction design. While the employers' dissatisfaction with the quality of graduates was well researched, less work has focused on the graduates' satisfaction with their (lack of) preparedness for the industrial arena [10]. Thus, the case study presented in this paper addresses the latter aspect through interviewing a few design practitioners who graduated a Master Program for interaction design. The discussion section highlights the main challenges relating to teaching design and proposes some solutions for addressing them.

2.1 Design as craftsmanship

Wroblewski talked about the craftsmanship, as an inherent component of the process of designing human computer systems, component that involves skillfulness in both planning and acting [24]. This craft perspective emphasizes that the collective knowledge of such skills are held by design practitioners who can be "unaware or incapable of articulating the principles motivating their designs or to reproduce the results of applying those principles".

In the context of craftsmanship it is worth mentioning the distinction between procedural knowledge and declarative knowledge, that has long been acknowledged in many theories of learning and cognition [2],[3],[20]. Declarative knowledge is knowledge that people can report and of which they are consciously aware. Offering a descriptive representation of knowledge, declarative knowledge expresses facts, like what things are [23]. On the other hand, procedural knowledge is that knowledge that people cannot verbalize. They form part of a mental model which enables the execution of some tasks because of the technical skills capturing the "knowing-how" [4]. Because of the lack of awareness characterizing it, procedural knowledge is usually taken for granted [1]. The successful learning and practice of design requires both declarative knowledge which can be acquired from textbooks, and procedural knowledge which can be acquired through practice and is in general more difficult to capture, teach or acquire.

2.2 Design as a profession

Despite a considerable body of knowledge that has been developed in the field of Human Computer Interaction (HCI), proprietary and financial reasons limits the access to design as it is actually practiced in industrial arena. Even when this

access is enabled, through workshops and tutorials at conferences in the field or through a limited number of training resources, e.g. videos, demonstrating how design methods can be practically used [17], its high cost prevents students' participation. In fact, there are mostly practitioners who can attend such training sessions. This situation makes design practice almost an esoteric matter which limits students' access to it, and increases the gap between academia and industry. Since HCI is a multi-disciplinary subject, the designer of an interactive system would be knowledgeable in a variety of topics such as cognitive psychology, sociology, computer science and engineering, business, graphic design, technical writing. It is mainly this multidisciplinary aspect of HCI that raises difficulties in practicing and, even more, in teaching design [13].

The demands involved in the professional practice of design require that students - future practitioners - have not only technical knowledge and skills, but also design skills [13]. This need explains the growing interest in practice of design and consequently in teaching design. The latter is particularly relevant since studies suggest that unfortunately, much employability learning occurs at the workplace, rather than in universities [25].

2.3 Design as a taught discipline

The most typical context for learning design is through design projects, where students work together to complete them under an educator's guidance. However, since the work is mostly outside the class, the guidance that they receive is usually limited [13]. Design is mostly a heuristic process, not clearly defined and whose ambiguity starts even from the definition of design problems. Such problems do not have correct answers and "educators cannot lay out in advance exactly how students should proceed or what information will be relevant to the design. Instead, design problems require a more reactive and flexible approach by educators" [13].

The craftsmanship dimension of design suggests that teaching HCI design cannot be ensured solely on the basis of traditional classroom instruction, but it requires an additional experiential component [21]. The latter is usually covered through a collaborative project where students are involved in the designing process as member of a design team:

"Students should be placed in a problem situation that challenges them to integrate prior learning and experience, to learn to work with others, and to justify their choices to professional colleagues. It should also stress alternative ways of thinking about the material and should encourage students to develop the habits of critical thought that will enable them to continue the development of their knowledge after graduation through reading, direct experience, and reflection" [21].

3. The challenges of teaching interaction design

The major difficulty in teaching interaction design is related to our limited understanding of how design, which is primarily a creative process, really occurs. Thus, the challenges of teaching design can be seen all throughout the design process, starting from problem specification, continuing with the relevant feedback that the students have to receive, and not at least relating to the assessment of design-related activities and outcomes.

Problem specification in the context of interaction design usually strives a fine balance between clarity and ambiguity. While the educators try to provide just enough details to let room for the exploration of the design space, students would prefer a more articulated and structured problem definition [19]. This tension is generated by students' limited ability to handle less structured tasks. However, the skill to formulate problem settings is preceding and at least as important as the one of finding solutions. Unfortunately, the acquisition of the latter skill has received insufficient attention in higher education and students, even the graduate ones, are often less prepared for this challenge; it is a skill to be learned. Setting the problem is needed not only during the initial stage of the design but the iterative nature of this process requires continuous reformulation and restructuring of the problem [24].

Another challenge relates to the relevant aspect of feedback that the students need from their educators [13], since ultimately the process of learning design is as good as the feedback received by the students during this exercise. Without qualified feedback, the experience of being involved in the design project has less to offer. In order to provide efficient design guidance, the educators need to be involved in the critical decision points along the design cycle. This is usually not a trivial task since in order to progress efficiently students need to show initiative to organize their work within and mostly outside the mentoring sessions [21].

The difficulty to objectively assess the quality of the design outcomes represents another challenge of teaching design [24]. It stems mainly from the difficulty of evaluating any design outcomes as being right or wrong since the design decisions [21] that have to be made will always leave unexplored a multitude of options against which the current outcome can never be compared. Of course several prototypes can be evaluated through user trails and compared against each other but this is not enough to claim that a particular design is the best that can be produced. The evaluation of the design process (as opposed to design outcomes) is even more problematic, if one wants to go beyond the design stages and wishes to explore the considered design options and the rationale for deciding which one has been followed. The breadth and depth of the design space exploration usually goes against the design project resources which are usually limited. In addition, there is no current methodology that can account for the insightful conversion of a set of design constraints into affordances.

All these challenges of teaching design relate to the creative nature of this process that cannot be fully understood unless it is experienced [13]. The characteristics of the design process together with the difficulties related to teaching and

learning design lay a challenging arena for educational science when learning theories are called to support teaching design.

4. Theoretical perspectives on learning that can inform teaching interaction design

Below there is a brief presentation of the theoretical perspectives which may increase the understanding of learning and teaching design. Giving that the most challenging aspect of teaching design is related to its craftsmanship component, we will start by considering the two approaches developed for teaching craft namely apprenticeship and teaching by paradigmatic examples [24].

4.1 Apprenticeship and teaching by paradigmatic examples

Apprenticeship is a teaching method, still alive in many fields, e.g. medicine, architecture, software engineering, that ensures individual coaching for learning the craft skill. Usually practiced in a design studio, it enables learning in a risk-free environment, where the errors are explained and the progress is enabled through direct experience. Relevant for apprenticeship is good coaching and students' ability to communicate with their peers and the coach, primarily to externalize their ideas and provide/receive feedback. Coaching can be delivered through the demonstration of those tasks whose execution is to be learned by the students. Articulation takes place when the students start to reflect on their actions and decisions. Such reflections can be externalized verbally or graphically. Apprenticeship involves a continuous dialogue between educator and students, where the former performs a think aloud through which the mental model about the task and the application supporting the task becomes transparent and available to the students. Teaching by paradigmatic examples enables students' access to a large set of design products that can constitute useful landmarks in the design space. Such landmarks may be used to guide the design process, e.g. as starting point from where the designer can further explore other paths through the design space.

4.2 Constructivism

Constructivism is an approach to teaching and learning which considers that people construct their own understanding through experiencing things and reflecting on their experience [18]. Through this reflection component, constructivism is related to "reflection in action" approach [19], but it does not necessarily require action. The experience of things can be merely a simulation, an experiment or an exercise of imagination, through which the meaning is not transmitted by the teacher but created by the students through their learning activities [18].

There are two learner-focused strategies of particular interest in the case of teaching design: problem-based learning and collaborative project-based learning [8]. Problem-based learning is a teaching/learning strategy that involves group work for finding solutions to real problems. Since the exploration is the aim of the learning process, problem-based learning requires students to take responsibility for their learning and to develop critical thinking skills. Collaborative project-based learning is a strategy which assumes that students are part of a collaborative group project where the end product is the primary goal. These are both constructivist approaches to learning which facilitate deep learning [8].

4.3 Experiential learning

Building on constructivism, experiential learning is an approach which considers four stages of learning: concrete experience, reflection, abstract conceptualization and active experimentation [14]. In the context of teaching design the influence of experiential learning places learning responsibility on the students whereas the educators area responsible for creating the learning environment in which students can experience, reflect on experience in order to understand it, and actively experiment this understanding.

4.4 Situated learning and community of practice

Situated learning [15], [22] is a theory of teaching and learning which considers that in order to be successfully acquired, knowledge needs to be presented in an authentic setting which facilitates social interaction. Related to situated learning is the construct of community of practice, a group of people who work together in order to achieve some common goals. In this way, learning is seen as the process of becoming member of a community of practice through collaborating with individuals with greater experience.

All the above approaches are related to each other: constructivism offers a basis for the development of experiential learning, while apprenticeship models can be aligned with situated learning and communities of practice which offer the most suitable contexts for learning to occur. In addition, each of the approaches to learning emphasizes the need for practicing design under a good coaching, whereas successful communication, both with educator(s) and with peers, plays a vital role. They also require practical experience together with a thorough understanding that can only occur through reflecting on this experience. Reflection is a key feature to all the approaches discussed above, and can be seen as reflection in action (thinking while acting) or reflection on action (thinking after acting) [19]. Reflection in action has three main distinctive features: involves learning by doing, coaching and a continuous dialogue between coach and student. It is mostly used by practitioners in novel situations, when text-book solutions do not suffice and refers to a cycle involving designer's actions which trigger a process of reflection and interpretation of the situation, followed by a subsequent action which is again analyzed and interpreted. Each action involves an element of surprise, since its results cannot be deterministically anticipated.

5. Case study

This section offers a description of a case study where a design module is evaluated by graduates and their module tutor. The Collaborative Project Design (CDP) module is part of MRes (Master by Research) program which represents a collaborative initiative between the departments of Psychology and Computing at Lancaster University. The overall program focuses on the development of research skills in designing and evaluating interactive systems. The program runs for a small group of students (around 10) who are usually highly motivated, sometimes with couple of years of industrial experience, and with educational backgrounds in Psychology, Computer Science, Information Technology and sometimes Arts. This is a fortunate mixture which resembles some of the multidisciplinary nature of real design teams.

Within this programme, the CDP focuses on collaborative design of an interactive system. It is a compulsory module which runs for 10 weeks and worth 10% of the degree. Students are given a real life topic with its own affordances and constraints and are asked to design a suitable system to address the proposed topic.

In this way, the CDP module is structured to support a constructivist approach to learning. While mainly a collaborative project-based learning, e.g. students usually work in three groups of three or four students with mixed educational backgrounds, the CDP module presents also some elements of problem-based learning. The collaborative project-based learning relates to the multidisciplinary teams working towards designing a system to support people activities. This assumes a project product as a learning goal. However, it is the process of designing that it is the most important, rather than the final system prototypes that the teams can deliver, and in this respect, the learning approach is closer to problem-based learning. In addition, the system to be designed is not clearly stipulated, neither the possible routes to be taken in developing it. This resembles more a problem based-learning approach, where the starting point is usually an ill-defined enquiry [8]. Students are challenged to formulate questions, rather than seeking exclusively for answers. They need to develop learning skills like structuring the information, exploring the alternatives, analyzing the limitations of each options and deciding for the best idea to be designed while accounting for a series of constraints. Within this teaching setting, both students and lecturer traditional roles are challenged. Students have to take increased responsibility for their learning, continuously reflect on their experience and develop team working skills, while the educator becomes a facilitator and guide [8]. While the educator is trying to enable students' access to paradigmatic examples, (s)he can hardly compensate for the absence of a real community of practice from which students could greatly benefit.

By the end of the module, students produce low fidelity prototypes or simulations rather than working prototypes. The assessment procedure involves three tasks: two individual reports in which students reflect on the design outcome and the collaborative nature of the design process respectively. In addition they have to prepare a website and a poster that needs to be explained to a panel of experts through a group presentation.

The field study consists of 4 in-depth interviews, three with former MRes students and one with their CDP tutor. All three students are currently working as practitioner designers. Interviews were structured to capture the interviewees' opinions on the strengths and limitations of the program/module.

5.1 Interview structure

The interviews were structured around a series of open-ended questions organized around two dimensions: the MRes Program as a whole and the CDP module (see Annex 1). Along each dimension the interest was on capturing interviewees' opinions about the level of acquired knowledge, skills and values in the light of program/module gains and limitations. A particular set of questions probed into the success of CDP module to prepare its students for their careers as practitioners in the field of interaction design.

5.2 Findings

The subjects considered that the whole MRes programme was successful and assessed it as "a brilliant programme", "very well structured and organized", that "was enjoyable". The most important things that the students learned were the transferable skills of working in team; they favored "the team design like in design environment".

The CDP module was considered "very useful" and "well organized", where "the three teams working together helped creating a sense of real world experience". The former students considered that they gained "social and practical skills" and "confidence in communicating with people about design decisions". They also appreciated "the discussions around the design which were useful", particularly for enabling reflection on action.

The module limitations referred to the design project whose initial brief was considered as being "too abstract with a lot of freedom, which is good but in real world we also have a lot of constraints". Participants considered that "the scope of the project was too large" and "too much freedom is bad". "Constraints were too loose – in working environment we have some design constraints, but quite few and clearly defined ones". "We needed to define our own team and we missed a predefined goal". The tension between a clearly and a loosely defined design problem becomes obvious when students' expectations are paired with the CDP tutor's opinion: "When I designed the stuff for the course I had in mind what I could offer the students that would be as close as possible to what they would be doing in industry, but also to give them the opportunity to think out of the box. I also wanted it to be collaborative in many levels, inter and intra group". Subjects also reflected on the limitations related to the assessment of their group work and on the need for better project management skills. The latter are particularly needed to function well in industrial settings and would have been improved through students' direct access to communities of practice "it would have been nice to have real work

experience". They also considered that would have benefited from additional skills for design methods and techniques, such as prototyping, graphical software or web design.

6. Discussion

The presented learning theories argue for a good mentor, whose roles are diverse and complex. Thus, in a learner-focused strategy, the educator's role is considerably different, (s)he becoming less a presenter of information and more a facilitator and guide of students' learning. Therefore, we can conclude that a main challenge regarding the teaching of interaction design is the effective coaching of the design team. The best coach is nevertheless an experienced practitioner designer. According to the setting developed for running the design project, from design studio to micro-sabbatical [21], the practitioners' involvement can vary considerably. Despite its acknowledged importance, the curriculum for interaction design rarely involves students' direct exposure to practitioner design experts, e.g. communities of practice [11]. Having practitioners involved in the teaching exercise through sharing their hands-on design experience has an invaluable benefit: it guarantees students' access to the current design practices by facilitating their skills development – that "knowing-how" – that lies beyond the knowledge covered in the textbooks. However, such an endeavour requires significant commitment, whereas time is always an expensive resource in the industry arena. Hartfield et al. [9] successfully involved a team of designers in such a project, who acted as mentors along the entire project duration. Despite its great advantage, this involvement in coaching a design team poses considerable challenges on practitioners' time resources [9]. A more practical solution is having practitioners as invited guests. This will limit their participation to only one session, where they can focus on presenting and practically demonstrate a particular, often-used design method. The combination between presentation and demonstration is fortunate: it provides students' access to both declarative and procedural knowledge through paradigmatic examples associated with the case studies. In addition, the demonstration is an example of reflection in action whose considerable benefits were discussed above.

Another problem related to teaching interaction design refers to the constraints provided in the problem formulation. There is a considerable tension between students' need to have the project requirements well structured and the educator intention to have it more abstract in order to let the students structure the problem. A solution in this direction is to define it less abstract and more realistically. For this, if the design project does not take place in industry or with industrial partners, it can at least be inspired by a project running in the department, whose particular sets of constraints are more realistic than any other design project that the educator would try to imagine.

Another important challenge of teaching design is related to the interdisciplinary nature of HCI and to the difficulty of setting up proper design settings to enable students' involvement in real world projects. Additional difficulties relate to the objective assessment of the group work. Firstly, there is one outcome for the entire group, in which it is difficult to accurately estimate the amount of effort put in by each of the group members. Secondly, the design itself is not right or wrong and this challenges the habitual ways in which students expect to be assessed and guided [13]. One way to address this problem is to ask students to accompany the project report with additional documentation regarding the role of each group member. The group has a pretty clear idea of how much each of them contributed to the project [12] and in addition, each group can assess the work of the others' which has a twofold benefit. On the one hand it trains students to reflect on the quality of the design process and outcomes and to select criteria that can form the basis of a more objective assessment, while on the other hand it facilitates peer communication in the design process which is an important transferable skill to industrial settings.

7. Conclusions

The paper reflects on the challenges of teaching interaction design that relate to the problem specification, the need for expert feedback and a better assessment of the design process. These challenges are analyzed through the findings of a case study and reflected upon in the light of several theories of learning and teaching. We conclude that teaching design requires good coaching, reflection on experience, access to community of practice and efficient communication.

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Annex 1

Interview Structure

A. MRes programme as a whole

1. General thoughts and feelings
2. What was the most important thing that you learned? Knowledge, Attitudes (values), Skills
3. What was the greatest gain?
4. What do you think that it prepared you for? (Academia vs Industry)
5. What were the programme limitations?
6. If you could design this programme, what would you change?

B. CDP module

1. Module description - thoughts and feelings
2. What was the most important thing that you learned? Knowledge, Attitudes (values), Skills
3. What was the greatest gain?
4. Which were the module limitations?
5. If you could design this module, what would you change?
6. Are the design methods you learned useful in your current job?
7. Are the evaluation methods you learned useful in your current job?
8. Do you think that this module prepared you well for your practitioner job?

In which way it did?

In which way it didn't?

C. Factual data:

1. Educational background
2. Year since graduating MRes
3. Current job
title, length, short job description.
After being hired, did you receive any extra training? What did it consist of?
4. Within your current job:
What design methods do you usually use?
What evaluation methods do you usually use?
What prototyping techniques do you usually use?
What toolkit, software do you usually use for prototyping?