Research for users: critical knowledge and experience for design and engineering students

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ABSTRACT: In recent years, researchers and participants in the design and engineering disciplines have increasingly considered and valued the importance of a user-oriented or user-centred approach in design practice. A major advantage of this approach to design is that designs with a high degree of *userfitness* are more likely to result. In the article, the author illustrates how users' research activities have been incorporated in design and engineering programmes. The author focuses on learning and teaching experiences, and on the design outcomes generated by students. The author also identifies that the most important value of incorporating a user's research experience in design and engineering programmes is not giving practice knowledge and experience to students, but rather in allowing them to experience and find out by themselves the importance of respecting users in their professions.

INTRODUCTION

In recent years, design and engineering professionals have increasingly considered and valued the importance of user research. The major reason for this is that only through a good understanding of users and their professions can one correctly and significantly meet market demands and serve humankind.

However, there is still a discrepancy between the real needs and expectations of markets and society, and education. Complaints have been frequently heard that the current education systems cannot prepare students to meet these market and social needs.

In detail, many design and engineering education programmes nowadays still place little or no emphasis on providing user research experience for students. That is, some of these programmes do not require or motivate students to carry out user research [1][2].

Even though some programmes claim to expect students to consider the importance of user experience in design by requiring them to conduct user research, these research activities are not well planned as regular and compulsory activities in the programmes. In turn, students cannot be expected to have the necessary experience and confidence to identify, know and understand users' needs, wants and aspirations, and to generate design solutions with a high degree of *userfitness* [3].

In this article, the author illustrates how user research activities have been incorporated in design and engineering programmes as offered by a school of design and several engineering departments. The discussion focuses on the performance of, and feedback from, those students who have applied user research in their design projects.

ENHANCED USER-RESEARCH RELATED ELEMENTS IN DESIGN AND ENGINEERING PROGRAMMES

Since 2000, several design and engineering programmes have been jointly organised and run by several engineering departments with the School of Design at Hong Kong Polytechnic University in Hong Kong, People's Republic of China. Besides maintaining professional engineering elements in these programmes, one of the key objectives of these programmes is to promote creativity and innovation. Design subjects have been included in these programmes in order to enhance aesthetics appreciation, creativity and problem solving skills. The subjects are coordinated and run mainly by professors and instructors from the School of Design in collaboration with professors and staff from the Department of Engineering.

Each of these design subjects aims to provide particular knowledge and learning experience to students. The subjects include the following areas:

- Design thinking;
- Social and cultural analysis;
- Green and sustainable design;
- Product semantics;
- Design humanities;
- Design cultures;
- Design for the public;
- Special design projects, eg industrial training project, client-based project, final project.

Due to the different objectives, nature and contents of the subjects, the focus of the work and learning activities of these subjects also vary. Some of the subjects focus on research and analysis, and some emphasise problem solving, while others highlight the professional application and implementation of design ideas.

Disregarding the differences in focus, each subject has, more or less, incorporated research elements that require or motivate students to conduct more exploration. That is, students are encouraged to not only stay in the studios, workshops and laboratories, but to go out and conduct empirical research, such as field studies.

Regarding those subjects that are more related to social and cultural analysis and product semantics, these programmes generally require students to put more effort into understanding *users*. Besides general design investigations and activities, students are required to conduct *user research*. This is not optional for students. Instead, it is a compulsory or mandatory element in these subjects.

Apart from the regular requirements, user research activities vary each year in terms of subject and project requirements. For example, one subject may require students to conduct user research that is more related to local or Chinese cultures, while another may require students to investigate a certain class of users using a particular kind or type of products. Even in the same class, a group of students may sometimes be motivated and suggested to explore the lifestyle of a specific age of persons, while another group of students may need to identify and understand the daily difficulties of a particular group of disabled persons.

In undertaking such research, project supervisors (professors or tutors) will generally allow students to have a high degree of flexibility when selecting particular methods that fit their distinct project objectives and needs [4][5]. Before starting their research, research methods, case studies and previous project experiences have to be presented to students so that they can gain some insight and direction for starting their projects.

CASE STUDIES

From mid-2004 to mid-2006, studies were conducted in order to understand the performance and comments of students in the design subject, particularly as they related to social, cultural and humanity issues. These design subjects were project-based in the sense that students needed to go through the whole design process. Depending upon the nature and requirements of the programmes and subjects, some projects required students to carry out the project individually, while others called for projects to be conducted in small groups.

Each student or group of students (in a group project) were required to achieve the following:

- Identify problems and needs;
- Identify a project title;
- Set up project aims and objectives;
- Establish design considerations and specifications;
- Conduct project research;
- Propose design solutions/ideas;
- Develop a final solution/idea;
- Implement the solution/idea;
- Evaluate and test the outcome.

In order to suit different curricula and subject contents, the above items (that is, the nature and contents of the design process) were not fixed and might not be in this order. Indeed, these items could be amended with reference to different subject objectives and project requirements. For example, the *design process* suggested to students might be different in different subjects.

The nature and requirements of design solutions might also differ. For example, students were sometimes required to focus on writing and presentations to report their findings and design directions, while at other times, they were asked to produce prototypes and, in turn, to have more on-site or user testing [6].

The main objectives of the studies conducted from 2004 to 2006 mentioned above were to understand how students responded to, and performed in, the required user research activities.

The methods of study included the following:

- Observations on project development:
  - Throughout the whole project development (ie the design process), students' performance levels were observed;
  - The focus was on their attitudes and performance in user research activities;
  - The project supervisors worked as the observers;
  - Unobtrusive observations during the project supervision and tutorials in studios or classrooms were conducted [7]. These kinds of observations maintained a natural environment for students to perform in, while still enabling supervisors to note down their behaviour [8].
- Interviews with students:
  - Several students were selected randomly from each class for in-depth interviews;
  - Participation in the interviews was voluntary;
  - In order to minimise students' anxieties, the interviews were conducted in a casual atmosphere [9][10];
  - Students were also promised that their responses would not have any association with the results of their projects;
  - The questions were semi-structured, prompting the participating students to elaborate on their comments and feelings [10][11];
  - The topics for interviews were related to students' perceptions, attitudes and experiences in user research, for example, their practical difficulties in conducting user research, concerns and satisfaction with regard to the research process, and comments on the curriculum arrangement.
- Reviews of project output:
  - The project supervisors reviewed the nature and quality of the output of the students' projects;
  - The focus of these reviews was on the issues of users. For example, the supervisors compared the areas and weighting of consideration given to users in these projects with those in other subjects that did not have the requirement of user research;
  - The reviews did not compare the quality of work among students. That is, the reviews were intended to

reveal the nature and emphasis of the projects, for example, the degree of social concern or product aesthetics.

RESULTS AND DISCUSSIONS

The findings of the studies revealed several major points worthy of discussion and further investigation. They do not only relate to the technical issues of conducting user research by the students, but more on their perceptions, attitudes, value judgements and behaviour with regard to user research.

The findings also indicated some wrong perceptions of the public and professionals in the design and engineering industries. In fact, such types of perceptions continuously and significantly affect the development of user research. These findings included the following:

- There were deviations between students' perceptions and behaviour with respect to the importance of user research, as follows:
  - Although neither design students nor engineering design students disagreed with the importance of user research, they had quite negative reactions to it. In particular, when the projects started, a significant number of students tended not to take user research seriously. Put more accurately, design students, in general, seldom denied the importance and value of user research as well as other kinds of research. They also seldom refused the importance of giving more consideration to users' needs and preferences. However, the observations indicated that what students perceived or verbally agreed was important might not be reflected in their actual behaviour. That is, a significant number of students did not take research work seriously. Many of them only saw it as a compulsory stage or a kind of project requirement. Students just wanted to complete their task as quickly as possible in order to fulfil the *requirements*, but without the careful implementation of the research work [6];
  - As some other studies conducted since 1999 have revealed, many students still pay most attention to the final outcome of their projects [4][12][13]. These studies also indicate that this is not only because of the unbalanced weighting of the assessment system, in which the final outcome was given greater value than the process used to arrive at it, but also the result of the usual practice of the design process, in which all of the work carried out in the earlier stages of the process seemed to be directed solely to the final output [14];
  - Industry practice was also one of the factors that affected how students saw the importance of user research, as well as other research work. In the past, design research – even in industry – has mainly focused on functional and marketing research. Although both claimed to consider clients or users, user experience was still relatively less of a concern. In turn, this practice gave the impression to students that research on user experience was not practical in design applications. Nevertheless, fortunately, there have been some changes to this situation in recent years. More design professionals and companies have started to place greater emphasis on the topic of *user experience* and, in turn, to conduct more user research;
  - The observations and interviews in the case studies illustrated quite a significant change in the students' perception of user research. As some students pointed out, more practice in user research would enable them to better understand the *pros* and *cons* of this kind of research. The pros included the possibility of revealing the real needs and expectations of users, while the cons included the difficulty of facing and having a balanced consideration of the real dilemmas of different and diverse needs and expectations. As one student pointed out in an interview, a designer disregarding this kind of research in design was merely lying to himself/herself.
- Students did not know how to conduct user research, as revealed by the following:
  - Particular subjects that focus solely on research studies and methods are rarely seen in current design and engineering design curricula. Most of the time, the current practice in design programmes is that one to two particular research methods are incorporated in particular subjects in a programme. The advantage of this type of curriculum arrangement is that students can apply certain research methods in particular subjects and cases more practically. Some educators also maintain that such a syllabus arrangement can, in turn, arouse the interest of students in learning research methods. However, it also has the negative outcomes and limitations that some research activities (ie approaches, methods, tools) may be overlooked;
  - In fact, little emphasis on user research methods, as well as other research elements in programmes, also gave a wrong or misleading perception to students that research was not important in their professional-oriented programmes;
  - Although user research is more popular now, according to the observations, very few students had experience in it. When asking students about the meaning and objectives of user research in the early stages of their projects, most of them could not give a clear and well-defined explanation. Quite a large number of the students thought that user research was simply equivalent to social research. In fact, they could only name the terms and activities, but did not know or understand the rationales, meanings and objectives of such terms and activities. They also did not know how to use appropriate and effective methods or tools in order to understand particular groups of users' needs and preferences, for example, older people, children, blind people, etc;
  - In the evaluation sessions conducted at the end of the design subjects, the students agreed that the methods and tools of user research introduced in the design subjects, for example, an observation field note recording sheet, were useful. As they pointed out, according to their previous experience, some tutors and project supervisors only reminded or required the students to carry out some investigations into the

needs/requirements of users. However, there was a lack of plans and systematic guidelines to help the students to enrich their knowledge and experience in user research.

- Greater understanding of users led to a different focus of project development as follows:
  - The observations and interviews showed evidence that the students' attitudes and their project focuses significantly changed after they began to take conducting user research more seriously. As agreed by some students in several subject evaluations, the knowledge and experience obtained from user research made them take this kind of research more seriously;
  - Some students also noted that, after conducting user research, they *respected* users' individual and particular needs and aspirations more. As also affirmed by them, such respect was based on an in-depth understanding, and this understanding came from their findings and experience of user research;
  - The students further agreed that having increased contact with users and knowing more about them they tended to generate ideas from the users' perspectives, ie their own wants, preferences and needs. As identified above, the reason was that they would have a more in-depth understanding of users, not only according to their professional judgement as designers;
  - Students agreed that they were willing to spend more time understanding users after gaining experience in user research. Taking a subject related to design for persons with special needs as an example, after spending time interviewing and then understanding particular groups of persons with special needs, some students pointed out that they would like to spend more time on user research in their future projects. In another example, some students identified that they would like to spend more time on children's issues after they conducted a playground research and design projects in a public housing estate;
  - According to the observations and reviews of the project outcomes, the requirements of user research brought some drawbacks to the students' designs; that is, physical outcomes or presentations. For example, students spent less time on project development and implementation. On average, the quality of the outputs with respect to the product workmanship and presentation visual quality was not as good as before. As agreed by the supervisors, as well as the students themselves, there was a trade-off in time management when students were required to spend more time undertaking user research;
  - The students also mentioned frequently that they were grade-oriented. They were also under pressure from the examination-oriented (or assessment-oriented) education system of Hong Kong. Even though they knew the importance and advantages of conducting user research, as well as other research activities, without support from the project supervisors and tutors in the form of higher weighting on research implementations, findings and analysis, they would still place less emphasis on user research activities.
- Increased willingness and confidence to conduct user research in other subjects/projects:
  - The students identified that they might not undertake the same volume of user research in other subjects or projects. They agreed that it significantly depended upon the nature of the subjects and the weighting of the assessment;
  - Nevertheless, according to the evaluation feedback conducted in the last lesson of each subject (after the final presentation), most students agreed that user research activities had changed their thinking/ perception of the importance of this kind of research;
  - Most students agreed that the research activities provided experience and, in turn, increased confidence for the students to conduct more user research in their future learning activities. However, the students also agreed that they could not be sure as to whether such experience could be really applied in other projects. In fact, many of them, particularly those students who had studied conventional engineering subjects before, were conducting user research for the first time;
  - Moreover, this kind of confidence in conducting research did not necessarily imply that the students agreed that they had gained a higher level of understanding of users. Instead, quite a lot of students pointed out that undertaking more user research emphasised to them that the *user* was a difficult consideration in the design process. It was also the reason why some of the students still felt confused as to how to make decisions on their idea development. They indicated that the diverse needs and aspirations of users *made them feel crazy* about fulfilling users' needs. For example, a group of students conducted a study on older persons' wants and needs inside an elderly hostel. In the project presentation, the students pointed out that, even inside a small hostel with a small number of users (namely, older people and workers), there were different expectations that were always quite contradictory. That is, the more they knew, the more difficult they would find it to proceed with their idea development. Nevertheless, as discussed above, the students were still more willing to respect users' choices and look at the design issues from the users' perspective.

SUMMARY

User research is necessary and important in design practice as it is practically the only way to produce a design that fits the needs and aspirations of users [1][6]. In other words, although designers' experience and imagination are very important, without a careful investigation of users, all of the so-called creative and innovative outputs are probably groundless and mostly based on *guesswork*. In fact, many cases and experience identified in recent years prove that most of the failures in designs are due to the disrespect, misunderstanding and lack of concern regarding users' actual wants and needs [15][16].

User research is very important as part of the data collection for design considerations. However, identifying how to incorporate user research activities in design programmes for students is a crucial point. According to the case study above, it would be better if user research could be organised and

introduced into the curricula in a more systematic manner – a more regular way. According to the results of the subject evaluations conducted in 2004 and 2005, besides gaining practical experience and knowledge, the students' attitudes to, and their perceptions of, user research were significantly changed after undertaking user research. They considered user research as being relatively more important in design professional practice.

In fact, it should be considered that it is the most important objective and value of incorporating user research experience to students. It should be agreed upon that it is impossible to teach students to know all the user research methods, especially as they are easily outdated or changed in order to match up with the changing needs of society and users. However, an appropriate perception and attitude in respecting users is more than everything.

As the students also agreed, it is a fact that user research did not make them feel easier in dealing with users. Nor did user research give them the confidence to say that they knew users better. However, this kind of situation is, in fact, the most valuable reason for curriculum planners and project supervisors to incorporate user research activities in design curricula. Once design students know more about the importance of user research and designers' difficulty in predicting and understanding users, they can then consider and respect users more. With this consideration, designers will not *impose* their personal wills and not apply so much guesswork on designs that users are forced to follow. It is only through greater user research that design students, ie future designers, can gain increased confidence and evidence to produce designs with a higher degree of *userfitness*.

AUTHOR'S NOTES

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