Developing an instructional framework for teaching interface design to industrial design students

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Abstract: This study investigates the development of an instructional framework for teaching interface design to industrial design students with particular emphasis on activities and techniques associated with the consumer experiences (emotional characteristics). Various design activities and techniques were compiled and superimposed onto the product development process as to explore the feasibility of each design tools in the context of the experience-based design framework. Exploration – Finding - optimization model was identified as steps for the instructional structure. With this mode in mind, a group of industrial-design students at the Woosong University and University of New South Wales were asked to develop a software application for a certain types of mobile phone handsets. In the exploration phase, students were asked to generate user requirements by incorporating both traditional and experience-based research techniques. However, consultations with the students' works reveal that students who employed traditional research techniques tend to reflect only the cognitive aspects of the target user groups. To increase students' awareness of the experiences – based research approach, user scenario and diary keeping methods were introduced. Students' reports and proposals were reviewed to measure their level of understanding of the consumer experiences. Design activities and techniques were also reviewed at the finding and optimizations phases and students' works were analyzed through subjective evaluation and consultation. Through the project review, the author found that this new instructional framework with careful consideration of appropriate research techniques enabled students to restructure design problems away from conventional or tangible, parameter-driven design requirements and to discover concepts and ideas that would later form the basis for rich design outcomes.

***Key words*: Interaction Design, Community Design, Design Education**

1. Introduction

The user-centered design approach challenges design society to pay more attention to the activities and techniques that have been developed in other disciplines that include marketing, usability engineering and social science to meet ever-increasing consumer needs and requirements. Employing the concept of "consumer experiences" as a way to capture and understand consumer needs at the early stage of the design process was suggested among several design educators and researchers (Jordan, 2001; Cain, 1998; Sanders, 2000, 2002).

Knowing the fact that generating appropriate design requirements is the key for success in the user-centered design approach, Sanders (2000) argued that the traditional user research techniques reflect only the cognitive and physiological aspects of the target user groups, which leads to generate cognitive and physiological requirement of the product. While this approach has been successful for developing usable and useful product functions, it hasn't been quite successful in creating desirable features in most consumer products.

Various approaches and frameworks for generating sufficient consumer requirements were proposed (Jordan, 2001; Cain, 1998; Sanders, 2000). Jordan suggested new human factor-based product development framework,

which expands the scope of the user research into four different areas that include physio, psycho, socio and ideo characteristics. Cain' experience-based design framework (1988), which asked designers to employ current consumer experiences with the products as a source for new product enhancement, offered the theoretical framework for the development of instructional structure (refer to figure 1). Sanders (2000) also suggested the "design for experiencing" framework as a way to generate suitable consumer requirements by exploring three levels of consumer experiences (refer to figure 2). She generated several unique user research techniques for facilitating user understanding at the early stage of the design process.

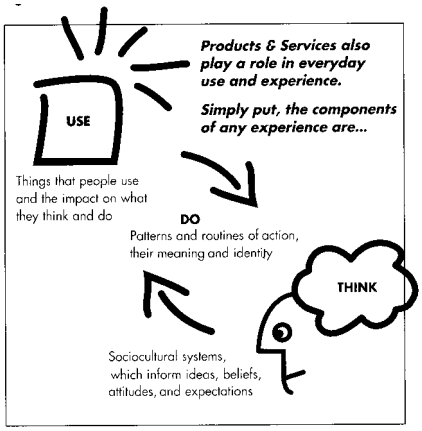

Fig 1. Experience-based Design Framework (Cain)

While these frameworks have different names and styles, they all seemed to stress the ethnographic nature of the research techniques and try to bring "consumer experiences" into the "design for experiencing".

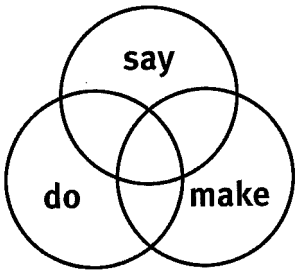

Fig 2. Framework for Design for experiencing (Sanders)

Confronted with ever-increasing design activities and techniques in the design education, industrial design students become confused. Whilst the above design activities and techniques can be understood individually, it is not clear how each design activities and techniques interact and relate to the whole product development process. Therefore more research with instructional design is needed in order to better inform the educational process and improve the attitudes, knowledge and design skills of graduates.

2. Instructional framework for teaching interface design to industrial design students

Given the consumer research models (Jordan, Sanders, Cain) superimposed onto the user-centered design approach, the author could clarify a list of design activities and techniques that can be incorporated into the instructional structure of the industrial design program in table 1.

Table 1. Design activities and techniques for new instructional framework

Stages	Design Activities	Techniques
Exploration (Product Planning)	User Profiling	User scenarios using user experience Diary Keeping
	User Requirements List	
Finding (Task Clarification)	Task Analysis	
	Product Personality Profiling	
	Design Requirements	Scenarios of use
Optimization (Concept Generation & Evaluation)	Interactive Design Development	USECASE Study Sequential Diagram Navigation Design
	Form Design Development	
	Design Evaluation	Usability Testing

Design activities and techniques were reviewed based on the general product development process and categorized into the exploration, finding and optimisation phases (refer to figure 3) as a fundamental instructional structure for industrial design studio program.

Using the instructional model (refer to figure 3), a group of industrial-design students at the Woosong University and University of New South Wales were asked to develop a software application for a certain types of mobile phone handsets as a part of their final studio class project.

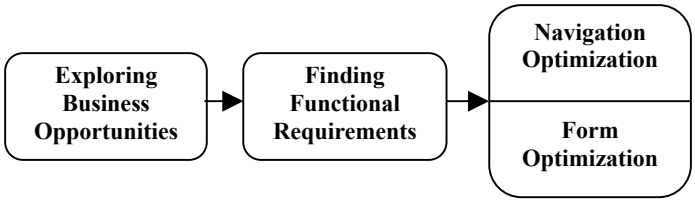

Fig 3. Suggested Instructional framework

Instructions were given as to familiarize the user-centered design issues, usability testing, user requirements and human errors along with the product development process. To be successful in the project, the students should follow a series of design activities and techniques generated in each stage that include user profiling, user requirements, task analysis, design requirements, navigation design development, form development and usability testing.

Student consultations and review of their reports in each stage were the major source for the evaluation of the suggested instructional framework. The following section describes the procedures and findings of the study.

3. Instructional Framework that incorporate experience-based research techniques superimposed onto the product development process

3-1. Phase I: Exploring user opportunities based on consumer requirements

In the exploration phase, the students (in groups of tow) were required to generate appropriate user requirements using a range of information sources and research methods, which include both traditional and experience-based approaches.

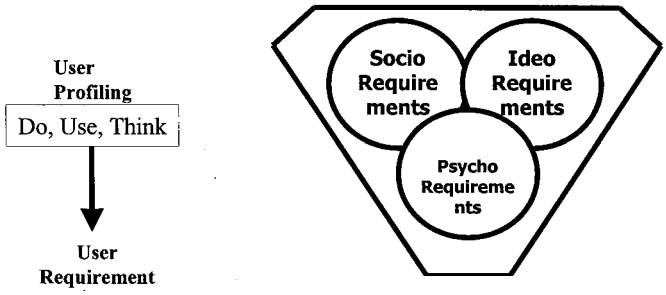

Fig 4. Exploration of user opportunities

However, consultations with the students' works revealed that students who employed traditional research techniques tend to reflect only the cognitive characteristics of the target user groups in their user requirement reports. Words like "busy", "need to be organized", "quick", "simple", and "easy of use", "convenience" were the most common languages that has been employed in the user profiling reports. These user profiling, which are not sufficiently reflect personal and social needs of the target user group generally lead to generate full of functional and logical requirements of the design.

To increase students' awareness of the experiences – based research technique, user scenario methods were introduced as these techniques enable students to explore various aspects of consumer characteristics in user profiling development. The following is the sample of the user profile concerning cognitive, physiological, identity and social issues at the same time by employing time-based scenario writing technique:

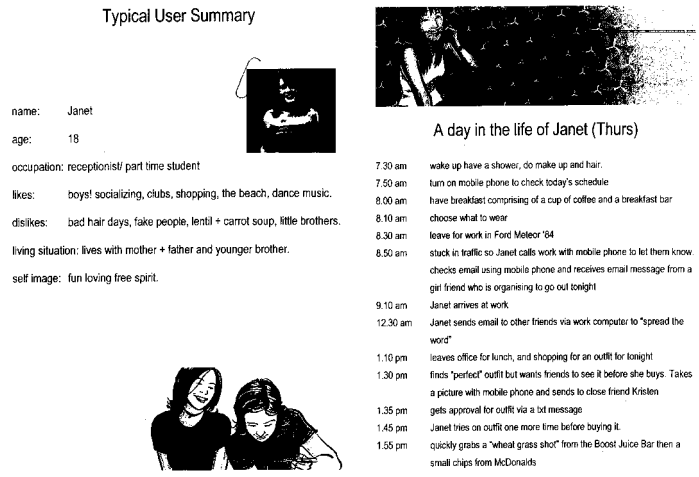

Fig 5. User Profiling using scenario technique

The user scenario technique reveals different types of information about user and context of usage, which generally require thorough analysis thinking to be used as a source for the next idea development.

With the user scenario report, functional requirements of the application can be easily generated. For example, Janet (hypothetical character) wants to ask opinions about an outfit that she found at shopping situation. In this situation, Janet might want to have a flash feature on her mobile phone camera since she want to have a very clear picture. And the keypad should have a back light feature so that she can operate functions while she clubbing. Descriptions on the context of use generally enable student to generate personal identity and social requirements of the application. Words like "Clubbing", "Private", "Secret" and "Personal" were used as to describe the main target's personal characteristics and social needs.

Following the investigation on user scenario, the results were compiled in the form of experiential quadrants, where new functions and features are identified and interpreted as expected experiences. The experience quadrants technique was introduced as a way of comparing current experiences with expected ones, which was initially suggested by Pine and Gilmore (1999), providing two-dimensional spaces (shown in figure 6). Whilst experiences are very personal things, various types of consumer experiences can be described within this quadrangle space..

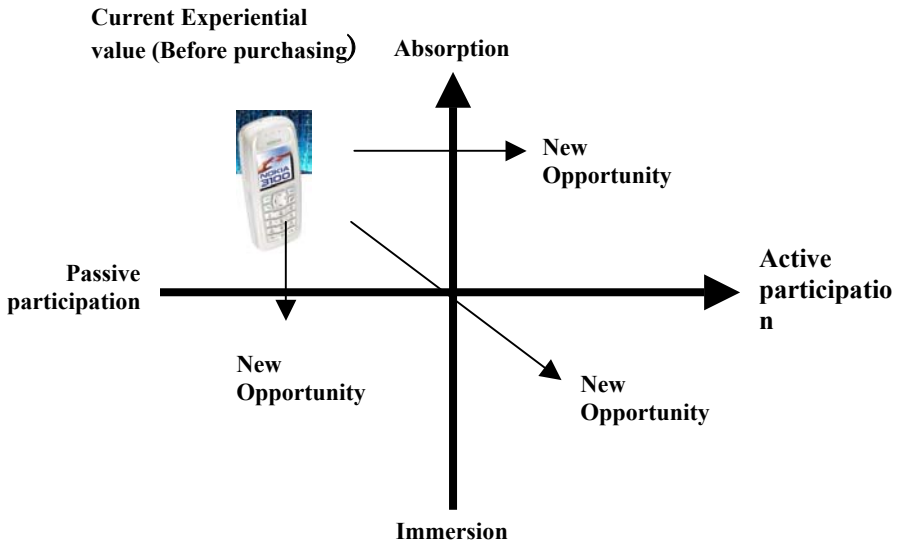

Fig 6. Experiential quadrants

For example, "watching a phone at the shopping mall" experience is very passive and absorbing in nature, however interaction with the device generates quite different experiences. One is more active than the other.

Using the examples located with the quadrants, any type of consumer experiences can be clarified and compared with two distinct characteristics of

experience: the degree of participation and the degree of immersion. In the above examples, “watching a phone at shopping mall” and “performing a certain task in daily life situation” experiences were compared by extent of participation and immersion. What flows from the ‘positioning’ of experiences is that certain types of experience can be intensified, broadened, transformed and artificially generated. Knowledge of the category and positioning of experience enables the modification of the experience to meet certain marketing objectives.

The making of experiential quadrants enabled the students to focus on experiences associated with function and features of the product.

3-2. Phase II: Finding functional requirements

In the previous phase, the students were encouraged to develop a user scenario and user profiling as a way to identify user requirements. These investigations led to the development of the design requirements, which involves functional and emotional requirements of the products (refer to figure 5).

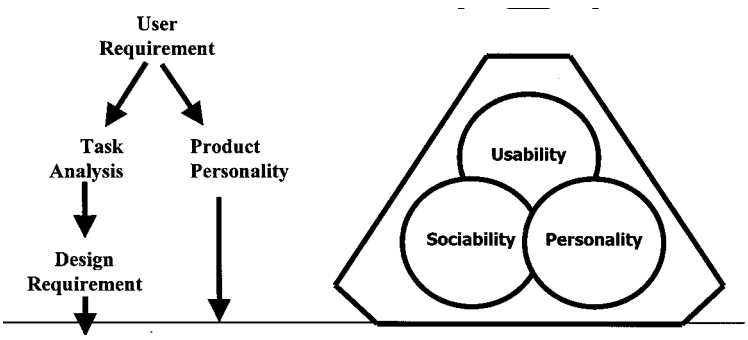

Fig 7. Finding Functional and emotional Requirements

In order to accommodate considerations of usable and useful issues associated with most modern interactive system, the finding phase includes basic activities with three additional modules that focus consideration. With reference to figure 7 the usability, sociability and personality are included to facilitate consideration of the outcomes of each design activity. The stages can be used for discussion with users and observations of use, or subjected to more formal user testing in order to extract detailed information about usefulness and usability.

The investigation on usability helped the students to identify a list of functional (physical and cognitive) requirements of the system (refer to table 2) whilst sociability and personality engaged the students to evaluate emotional, social and personal aspects of the system interaction by simulating the different ways in which people might access those functions.

Table 2. Task analysis and functional requirements

Tasks	Action to be made by users	Physical requirements	Cognitive requirements
Selecting a place	Using scroll button to highlight a venue. Pressing the key that controlled with ‘select’	Slight variation of the power grip on phone. Downward movement of the thumb.	Understanding how the phone works. Hand eye coordination

In this case, students were asked to explore usability, sociability and identity aspects of the interactive system to generate design requirements. As a way to meet usability requirements of the system, task analysis and cognitive walkthrough methods were introduced to generate a navigational structure of the system (refer to figure 8).

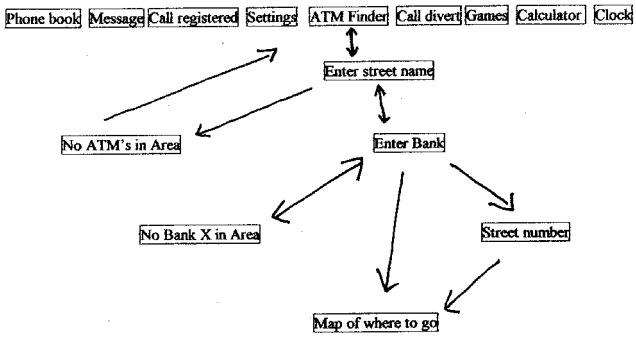

Fig 8. Samples of system structure

To generate emotional requirements of the system, the following scenarios of use were generated to explore the possible social and identity issues involved in the product development. The figure 9 shows various scenarios of use where social and identity issues can be explored.

Fig 9. Scenario of use

After identifying usability, sociability and identity aspects of the design requirements, the expected consumer experiences were generated using the experiential quadrants techniques. Scenario of use revealed participants' value, lifestyle and social images. Task analysis was good at revealing cognitive aspects of consumer – product interactions. For these findings to be a real source for the design concepts development, experiential language has to be further investigated.

3-3. Phase III: Optimization

The design requirements were generated with respects to the usability, sociability and identity, with which students were able to develop interactive and formal part of the product design. For the navigation design, techniques that include task analysis, scenario of use, use case study, sequential diagram and menu grouping were employed as a source for the storyboard development of the program. Design elements like color, buttons, layout, background, feedback dialog-box and link style were depicted as an interface guideline. Graphic interface-style and guidelines were generated as to reflect identity and social characteristics of the target user groups (refer to fig 11). For example, Internet shopping applications reflects identity and social characteristics of the housewives, while educational applications choose design elements for elementary kids.

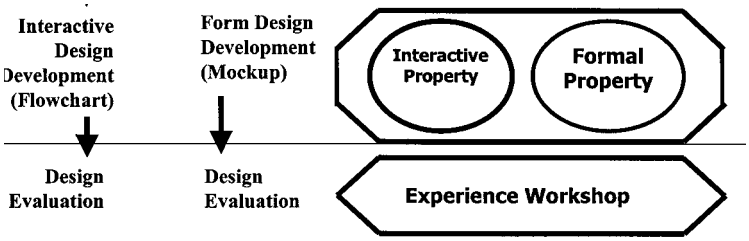

Fig 10. Activities and deliverables in optimization phase

However, communication of personal and social characteristics embedded into the navigation system using buttons, color, layout and background images were considered very limited.

Fig 11. Samples of graphic user interface design guideline

4. Conclusion

Consumer needs and requirements have to be expressed through a formal property of the product. However, the usability approach hasn't been successful in expressing these values since the usability property can only be experienced after the product has been purchased. In order to tackle these issues in the product development process, incorporating consumer experiences at the early stage of the process was suggested.

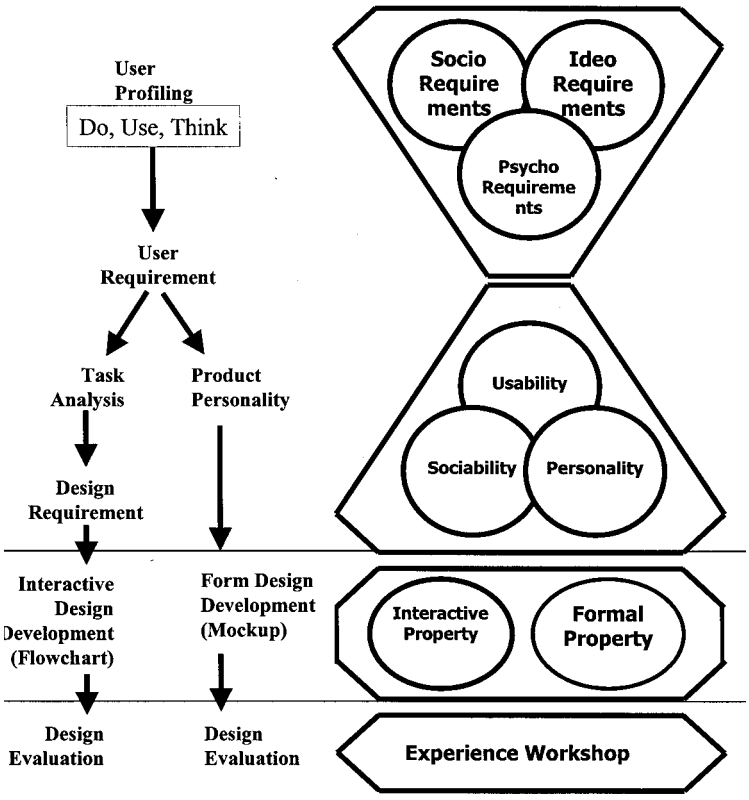

Fig 12. Final instructional structure

Various design activities and techniques were reviewed and the new instructional framework was suggested. Exploration – Finding – Optimization model was developed as a way to tackle personality and sociability issues in developing design brief. Consultation with students' work reveals that introducing experiential property such as emotion and personality at the consumer research and the design brief phase encourage students to expand their concern to the area of social, ideo and cognitive aspects of consumer characteristics.

Through the students' exploration, the author concluded that this new instructional structure enabled students to restructure design problems away from conventional or tangible, parameter-driven design briefs and to discover concepts and ideas

that would later form the basis for original and sustainable solutions. And the author also found the instructional framework to be extremely valuable for the students as it did facilitate the design-thinking principles even in the early exploration phase of the process.

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