Acquiring User Interface Design Skills through Experiential Learning

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Abstract:**In these days of intuitive and intelligent software systems the audience is not going to put any effort into using the product, application or operating system – they'll expect it to be obvious. The perception of any software is driven entirely by its User Interface (UI). Usable software sells better and unusable software is abandoned. Designing usable UIs is challenging and instilling such designing skills in students is even more challenging. This paper investigates Experiential Learning methodology used to imbibe UI Designing Skills in students through the course "Principles of User Interface Design". The primary objective was to attain Graduate Attributes/Program Outcomes (POs) 1, 2 and 3 as defined in the Outcome Based Education (OBE). The approach comprised of two main activities– Identifying Good UIs and Bad UIs and Designing UI Prototypes. A rubric based assessment was used to test the concepts' realization among students. Though thisnovel approach did not claim to have given students deeper knowledge in UI designing, it did aim for a useful foundation. The approach can be adopted in designing good UIs in mini projects and capstone projects.**

Keywords: User Interface Design, Action, Reflection, Experiential learning, Cognitive walkthrough.

1. INTRODUCTION

The perception of any software application or business is represented by its User Interface (UI). The UI facilitates the user to communicate with the software or business. It is displayed in terms of pictures, sounds, colors and text. The UI makes software either usable or unusable. Therefore, UI plays a vital role in creating an impact of the entire system on the user. A good UI design will be successful in communicating the intended impression to the user. The UIs have been offering personalization framework to the users. These frameworks provide the users with the options to choose and control interface preferences like defining own menu structure, selecting a theme for the menu and changing profiles and shortcuts [1]. Software applications are often judged by their interfaces rather than their functionality by the users [2]. Teaching students to build better UI designing is a challenging task.

This paper presents the experiences of the approach used to deliver the course "Principles of User Interface Design" offered to the MCA freshmen students. The course aims at building strong foundation of UI Designing in the students. It enablesthe students to understand the Human-Computer Interaction theory and practice. Further the course demands the students to be actively and personally engaged in the process of exploring, investigating and designing UI for software. Following are the course outcomes –

1. Analyze existing user interfaces to Identify design elements.
2. Apply design principles, guidelines and heuristics in creating a user-interaction approach that will facilitate in solving a real-world problem.
3. Design a usable low-fidelity user-interface for a given set of requirements using technologies the student is familiar with.

The course outcomes aim at integrating the theoretical and practical elements of learning. Experiential learning methodology was adopted for the delivery of the course concepts. The methodology focused on enhancing the designing skills through cognitive actions. It stimulated reasoning abilities in studentsand emphasized the significance of experience for learning [2].The techniques used in the approachincluded, a set of interactive practices through which,the students had opportunities to learn from their own and each other's experiences.

Through Experiential Learning the instructor can create a space for students to learn through their own experiences leading to self-discovery. It engages the learner as a self-teacher and hence, the learning activities involved should be personally relevant to the student. As the course demands students to connect concepts with the real world, the Experiential Learning methodology was chosen. They were able to instantly connect with the concepts being studied, rather than just observing, reading or imagining about them.The following sections present the techniques applied throughout the course.

2. THE PROCESS

The process began with grouping of students in teams of four to five members. Each team was supposed to perform in two activities. The first activity was "Investigating good and bad UIs" and the second was "Designing User Interface Prototypes" which was further divided into sub activities – Task and User Analysis, Initial Design and Cognitive Walkthrough, HTML Prototyping. Figure 1 shows the division of the process.

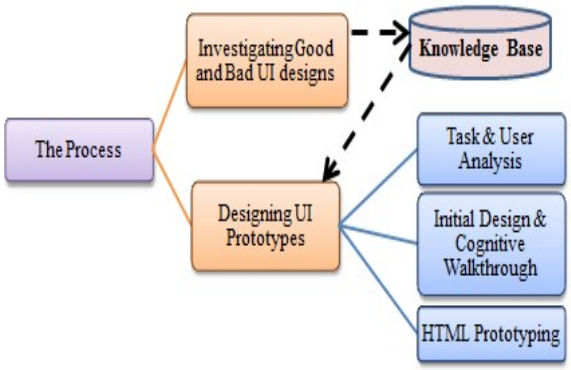

Fig. 1 The Activity Process

A. Investigating Good and Bad UIs.

The main motive of this activity was to educate students about the basic principles, design standards and methods used in UI designing. It intended to accomplish the first course outcome and Program Outcome (Graduate Attribute) 1 – Computational Knowledge. The introductory classes presented a set of case studies that dealt with the basic concepts of UI design. Based on these case studies each team was asked to choose and present examples of Good UIs and Bad UIs. A good UI design would be Simple, Easily Learnable, Efficient, Consistent, Predictable, provide proper error handling and prevention, informative feedback, reversal of actions (undo/redo) and shortcuts for frequent users [3]. The right of mix of patterns, metaphors, colors, typography and modes would make a UI usable. On the basis of these parameters students investigated various UIs and chose a set ofgood UIs and bad UIs each and presented the same. They substantiatedtheir views onthe usability of a UI design. While investigating UI design examples and differentiating good ones and bad ones, the students used their experiences of various UI designs of existing software they were acquainted with. This played an important role in mapping the practical experience and theoretical conceptualization. The students were able to reflect upon their experiences and relate them with course concepts.The activity involved the students in observing the phenomenon being taught and to get in touch with it directly. The process of identifying the goodness of a UI is the basis for designing a good UI. In this regard the activity allowed the students to experience the key concepts of the course. By the end of this activity most of the students could differentiate between good and bad UI designs. They could develop a knowledge base of characteristics of UI designs which was used in further activities.

B. Designing User Interface Prototypes

This activity directed the students to build UI prototypes using the basic knowledge gained about UI designing and their own experiences of using various UIs. The activity was conducted in three phases. It proposed to attain the course outcomes 2, 3, Program Outcome 2 – Problem Analysis and Program Outcome 3 – Design/Development of Solutions.

1) *Getting to Know Users and Their Tasks (Task and User Analysis):* This activity was planned to train the students in collecting the requirements from the users and their analysis so that they could learn about the users and their tasks.Analyzing user types is utmost important for designing an UI. In this attempt the students were instructed to categorize the users into technology no-voice users, professional users and teenagers. Each category has its own perception and expectations about an UI. The novice users get annoyed with a difficult and complex interface. They look for an easy-to-use UI. These users may easily get irritated if they have to change their habits in using UIs of different applications. Hence, for no-voice users familiarity between

different UIs is very important. The category of professional users who are frequent users of software applications demand intelligence from a UI. They require efficiency the most and want the UI to avoid administration tasks. Teenagers are extensive users of software applications. They easily gain acquaintance with any UI. Also, they are more excited in learning new experimental designs.

Each team was provided with a small application or selected tasks of an application by a faculty member. The teams interviewed the faculty members on how the application tasks would be done by each of the user type analyzed previously. They were asked to focus on the need to store and update data but not on how it will be loaded into the computer. The teams created use cases from the requirements collected. At the end,each team submitted a documentconsisting of the following:

1. A description of the users interviewed.
2. The general characteristics of the expected system users (age, education, etc.).
3. A description of at least five scenarios of system usage. The scenarios would represent the different instances of the user using the system. These scenarios presented the most important functionality of the interface.
4. A list of the basic tasks (use cases) the system would support.

These exercises encouraged the students to work through open-ended problems. Each student played the role of an UI designer while interviewing the faculty members. The teams analyzed the collected requirements of the tasks and studied them from the perspective of the three different user types analyzed. In experiential learning, personal experience is the focal point for learning [4]. Hence, the students had an opportunity to correlate their experiences of using UIs similar to the requirements they collected. After spending some time on debriefing, they defined the general characteristics of the expected system userssuch as age and education. Further; the teams prepared a set of scenarios representing the important functionality of the interface. To do this, teams used Story boards that helped them in planning and organizing the UI [5]. This method allows students to perceive the interconnections i.e., “how one idea relates to another and how pieces of information come together”, before the design process begins. Finally, the teams made a sanity check on the list of basic tasks to ensure that the scenarios didn’t miss out anything critical. Figure2 presents the scenarios written by teams for this activity.

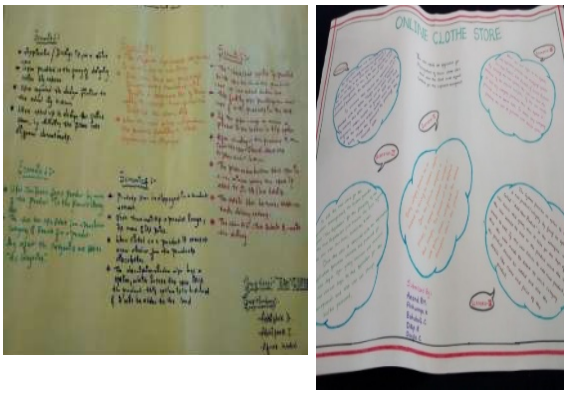

Fig. 2 User Scenarios

2) *Creating the Initial Design and Cognitive Walkthrough:*In this phase the teams used the document prepared in the previous phase to produce an initial description of the interface and perform cognitive walkthroughs on it. Students brainstormed to develop ideas for possible solutions. Brainstorming technique helped them to evaluate ideas generated and isolate the impractical ones. The teams finalized on simple designs, structuring of data entry, look-and-feel and layout that addressed important usability dimensions. Paper prototypes were prepared and the teams did a walkthrough on the snapshots to ensure the accomplishment of all the collected requirements. Further, these prototypes were tried with the Faculty members who provided requirements. The prototype had to probe the user and provide the user with a feel that the designs initiate actions. Feedback was an important aspect that was supposed to be addressed in the design. Teams observed and recorded the user’s walk through of the prototype. The user feedback was reflected on the design and process was reiterated until the said changes were done. A write up on the following was presented by the teams –

1. An overall description of initial UI design.
2. A story for each user action that would answer if –
   - The user is doing the right thing?
   - The correct options are available?
   - The user is able get the action intended?
   - The feedback is provided when a correct action is performed?
3. A description of any problems discovered with the walkthroughs and description about how they were fixed in the revisions of the design.

At the end of this activity students had a growing knowledge of UI designing and were able to integrate theoretical elements with the practical ones. Every

student was engaged in the process.Figure3 presents the paper prototypes prepared by the teams.

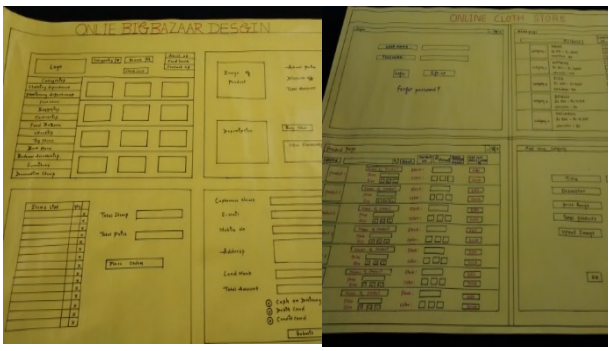

Fig3 Paper Prototypes

3) *HTML Prototyping:* This was the final phase in which the teams prepared a low-fidelity HTML prototypes using the tools learnt in their Web Programming Laboratory. Students were responsible to focus on design patterns, controls, colors and typography. Aesthetics – the visual appeal, ease of use, simplicity, efficiency and reliability were focused in these prototypes. The issues such as use of colors (to avoid red-green and blue-yellow color blindness), symmetry, alignment and spacing of elements and typography were considered the most for the visual appeal. The teams were instructed to deliberate on the layout of buttons, text, table data, tab order for data entry, feedback (prompting, status, warning, error messages) and dialogue sequencing in the design process. Also the designs had to provide users the complete control along with minimum load on the users' short-term memory. Further,the use of metaphors was also focused. Use of metaphors facilitate the designers to transform its logic into learnability element of an UI. Hence, metaphors make learning fast and easy. Sometimes, they also discourse the specific understanding of a certain user group.

These prototypes were tried with the users and the feedback was recorded. The process was reiterated to improvise the designs and incorporate the changes given in the feedback to satisfy the user. The teams came up with a write-up on the following –

1. A description of the transition from paper prototype to HTML prototype.
2. Reasons stating the choice of controls, colors, typography and design patterns.
3. A description of the changes done through the iterations.
4. The overall rating given by the Faculty member for the UI design.

The prototypes helped the students to investigate the design questions regarding the function of the UI, its look and feel and any alternative designs.By simulating the task and observing users' interaction with these prototypes, the teams made significant learning about the usability aspects of UI designs.

3. EVALUATION AND RESULTS

A final presentation was conducted for the teams to showcase their work done in all the three phases. The demonstrations depicted a good degree of student awareness of interface design issues. Also students became aware of trade-offs between the various design principles they had to make to achieve a functionality. It was observed that some students lackedEnglish communication skills and hence were not able to prepare good write-ups.Nevertheless, they ensured their UI design was well informative in accomplishing the tasks collected. A rubric was used by the course instructor to evaluate the students' work done in the entire process. The designs were evaluated for use of simple and natural dialogue; design patterns; consistency; feedback to the user's action; error handling and messages; clear exit marks and documentation. The teams were made to test each other's prototypes for usability while the designers had to observe and document the user behavior. The teams interviewed the users for their reactions about the test. The findings were incorporated into the designs. Each team was asked to state 'how their design was changed as a result of testing'. This procedure ensured evaluation from the instructors' view and end users' view. Finally each student summarized the usability principles learnt from this entire process.Figure 4 below gives the overall view of the teams' performance and Figure 5 gives the percentage of attainment of course outcomes.

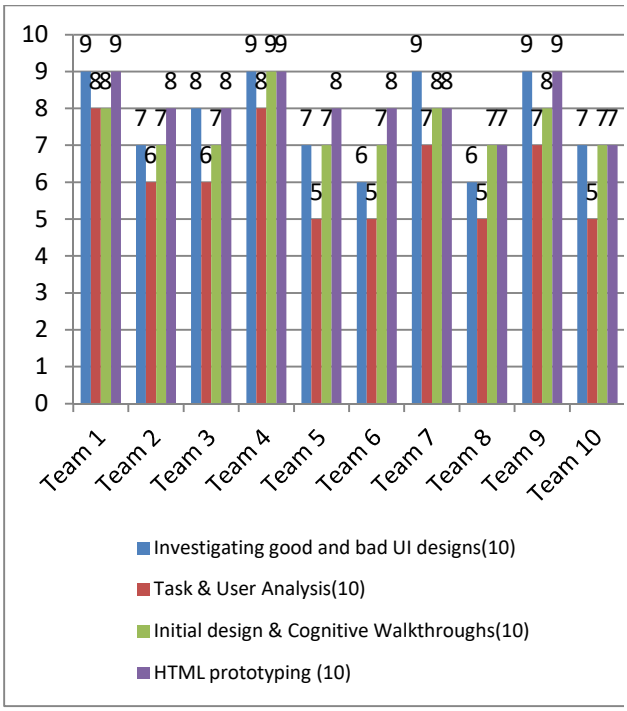

Fig4 Team Performance in Activities

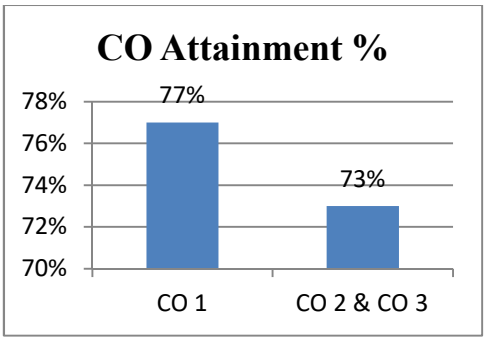

Fig 5 CO Attainment %

4. CONCLUSION

The approach emphasized reflection and promoted long-term learning and sharing of knowledge among students.Though it did not claim to have given students deeper knowledge in UI designing it did aim for a useful foundation. The performance of students depicts that they lacked in the Task and User Analysis activity. This could be a learning experience for the course instructor also and has to be addressed in the next offering of the course. The students could meet central ideas, terms, concerns and practical value of the course concepts. The students' performance reflects the attainment of the following Program Outcomes (POs) / Graduate Attributes put for MCA program.

PO 1 – Computational Knowledge,
PO 2 – Problem Analysis,
PO 3 – Design/Development of Solutions

The process does claim to have achieved the PO 5 – Modern tool usage as the students learnt the tools for designing HTML prototyping in their Web Technology Laboratory. However, students could have performed better if they had more time. This was due to the fact that the students were also loaded with other courses' activities in the semester. In order to evaluate the success of the approach in a better way the end-semester theory examination results for different batches of students need to be compared.Also the retention of knowledge gained from this process can be a good indicator for the evaluation of this approach. This wasn't possible as the approach was used for the first time.

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