Abstract - In this paper, a case study of using faculty research as an educational tool for undergraduate students is described. In this case, a preliminary study aimed at developing an integrated understanding of the functional and emotional aspects of user experience with products was conducted. In addition to the primary objectives associated with this aim, the study serves as a educational tool for undergraduate students in industrial engineering and industrial management. The primary objectives of the study are to explore and use a variety of methodologies for developing an integrated understanding of user experience. Undergraduate students in three separate courses participated in the research by: 1) serving as study participants; 2) observing study sessions; and finally, 3) evaluating results. The researchers used the experience to help students improve data analysis skills and to use the results of human factors studies to identify customer needs. Based on the success of this initial endeavor, a variety of follow-up activities are planned.

Index Terms - Human factors research, product evaluation, undergraduate research, voice of the customer.

INTRODUCTION

Providing hands on opportunities for engineering students to explore key concepts is a cornerstone of effective engineering education. Furthermore, understanding the needs of customers, clients, and end users is of increasing importance for engineers and industrial managers. To successfully compete, engineers and managers will need to develop specific skills to research and assess needs of customers.

The authors are developing potential research opportunities in the area of cell phone design and use. As a starting point, a preliminary study of the physical design of cell phones was developed. Because the authors are instructors in courses specifically related to areas of customer needs assessment and user research, this study was also used to provide educational opportunities for students in those courses.

THE STUDY - INTEGRATING FUNCTIONAL & EMOTIONAL ASPECTS OF THE USER EXPERIENCE

A key objective of human factors engineering in consumer products is to develop products that are "useful, usable, and desirable." A variety of tools can be used to investigate user needs, tasks, environments, responses, etc. These tools include "traditional" human factors techniques (psychology, anthropometry, etc.), as well as tools and techniques borrowed from fields such as anthropology and design, among others. To investigate "desirability," methods are borrowed from design research, personality studies, etc., and new methods are developed to answer specific questions. To develop an integrated understanding of what makes a product useful, usable, and desirable will require a combination of methods and analytical tools.

The initial investigation discussed in this paper focuses on using a combination of methods and analytical tools to develop an integrated understanding of what makes a product both "usable" and "desirable." The preliminary study, which was approved for human subjects research by the Mercer University Institutional Review Board, involves an examination of specific physical characteristics of cellular phones. The study involved a combination of product personality and traditional human performance measures and was conducted using students in one undergraduate industrial engineering and one industrial management course. All participants except one owned and used a cell phone frequently or regularly (the single exception had used borrowed cell phones on business trips and was in the market for one.) Each participated in an experimental session lasting between 1 and 1.5 hours.

In total, nineteen students from two courses (Ergonomics and Work Measurement, and Quality Management) participated as subjects in this study. Each experimental session consisted of two phases. In the first ("storytelling") phase, the participant was asked to describe his or her experience with cell phones, to briefly describe current and "ideal" cell phones, and to tell a true story involving cell phone use. In the beginning of the second phase, participants were asked to become familiar with three different cell phones and to respond to a semantic differential questionnaire designed to elicit participants' view of the "personality" of each phone. After this, participants were asked to dial several numbers with each phone, first while looking at the phone and then without looking. The experimental conditions studied in this phase were the type of phone (see Figure 1), relative difficulty of dialing the phone number, and whether or not the subject was looking at the phone while dialing. Dialing speed and error rates were measured for each combination of
condition. Participants were asked to freely describe their response to each phone as they “practiced” dialing during the performance phase, and were asked to provide a three-word description of each phone and state their overall most and least preferred phone during a final debriefing.

As will be discussed in the next section, in-depth analysis of the study results will be conducted during the summer and fall. However, results from individual phases of the study were used in a laboratory assignment and project to provide a meaningful context to support learning.

II. Determining the Voice of the Customer

After all study sessions were complete, personal reactions to each phone, three-word descriptions, and high and low preference from eight participants were collated into an Excel spreadsheet. Demographic data including age and gender for each participant were also included. Students enrolled in IDM 355 (Quality Management) were asked to complete a “voice of the customer” project in which they were required to use a minimum of three basic quality tools to analyze the data. Pareto diagram was the most frequently used tool. Check sheets, design of experiments including one way and two way ANOVA, and histograms were also used. Although students had previously successfully completed a course in statistical analysis, the challenge in this project was to synthesize a wide variety of subjective responses into useful categories of data. Students who had learned these techniques for primarily quantitative data found it necessary to extend their understanding to include interpretation and manipulation of qualitative data.

III. Human Factors Data Analysis and Modeling

An undergraduate student has been recruited for an independent study course to analyze the full study, build a preliminary model of user experience with cell phones, and define opportunities for future research. The student will also prepare a paper suitable for publication in professional conference proceedings. In addition to the educational experience for the individual student involved in the independent study, the results of the analysis and modeling efforts will be disseminated as instructional materials in a variety of courses, including ergonomics, human factors, quality management, and engineering statistics.

CONCLUSIONS AND FUTURE PLANS

The use of faculty research to teach valuable skills in undergraduate courses has definite benefit, as demonstrated by the study described in this paper. Using a simple preliminary study, the researchers were able to develop instructional opportunities to support three different courses, as well as additional opportunities for upcoming courses.

The usefulness, usability, and desirability of a cell phone is a function of many factors, and include not only the physical and interface characteristics (design, menu structure, features, etc.) of the phone itself but also the coverage and reliability of the service, the quality of customer service, etc. Because of the variety of factors affecting cell phone user experience, there are many potential opportunities for integrating research explorations into individual and class learning experiences. For example, a design project planned for the fall semester Human Factors Engineering course will include additional user research leading to a specific interaction design to meet identified needs. In addition, students in future Quality Management courses will explore the use of semantic differential questionnaires to evaluate cell phone service quality.