

THE VALUE OF A ONE SEMESTER EXPOSURE TO THE INSTITUTIONAL REVIEW BOARD PROCESS *

Tanya Estes, Linda Mallory, and Edward Sobiesk
United States Military Academy
West Point, NY 10996
845 938-3429
tanya.estes@usma.edu

ABSTRACT

Genuinely considering the user experience is an important element of developing usable and acceptable hardware and software. When working outside of a simple classroom project, however, an Institutional Review Board (IRB) approval must be obtained before conducting user studies with human subjects. Obtaining IRB approval is often viewed as a bureaucratic procedure to be endured rather than an opportunity to teach the value and process of conducting user studies. Here, we present our experience educating students on Human Protections Training, seeking IRB exempt approval, and conducting user studies all in a one semester experience. By going through the IRB and user study process, our students learn about the ethical treatment of participants and also experience firsthand the issues and insights involved in critiquing a design that would not have been discovered without usability studies. This best practice is completely in line with curriculum guidelines for computer science from the Association for Computing Machinery (ACM) and IEEE Computer Society requiring coverage of HCI and ethics.

INTRODUCTION

Ethically conducting user-centered design and testing for Human Computer Interaction (HCI) is recognized as a key component of software development and is a recommended part of ACM/IEEE computer science curriculum guidelines [1]. Most computing programs include HCI content at the undergraduate level, but may not require

* Copyright © 2016 by the Consortium for Computing Sciences in Colleges. Permission to copy without fee all or part of this material is granted provided that the copies are not made or distributed for direct commercial advantage, the CCSC copyright notice and the title of the publication and its date appear, and notice is given that copying is by permission of the Consortium for Computing Sciences in Colleges. To copy otherwise, or to republish, requires a fee and/or specific permission.

students to conduct a full usability study outside the classroom. Instead, classroom-based user studies are employed by many undergraduate HCI courses, avoiding the need for students to deal with Human Protections Training (HPT) and gain IRB approval for their studies. This paper argues that going through an IRB process within a classroom experience has multiple levels of value, not the least of which is exploring some of the issues involved in user-centered design and testing.

BACKGROUND

The use of heuristics in HCI provides a form of evaluation in the effort to ensure a usable device or software. Jeffries et al. demonstrated that usability studies “exposed more severe problems, more recurring problems and more global problems than did the heuristic evaluation” [6,7]. Heuristics certainly should be included in HCI instruction, but must be supplemented with a discussion of (and preferably an experience of) usability studies.

Rossen et al. propose using case studies, rather than conducting full user studies, to have students walk through the life cycle model of software [12,13]. They devised three case studies that provided details about the customer, helping to define user requirements and inform design. Students performed classroom based case studies using testing documents provided but not IRB approved studies with recruited users from outside the classroom population. Rossen et al. made a key observation in their paper that “These [the testing documents] are very useful to computer science undergraduates who have never conducted behavioral tests and have little insight into the kinds of questions one might ask.” [12]. This statement points out that it would be ideal to expose computing students to the ethical conduct of studies involving interacting with human users, including the education provided by the HPT needed to apply for approval under IRB.

Cotler et al. make the argument that going through the IRB process “will also help them [computer scientists] to become more ethical researchers.” [3]. If this is the case, why not complete the IRB process? Institutions may eschew the IRB process due to a perception that the research conducted by undergraduates is unlikely to result in “generalizable knowledge” worthy of publication [8] or because the process cannot be completed efficiently in a “standard 16-week term.” [4]. We disagree with these arguments. We believe students who experience a one semester IRB process learn about the ethical treatment of participants, gain improved feedback on their design, and are even able to publish interesting findings.

INSTITUTIONAL REVIEW BOARD

The Code of Federal Regulations (CFR) Title 45, Part 46 covers the protection of human subjects and serves as the primary references for an IRB [9]. The purpose of an IRB is to ensure that informed consent is obtained properly and that participants are not subject to unreasonable risk [9,14]. A misconception is that obtaining IRB approval for usability studies that span only the length of a single semester is difficult-to-impossible. IRB approval times vary between institutions, and the Common Rule makes it possible to add to the basic requirements spelled out in CFR 45 [5]. In a time constrained

classroom environment, however, we think the key to success is ensuring all usability studies conform to the requirements of IRB exempt status. IRBs have three categories: full, expedited, and exempt [14]. A study that qualifies for IRB exempt status provides the advantage of a much faster approval timeline, but must comply with one of six possible exempt scenarios. Most HCI usability studies seek exemption under 45 C.F.R. part 46.101(b)(2) “Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior” [10]. It is advisable to shape possible projects to ensure compliance with these requirements from the start. Early engagement with your Human Protection Administrator makes it possible to conduct studies in a shorter period of time. In our case, IRB exempt applications were completed at least two months before the end of the semester. A valuable part of the experience was showing students “what right looks like” through example study elements. We created a sample GUI and study, along with an IRB exempt application, a user task list, and pre and post questionnaires. For our course, students must design their own GUI and the full user study well in advance of the IRB exempt application being filed. This is because the study instruments and methodology that are approved by the IRB must be the exact same ones that are actually put into play for the study. We found that providing adequate time for a preliminary pilot study is optimal, as many teams discovered study design and questionnaire problems on the first or second runs with participants that could have been worked out prior to the event via a pilot study. A basic illustration of the process we used is shown in Figure 1.

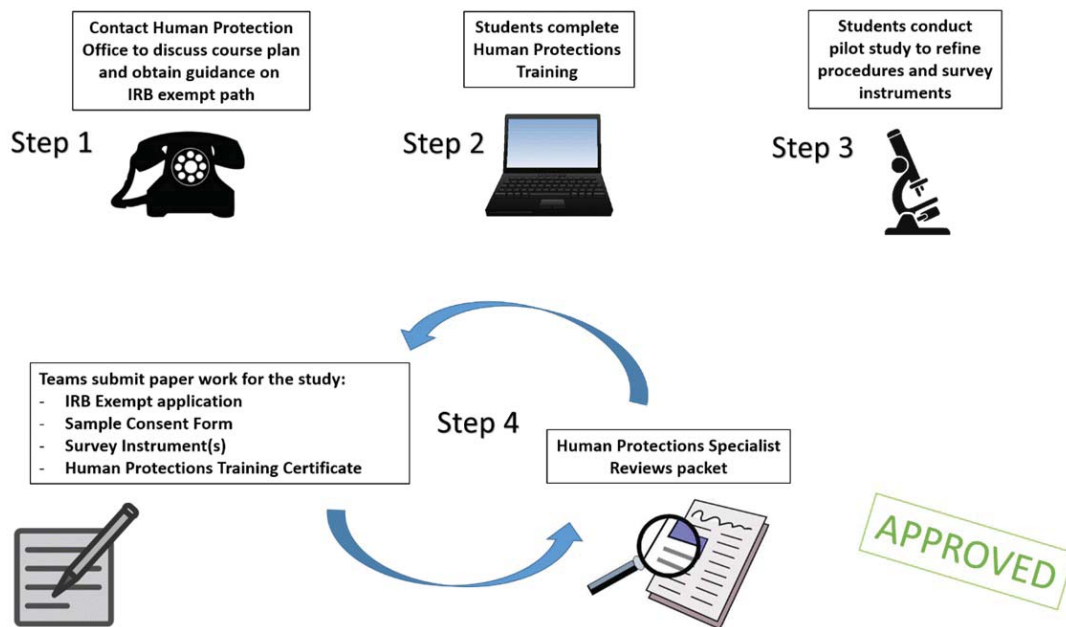


Figure 1. IRB Exempt process.

Project Goals

We now describe the experience of our students completing Human Protections Training and conducting a usability study of a Graphical User Interface (GUI), including

submitting their study for IRB exempt category approval, and then conducting the actual study with participants and writing a paper about their work.

METHODOLOGY

Our course, User Interface Design, is a project-based course that covers HCI concepts. Students build GUIs using the Python module Tkinter. The course project served as the capstone for the course. The project requirements consisted of several assignments leading up to the final turn-in. Students worked in teams of three to four people. All students were required to complete Collaborative Institutional Training Initiative (CITI) [2], our HPT, in order to be qualified to conduct usability studies through the IRB approval process. The first assignment consisted of a briefing from each team proposing what they would create, a basic flow chart of the program, and modules that would be required to create the program. Teams next had to apply for IRB exempt approval, which consisted of the IRB application itself, task list, and pre and post questionnaires. Teams then built a low fidelity prototype of the project, and provided a Gantt chart to demonstrate how they planned to complete tasks they identified as necessary to finish studies and the project. Finally, each team executed the plan and conducted user studies. The instructor attended at least one usability study session per team in order to ensure professional conduct of the studies. The final deliverables were the working code for the project, a four page paper detailing the results of the study, and a presentation of their findings.

THE USABILITY STUDIES

Students successfully completed CITI training. Seven teams of students formed and briefed their initial project plans. The project categories consisted of two games, four practical applications, and an interactive music program. We have summarized interesting findings discovered as a result of user studies conducted by each team here.

User Study Findings

User studies exposed flaws not discovered through initial evaluations conducted by other team members in the course. Team-internal testing likely failed to reveal problems with an interface, as these students had been too deeply involved in creating the GUI and therefore would “work around” issues that outside study participants immediately noticed. Teams also found that even asking other students in the class to evaluate a design did not lead to the same discoveries as full user studies. This may be explained by the fact that all students in the course were exposed to similar design patterns and concepts and so had a tendency to work through problems that were impossible to navigate without this additional knowledge.

In both game applications, user studies revealed confusion on how to play, win, and even control elements of the games. One team included a “help” button which none of the study participants ever clicked. The design team had intended for the user to learn to play the game by clicking the “help” button before the first attempt to play it.

Studies conducted of the practical application GUIs also revealed unexpected issues. One team created an application that incorporated basic smart phone functions, such as a calculator, notepad, timer and alarm clock. Several study participants tried to perform actions that can normally be completed in other similar applications, such as cutting and pasting using Ctrl-C and Ctrl-V, which were methods that the team had not implemented. Though the application worked well otherwise, such problems cause confusion and frustration on the part of a real-world user.

RESULTS

Projects in this type of HCI course should be limited to ensure compliance with IRB exempt requirements. Two of the seven project teams sought to either time participants at various tasks or evaluate them on a go/no-go basis, which are not covered under IRB exempt status. Teams who cannot qualify for IRB exempt status can still complete the project as a simple classroom study, which does not require IRB approval. While two of the seven teams did not obtain IRB exempt approval, all went through the IRB process. Several students from the course are now conducting research on capstone projects as seniors that require IRB approval. The experience gained from our course has allowed these students to easily navigate the IRB approval process and may allow their research findings to be published, should they be judged to contribute to the body of knowledge in the field.

Practices to Sustain

Early interaction with the Human Protections Office (HPO) allows for project approval and completion inside a single semester timeline.

Giving students the ability to choose their project was an important element, as they enjoyed developing their own ideas rather than a canned scenario.

Observing at least one user study per team allows instructors to monitor for professionalism and consistency between teams.

A Gantt chart ensured teams established milestones and timelines.

Low fidelity prototyping allows students to explore different GUI layouts and flow. Teams that tested with a paper prototype developed a better final product, but those who chose to conduct user testing on the high fidelity prototype made even more interesting discoveries specific to the actual implementation. This enabled a teachable moment where instructors had the opportunity to discuss the value of conducting the user studies at various points in the development cycle.

Having students create a short research paper on their GUI and findings was invaluable as it potentially provided some of the students with their first opportunity to write a publishable quality work.

Practices to Improve

Budgeting time to allow teams to conduct a pilot study would help in finding problems with task lists and/or questionnaires. However, on a positive note, the students discovered the benefits of a pilot study on their own as they found mistakes during full studies.

It would also be advisable to give more guidance to students on project selection, as two of our teams chose to conduct studies in a fashion that did not allow for exempt status, specifically trying to time participants at tasks or have participants perform go/no-go tasks.

CONCLUSIONS

This work presented an argument and methodology for better including the Human when studying the domain of Human Computer Interaction. A process was presented in which students designed an application that included a GUI, completed Human Protections Training, and experienced an IRB approved usability study process. While this paper summarized some interesting findings of the usability studies conducted by our seven teams, the importance was not these discoveries, but rather the way in which these issues were found. Heuristics performed by at least five experts will reveal 75-80% of issues with a design [11], however, it is the last 20-25% of the study that we believe is critical to identifying some of the most egregious problems that may make or break software and/or hardware solutions. HCI educators should consider introducing study design and IRB approval as early as possible in a course to ensure problems are caught early in the design process.

We hope this work will spur other efforts to promote undergraduate students experiencing the entire usability study process. We believe computing practitioners must be an advocate for the user, and we feel our presented experience significantly increases that mindset.

The views expressed in this paper are those of the authors and do not reflect the official policy or position of the United States Military Academy, the Department of the Army, the Department of Defense, or the United States Government.

REFERENCES

- [1] Association for Computing Machinery and IEEE Computer Society. *Computer Science Curricula 2013 Curriculum Guidelines for Undergraduate Degree Programs in Computer Science*.
<http://www.acm.org/education/CS2013-final-report.pdf>, retrieved May 25, 2015.
- [2] Collaborative Institutional Training Initiative. <https://www.citiprogram.org/>, retrieved November 12, 2015.
- [3] Cotler, J.L., Fryling, M., Rivituso, J., Mathews, L., Practico, S., The Social Side of CS: Engaging Undergraduate Computer Science Students in the IRB Process

- for Research Investigating Cyberbullying in Online Multi-Player Gaming Environments. *Journal of Computing Sciences in Colleges*, 30(6), 2015.
- [4] Cronk, B.C., The OUR-IRB Project: A Necessary Tool for Risk Management and Ethics Education. *Council on Undergraduate Research Quarterly*, 27(4), 142-146, 2007.
 - [5] Garfinkel, S.L., Cranor, L.F., Institutional Review Boards and Your Research. *Communications of the ACM*, 53(6), 38-40, 2010.
 - [6] Jeffries, R., Desurvire, H., Usability Testing vs. Heuristic Evaluation: Was there a contest? *SIGCHI Bulletin*, 24(4), 1992.
 - [7] Jeffries, R., Miller, J.R., Wharton, C., Uyeda, K.M., User interface evaluation and the real world: A comparison of four techniques. *Proceedings of CHI*, 119-124, 1991.
 - [8] Kallgren, C.A., Tauber, R.T., Undergraduate research and the institutional review board: A mismatch or happy marriage? *Teaching of Psychology*, 23(1), 20-25, 1996.
 - [9] Labaree, R.V., Working successfully with your institutional review board. *College & Research Libraries News*, 71(4), 190-193, 2010.
 - [10] Protection of Human Subjects. 45 Code of Federal Regulations, part 46, 2009.
 - [11] Rogers, Y., Sharp, H., Preece, J., *Interaction Design: Beyond Human-Computer Interaction 3rd edition*. John Wiley & Sons, 2011.
 - [12] Rossen, M.B., Carroll, J.M., Rodi, C.M., Case Studies for Teaching Usability Engineering. *SIGCSE '04*, 2004.
 - [13] Rossen, M.B., Carroll, J.M., *Usability Engineering Scenario-based Development of Human-Computer Interaction*. San Francisco: Morgan Kaufmann, 2002.
 - [14] Smale, M.A., Demystifying the IRB: Human Subjects Research in Academic Libraries, *Libraries and the Academy*, 10(3), 309-321, 2010.