Using Independent Studies to Enhance Usability Assessment Skills in a Generalist Program

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Abstract - This experience report describes how two technical communication professors from Mercer University use focused, independent-study courses to help students advance beyond the general coverage of the technical communication curriculum to gain additional expertise in specific areas of technical communication. Specifically, we focus on the usability curriculum and how it is enhanced with such independent studies. We describe our experience with several substantive projects including work with the US Department of Homeland Security in the basic course and independent studies with Go Baby Go, visual-acuity simulations, and the development of a patient-information console. Each of these projects has provided undergraduate research opportunities and enhanced usability experiences for our students.

Index Terms - Independent study, Technical communication, Undergraduate research, Advanced skills, Usability assessment

INTRODUCTION

This experience report describes how two technical communication professors from Mercer University use focused, independent-study courses to help students advance beyond the general coverage of usability in our technical communication curriculum and gain additional expertise in specific areas of technical communication. In this paper, we review the technical communication department's general curriculum and some of the specific projects that we have developed to enhance students' learning experiences. One project is the result of developing an ongoing relationship with the United States Department of Homeland Security to conduct usability tests on aspects of their web site, and the others are projects developed to support Mercer University's outreach into the community. We review our experiences with this process and discuss what we have learned along the way to improve research-oriented learning opportunities for our future technical communication students.

BACKGROUND

The Department of Technical Communication in the School of Engineering of Mercer University provides a generalist program to prepare its undergraduate technical communication students for a wide range of professional opportunities after they graduate. Technical communication majors currently take 18 semester-hours of core technical communication courses and an additional 24 semester-hours of electives in a specific area of technical communication. The core courses of document and web design, usability, instructional design, technical editing, and technical writing teach the topics that apply to the technical communication field in general. The technical communication elective courses enable students to focus their academic interests in a specific concentration by taking courses that specialize in such aspects of technical communication as multimedia, visual communication, information architecture, international technical communication, and social media management.

While the standard technical communication curriculum prepares students for a range of careers, the department also wants to support motivated students by providing opportunities for richer experiences in their specific areas of interest. Those students can work with a supervising instructor to design up to six semester-hours of independent study that focus on their individual interests. In the past, these independent studies have focused on technical communication specializations such as user experience, instructional design, and multimedia. The following sections describe how the Technical Communication Department at Mercer University teaches an introduction to usability assessment in one junior-level (third-year) course and provides additional learning opportunities through independent studies.

I. Introduction to Usability Testing

All technical communication students are required to take the Introduction to Usability Testing course, which provides a basic understanding of the usability-assessment tool kit and an opportunity to practice using the tools in actual usability studies in the department's dedicated user experience (UX) lab directed by Dr. Brewer. The goal of the course is to investigate the theory and practice of

designing and testing usable interfaces for different audiences and purposes.

Throughout the Introduction to Usability Testing course, students learn how to test the usability of products, documents, and processes. For their hands-on experience, students participate in two major course projects that introduce them to usability study planning and project management, user and task analysis, document and interface design, and usability testing. Students have conducted usability studies on apps and web sites for local for-profit and non-profit organizations as well as for government contractors and agencies. Students also complete a client project each semester for the United States Department of Homeland Security (DHS), doing formative testing of DHS sub-sites. Students leave the course with basic usability testing skills and recognition of whether they have an affinity for user-experience research and usability assessment.

II. Independent Study in User Experience

Students who are interested in pursuing further study in user-experience research, beyond the introduction they received in the required Introduction to Usability Testing course, can work with a faculty supervisor to develop up to two independent study courses in usability assessment and user research. Each three-semester-hour, independent study course requires students to complete 120 hours of work that consist of:

- 96 hours performing research activities
- 12 hours supporting the UX Lab facilities
- 12 hours promoting the lab

This mix of activities keeps the students focused on advanced research while encouraging students to take part in shaping the lab itself. Support and promotion activities include researching and recommending updates to software and hardware for use in the lab. Lab support has included such tasks as developing an instructional module to orient the new usability students and senior design teams to the UX lab and selecting new hardware for the lab, such as a printer and some wireless headsets. To promote the lab, students have written articles for the student newspaper, presented at campus events, and created posters for research fairs and events.

Independent-study students, however, spend 80% of their time on research activities and projects that help them gain a more advanced understanding of usability assessment and the field of user experience. To develop a sense of current issues in the field, UX independent study students actively monitor the conversation on the UXPA Facebook page. However, students spend most of their independent-study time designing and conducting user research in the lab. The next section describes the more notable projects and studies that our UX independent study students have conducted.

EXPERIENCE

An ongoing requirement, and challenge, for independent study projects is finding meaningful projects that have real-world influence and align with students' technical level and availability. Our independent study projects come from several sources: students who propose their own projects, and faculty-guided projects. Regardless of the project's origin, an independent study project must support the student's learning objectives and be supervised by a member of the faculty. In this section, we review these projects that have been studied as independent research projects in usability assessment:

- Testing assembly instructions for the Go Baby Go cars that provide mobility to children with mobility impairments
- Testing web site accessibility for visually-impaired readers
- Testing piClinic Console development iterations

I. Testing Assembly Instructions for Go Baby Go Cars

The Go Baby Go project is a community outreach program that modifies toy electric cars for use by children with mobility impairments. The most common modification is to configure the cars so children can operate the car without using their feet. Engineering students perform the modifications and the Technical Communication Department created a set of detailed assembly instructions to enable the students to perform these modifications safely and consistently, even though many students have very little experience. Twice a year, faculty from the Mercer University's School of Engineering, School of Education, and School of Medicine host a build event in which engineering students, students of special education, and physical-therapy students work together to modify 10-15 cars for as many children with mobility limitations.

Before we deployed the assembly instructions to a build event, UX independent-study students recruited undergraduate students to test critical sections of the instructions in the UX lab. Testing identified some usability problems and errors in the instructions that were corrected before the instructions were deployed to the students so they could modify and deliver the cars to the children quickly and safely. During the build, the engineering students were observed as they used the instructions to assemble the cars, and the instructions were improved after each build event. The instructions and continuous improvements have helped improve the process' consistency with each iteration.

II. Evaluating Website Accessibility for Visually-Impaired Readers

UX independent study students researched the usability of several websites for users with visual acuity

impairments. Student researchers started by testing and evaluating the accuracy of low-cost, commercially available visual simulation goggles. Once they established the goggles' accuracy in simulating a particular visual impairment, they went on to test the usability of several web sites for that visually impaired audience.

Over two semesters, UX independent-study students tested visual-impairment simulation goggles to validate that they caused participants with normal, 20/20 vision to perform the same as participants with the visual impairment that the goggles simulated. In this case, participants tested only changes in visual acuity, but there are a variety of goggles available that can simulate many other visual impairments. After experimenting and validating the effects of the different visual-impairment simulation goggles, the student researchers conducted a usability test of several web sites using the visual-impairment simulation goggles to identify areas in which those sites could be improved to make them more accessible to people with a loss of visual acuity. Students went on to disseminate their process and findings in a written report.

III. Testing piClinic Console Development Iterations

In the spring 2017 semester, the Technical Communication Department began research into a project that supports service learning and undergraduate research, which are integral parts of the educational experience at Mercer University. In the spring semester of 2017, the Research that Reaches Out initiative of Mercer University's Quality Enhancement Plan funded a grant to test prototypes of a low-cost patient-information terminal and determine if such a device could support automating basic patient-information processing in the limited-resource clinics found in developing countries. If successful, the piClinic Console could provide a low-cost alternative to help small clinics track patients and patient visits.

The success of the initial tests and the resulting project has, to date, created three-semesters of independent-study projects at Mercer University. Dr. Watson is now collaborating with the Departamento de Salud Pública de la Facultad de Ciencias Medicas (the Department of Public Health in the School of Medical Science) at the Universidad Nacional Autónoma de Honduras (UNAH) to create independent study projects for their Public Health students.

PICLINIC CONSOLE BACKGROUND

The piClinic Console was developed as a service-learning project that would provide a platform on which to create projects that highlight the technical communication skills used in professional product development and to provide benefits to our global community. The project was initiated in response to observations made while on earlier medical missions to remote Honduran clinics. During these missions, Dr. Watson observed over 1,000 patients visit a small clinic over the course of a week to be seen by a medical staff of about 10. The clinic staff documented each patient's visit in detail on paper, but the records were rarely referenced after the visit. Further research indicated that this was a common situation that many similar clinics shared [1]. Research showed that introducing complex and costly information systems into small and rural clinics had been problematic, often due to insufficient technical and financial resources available to sustain the systems [2][3]. There was, however, no research on trying to introduce less complex systems into such clinics. In 2016, technology to provide basic patient-information automation became available with the release of the Raspberry Pi Model 3 [4]. The following sections describe the project's history and how UX independent study students contributed to its development.

I. Initial Prototype Research

In the spring 2017 semester, a Research that Reaches Out grant funded student researchers to test several hardware configurations based on the recently released, Raspberry Pi 3 to determine if they would provide the basic functions the application required under the expected conditions. The prototype design addressed earlier observations made by Dr. Watson while on earlier medical missions in Honduras. Student researchers enrolled in the UX independent study recruited undergraduate students of Mercer University to test the prototype in usability tests of simulated tasks. Because of the early stage in development, the goal of these tests was simply to determine if the Raspberry Pi-based computer hardware could support the intended application by simulating application functions in a way that would test the hardware's performance. The student-led usability tests confirmed that a Raspberry Pi-based solution was viable and prompted a two-week user-research study to collect field notes from several Honduran clinics that would inform a more formal contextual design of the application. The field study provided valuable data and identified a cluster of pain points and common tasks that had not been observed earlier.

The data from the field study confirmed the need for a low-cost, limited function patient information terminal and identified the key functions that the minimum-viable product (MVP) would need. During the summer of 2017, collaboration with the UNAH was also initiated. Starting from scratch, many aspects of the patient information system (named, piClinic) were developed and tested in stages during the 2017-2018 academic year.

The project goal for the fall 2017 semester was to ensure that the hardware could support the basic functionality, data entry, and reporting requirements of the application that were identified in the earlier trip to

Honduras. To meet this goal, development during the fall semester focused on the application's infrastructure leaving the product's user interface to be very rudimentary—consisting of basic, HTML pages with no formatting. The system design was coordinated with the project's Honduran collaborators through email and Skype calls. During the fall 2017 semester, a UX independent-study student recruited student volunteers to participate in several functional-test sessions designed to test for only serious problems with information flows, user interface terms, and user interactions, while exercising and testing the app's data-management infrastructure.

For the spring 2018 semester, the project goal was to produce a prototype of the piClinic Console that could be tested in Honduran clinics during a field test in the summer 2018. At the beginning of the spring 2018 semester, after the application's infrastructure and basic functionality had been tested, the user interface was redesigned and styled to be more useful and attractive to facilitate testing with subject-matter experts in more realistic scenarios. The UX independent-study student recruited student volunteers who had some subject-matter expertise to test this iteration of the design and prepare it for demonstration to the project's Honduran collaborators.

Midway through the spring 2018 semester, Dr. Watson traveled to Honduras to meet with the project's Honduran collaborators in person and demonstrate the prototype. Additional design changes were identified during this meeting and are being implemented and tested by the UX independent study students in the U.S. and the Public Health students in Honduras at this writing.

The summer field test will determine if the system hardware and software are usable for actual users, if they add value to the clinic by making routine patient information management and reporting tasks easier and less error prone, and identify design requirements for the production-ready version. Data from the field test will inform the next iteration of the design and the development process has demonstrated how the UX research and testing methods vary throughout the product-development lifecycle.

II. Planned piClinic Research

Looking ahead, the piClinic project will provide many future opportunities for independent-study students in technical communication and other fields of study. Data from the summer 2018 field test will inform the design such that the piClinic Console will require only minimal technical knowledge to install and use it in a clinic. The field-test findings will be translated into independent study and classroom projects to design and implement the features where the project requirements align with the course's learning objectives.

The initial pedagogical goal of the project was to create technical communication projects in areas such as user research, usability testing, and localization. Future technical communication projects related to the piClinic Console include instructional design and documentation projects to support end users and future developers and instructional design projects to facilitate training new users. However, the project has since grown beyond its original scope to provide projects for public health students in Honduras and computer science projects at Mercer University. As the piClinic Console is deployed to clinics, it will also support research projects for public health students at Mercer University and the UNAH, while serving the clinics and their patients.

DISCUSSION

In this section, we reflect on the factors we have found to be successful and those that we would like to improve.

I. Successes

Overall, these projects have provided successful learning experiences for students. Through these experiences, students have been able to add depth to their technical communication degree while benefitting communities outside of the university. Students have also experienced some of the varied applications of UX design and usability assessment—much beyond what is possible in a single introductory course. Due to the alignment of these programs with university-wide initiatives, Mercer University has provided the additional funding necessary to support these research activities.

These projects reflect the multi-disciplinary nature of technical communication by engaging other departments within Mercer University and in other universities. In addition to the inter-disciplinary nature of the research, recruiting usability students from around the campus gives a cross-section of the university a view into the Technical Communication Department and what technical communicators do. The piClinic Console project is also fostering an international, inter-university relationship.

Each of these projects has helped a different community. The research into accessibility of web sites for visually impaired people and the Go Baby Go project have benefited members of the community around Mercer University. The usability tests on the U.S. Department of Homeland Security web site have helped people around the country, and the piClinic Console project will help people in developing countries around the world.

II. Challenges

Coordinating and scheduling work on projects like this requires successful coordination between the client, the student, and the course curriculum. Not every project will have these requirements align as a fixed semester course schedule requires. While the faculty in the Technical Communication Department manages the piClinic Console project internally, it still must coordinate with the

work of other stakeholders so it is not immune to scheduling conflicts and deadlines. While coordinating project and curricular requirements is easier for independent studies when there are more projects than students. Coordinating projects in the larger classes requires more planning. It might not be possible to incorporate a dynamic project into a more structured curriculum that must be planned in advance. For the piClinic Console, the initial development is dynamic and better suited to creating projects for the more flexible independent study projects. As the piClinic project becomes more stable, it can be considered for inclusion in more mainstream courses. In contrast to the piClinic project, the DHS website is comparatively stable and has over 35,000 assets, which makes it suitable for use as a recurring class project in the Introduction to Usability Testing course by allowing regular, formative testing of different portions of the site in each class.

Working with international students inserts another scheduling challenge into the mix when their academic calendar is offset from that of the local university. On the piClinic Console project, scheduling required some accommodation, initially, but became easier as the teams became more acquainted. In spite of the technical and scheduling challenges, virtual meetings and teams, however, have helped our international collaborations.

With the piClinic project, the range of technical skills required during the initial development presented some implementation challenges, initially. The development schedule was somewhat aggressive to meet the various deadlines imposed by external stakeholder requirements. This limited how much students could contribute to the development and design; however, some design tasks were identified that students could accomplish. The key property of these tasks was that they were loosely coupled to the development schedule. For example, one design student drafted some user interface (UI) designs on paper. These designs provided some visual design guidance that was later adapted for the project, yet they did not interfere with the development of the project's software. Thus, challenges became opportunities for the projects and the students.

Conclusions and Future Work

Having a small portfolio of projects and clients that are flexible in terms of technical requirements and scheduling has proven to be quite valuable to our students. These projects have made it possible to offer specific, tailored learning experiences to our undergraduate students who want to add richer, almost graduate-level research experiences to their portfolios. By identifying the properties of successful projects and clients, we can continue to grow our portfolio to provide more opportunities to our future undergraduate students in technical communication.

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