

Ethics and Usability Testing in Computer Science Education

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Keywords: participant pool, ethics, usability testing, user-centered design, research methods

Abstract

Ethics and usability testing are increasingly important parts of a modern computer science education, given the changing profile of computer science employment and the increased focus on privacy. This paper introduces the concept of a participant pool, a means to recruit participants for research, which can be a valuable tool in teaching usability testing and ethics. It has a role in an overall emphasis on software quality and the importance of research. It can also help to increase the profile of this research and the desirability of a Computer Science degree to the larger population.

1.0 Introduction

For anyone who has taken undergraduate psychology courses at a University, the participant pool is likely well known. The context described in this paper is Canadian, but it is not dissimilar to that in other parts of the world. As presented here, it borrows heavily from what has been common in psychology departments for many years. Though the regulations surrounding participant pools have changed over the years [8], they remain an important means for recruitment of undergraduate students to participate in research projects. They also function as a teaching tool with the goal of educating participants about research methods used in the discipline. This is doubly true when undergraduate students are involved in organizing an experiment that makes use of a participant pool. It is easily applicable in Computer Science, yet there is no record¹ of participant pools in Computer Science, aside from the one described in this paper.

When the phrase “participant pool” appears in a computer science context, it is often used to describe those who actually participate in an experiment. In the wider

sense that is used in this paper, the participant pool refers to all those who might participate in any experiment. It pools potential participants from a variety of undergraduate courses, regulated in a way that is consistent with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS) [8]. All Computer Science departments can benefit from establishment of their own participant pools, because this enables access to participants to be maintained. If Computer Science researchers are sometimes granted access to participant pools from other departments, this access can easily be denied.

The lack of formal structures to recruit human participants for computer science experiments may be related to the relatively low priority traditionally placed on the usability and quality of software [3] produced by students. A new emphasis on these issues of quality can be strengthened by the involvement of students in user testing, facilitated by a participant pool. It allows computer science undergraduates to be exposed to these values throughout their undergraduate program, so they might be better able to carry these values into their workplaces. The use of a participant pool can also help computer science students to understand why it is important to “care about people” [7, HC1, p.118] not only from a software quality standpoint, but also by understanding the social context of computing and its ethical challenges [7, SP2 and SP3, p. 143]. The participant pool with its, albeit minimal, overhead is to be preferred over casual arrangements that provide students with exposure to user testing without dealing with the complex and subtle ethical issues which are often involved.

This paper describes the procedural issues involved with establishment and use of a participant pool, the experience of operating this participant pool for several semesters, and what opportunities exist to improve the model.

2.0 Participant Pool Formation and Regulation

The topic of participant pools has been studied widely by psychologists [5, 4, 10, 9, 2, 11], who have noted various difficulties inherent in the structure. Despite the difficulties, the benefits are extremely important, for students and researchers. The most popular structure, in which bonus marks are offered to students in exchange for their participation, is a reasonable compromise.

Lindsay and Holden [5] describe the function of participant pools, “partly as a mechanism to reduce sample bias, partly as a convenient source of research participants for college and university faculty, and partly as a pedagogic device for exposing psychology to research methods.” Relying on students to volunteer their time introduces one definite form of bias because those who volunteer may also be the best students and there may be very few of them. If participation is mandated, the data from those who would not have otherwise chosen to

¹ Via web query:
<http://www.google.ca/search?q=“computer+science”+“participant+pool”>, ACM, and IEEE digital libraries (accessed February, 2006).

participate may be of less value. In the compromise case, the amount of bonus marks (or “research credit”) available to students is carefully chosen: it must be large enough to act as an incentive towards participation for those who would not simply volunteer their time and it must be small enough so that no student would feel compelled to participate because too many marks are at stake.

1. Respect for Human Dignity	the cardinal principle which aspires to protect the multiple and interdependent interests of the person
2. Respect for Free and Informed Consent	the principle of respect for persons translates into the dialogue, process, rights, duties and requirements for free and informed consent by the research subject
3. Respect for Vulnerable Persons	high ethical obligations towards vulnerable persons will often translate into special procedures to protect their interests.
4. Respect for Privacy and Confidentiality	standards of privacy and confidentiality protect the access, control and dissemination of personal information.
5. Respect for Justice and Inclusiveness	justice connotes fairness and equity in the review process and in the distribution of benefits and burdens of research.
6. Balancing Harms and Benefits	the analysis, balance and distribution of harms and benefits are critical to the ethics of human research and generally that the foreseeable harms should not outweigh anticipated benefits.
7. Minimizing Harm	research subjects must not be subjected to unnecessary risks of harm, and their participation in research must be essential to achieving scientifically and societally important aims.
8. Maximizing Benefit	a duty to benefit others and, in research ethics, a duty to maximize net benefits.

Table 1: Guiding ethical principles in the TCPS [8, Context - Part A]. In certain situations, conflicts may arise from application of these principles in isolation from one another.

An application was made to the local Research

Ethics Board to establish a participant pool for Computer Science on this basic model. The essential feature of the application was the formulation of regulations for administration of the participant pool that would conform to the guiding ethical principles of the TCPS [8], as highlighted in Table 1.

The Computer Science department created the administrative role of participant pool coordinator to oversee the operation of the participant pool. The job of the coordinator is to advertise the participant pool within the department and to mediate communication between researchers who wish to use the participant pool and the instructors whose classes are enrolled in the participant pool. The procedure for use of the participant pool is described in Table 2.

In the Computer Science department at the University of Regina, all undergraduate Computer Science courses offered in any semester may be enrolled in the participant pool, which means that students in the enrolled class are eligible to earn research credits. Membership is up to the discretion of the individual instructors, but it does not mean an additional workload. Each time an experiment is recruiting participants, the participant pool coordinator will send an email about the experiment (including contact information) to all instructors with courses in the participant pool. The instructors are then asked to forward this email to their students and it is left to the students to make contact with the experimenter. At the end of the semester and before final marks are submitted, each instructor is provided with a list of students who earned research credits during the semester.

Students may earn one research credit for each hour of participation, up to a maximum of two bonus marks applied to any one class in the participant pool. If the student is taking more than one class that is enrolled in the participant pool, he or she is eligible to earn two research credits for each enrolled course. Still, researchers who use the participant pool must provide an option to students who want to earn the research credit but are not willing to participate. In this case, the student may help with the execution of the experiment or prepare a written report on a related topic. No students have yet selected this option.

Where the participant pool is not available, researchers must either rely on volunteers or pay for participants. The disadvantages of the former have been discussed. With respect to the latter, payment for participation may become a prohibitive expense if the experiment is not part of a project with direct, budgeted funding. The Research Ethics Board Payments considers plans to pay participants with respect to whether they might be so large that they compel participation from others who would otherwise not choose to be involved. The researcher is responsible then for the opposite risk where the amount offered is insufficient to attract the desired number of participants.

When the arrangements for participation are not sufficiently at arm’s length, there is opportunity for

unethical behaviour to occur. An essential principle of the TCPS [8] is the respect for free and informed consent. Students approached by a friend who needs subjects for his or her experiment may feel unable to refuse, especially if the friend holds some power in the relationship. Similarly, students in a class taught by a researcher who needs subjects for his or her experiment would likely not feel comfortable refusing a request to participate in that study. The protocol enabled by the participant pool removes many of these concerns.

1.	request and gain access to participant pool from its coordinator
2.	apply for and receive approval from Research Ethics Board (REB), indicating the participant pool as the source of participants and that these participants will be compensated with bonus marks in selected classes. The use of the participant pool as the source for subjects greatly simplifies the ethics approval process since the reviewers are familiar with the participant pool mechanisms and procedures for subject recruitment need not be specified any further.
3.	forward notification of REB approval along with participant recruitment information to the coordinator who will then distribute the information to the instructors whose classes are enrolled in the participant pool. This information must contain an e-mail address that participants will use to schedule a session. Each participant will receive a receipt confirming participation and indicating to which class in the participant pool the bonus research credit should be applied.
4.	at the end of the experiment or the end of the semester, the researcher or research assistant will provide the participant pool coordinator with a list of participants and the class(es) where the research credit(s) are to be applied. The co-ordinator will then inform individual instructors about who earned research credits (and how many). The instructor (or researcher) will then only learn about which students have participated after the semester's work has been completed.

Table 2: participant pool use procedure.

3.0 Educational Benefits

Students associated with a participant can benefit in several ways, and the research credit offered to them in exchange for their participation can be considered to be well-earned. The benefits can be stated in terms of the goals of IEEE-ACM Computing Curricula 2001 [7, HC1, p.118], with respect to human-computer interaction (HC1) and society and professional issues (SP2, SP3). For the student who is a participant in departmental research, he or she also gains knowledge about the breadth of research being conducted within the department. By educating current undergraduates and the larger community about ongoing

research projects, more highly-qualified candidates may choose to pursue graduate studies at the institution and further broaden its research horizons. Similarly, the high-profile of research may interest undergraduates in pursuing a computer science degree. Equally important, that student will experience ethical treatment from all those involved in running an experiment and will develop appropriately high expectations for other similar encounters. When appropriate care has been shown to them, they understand the importance of that consideration, especially important if they become researchers.

For the student in a course that teaches human-computer interaction, the benefits are more substantial and they relate to the processes of data collection and interpretation. This student is given a firm understanding of what is involved when dealing with real people, as he or she will do once gainfully employed. More specifically, the implications of the ethical principles from Table 1 are highlighted by examining published cases [6] and by considering the implications of each principle. In particular, a discussion of the need for free and informed consent leads to an appreciation of its affect on human dignity, the importance of privacy and confidentiality, and minimization of harm. As an example, consider the manager who wants an employee to participate in a study where performance is evaluated. Free and informed consent may be difficult to obtain just as the privacy and confidentiality of the employee's data may be difficult to safeguard as the manager may have certain expectations about his or her access to the data. Release to management of data indicating poor performance may do great harm to the employee who may be fired because of it. The respect for justice and inclusiveness is important especially when interpreting data so that conclusions drawn from the data can be supported by the data and that the results are not generalized from a group of young computer science students to the population as a whole. Compare the principles listed in Table 1 to the Moral Imperatives of the ACM Code of Conduct[1], presented in Table 3 and it is clear that the participant pool has the potential for education beyond usability testing.

It is possible to use less formal arrangements in order to get participants for a study. For example, participation may be made part of a course requirement. Or, arrangements might be made between particular, related, courses such that students from one class can serve as participants for student projects in another class. Although these types of arrangements may be less troublesome to put in place, they do not offer as much teaching potential.

4.0 Experience

The participant pool at the University of Regina has addressed the need that led to its creation: poor recruitment of volunteer participants for a study. There is substantial anecdotal evidence about its popularity and success. It

requires a very low administrative overhead. Presently, there are generally one or two experiments available or planned at the beginning of each semester. The concept of the participant pool is taking some time to become established within the department faculty, as with any change of culture. Students have readily embraced it.

Contribute to society and human well-being. <i>[see Principles 1,3,5,6,7,8 from Table 1.]</i>	Protect fundamental human rights and respect the diversity of all cultures. Minimize negative consequences of computing systems, including threats to health and safety.
Avoid harm to others. <i>[see Principle 7 from Table 1.]</i>	Avoid injury or negative consequences, such as loss of information, loss of property, property damage, or unwanted environmental impacts.
Be honest and trustworthy <i>[see Principles 1,2 from Table 1.]</i>	Honesty is an essential component of trust. Without trust an organization cannot function effectively.
Be fair and take action not to discriminate <i>[see Principles 1,3, 5 from Table 1.]</i>	Uphold quality, tolerance, respect for others, and the principles of equal justice.
Honor property rights including copyrights and patent <i>[see Principles 4,5 from Table 1.]</i>	Even when software is not so protected, such violations are contrary to professional behaviour.
Give proper credit for intellectual property <i>[see Principles 2,4,5 from Table 1.]</i>	One must not take credit for other's ideas or work, even in cases where the work has not been explicitly protected
Respect the privacy of others <i>[see Principle 4 from Table 1.]</i>	It is the responsibility of professionals to maintain the privacy and integrity of data describing individuals.
Honor confidentiality <i>[see Principle 4 from Table 1.]</i>	whenever one has made an explicit promise to honor confidentiality or, implicitly, when private information not directly related to the performance of one's duties becomes available.

Table 3. ACM Code of Conduct[1], and comparison with TCPS (Table 1).

There are three different ways in which the participant pool can be used: support of a class project user study, support of a research user study, and support of research

data collection. In all three cases, the approval process follows the steps outlined in Table 2.

An effective strategy for class project user study has been to obtain a blanket permission for the course project from the REB, which is also renewable with modest effort. In the human-computer interaction course, students may be apprised of this process as part of their introduction to the relevant issues but they do not have to file individual requests for ethics approval. First, an influx of applications from students may greatly stress the volunteer review system in place within the REB. Secondly, even with a speedy approval from the REB, the turnaround time for these applications will be 2 to 3 weeks. If the students would write these applications for ethics approval only when their projects became clearly defined and specific requirements understood, there would be no time left in a semester (13 weeks) to complete a project of which the user study is only a part. In the application for blanket ethics approval, a basic structure for the students' studies is described that can include, for example, a pre-task questionnaire, a training task, the main task, and a post-task questionnaire. This model has been used, with success, in both undergraduate and graduate human-computer interaction courses. They do permit students in the class to see the value in pursuing user input about interface design. The 'user study' then becomes part of the arsenal that the student can bring to the problem of how to increase the quality of the software produced.

When students participate in larger, research-oriented user studies whose aim is to draw statistically valid conclusions about user performance, they can gain a better sense of the rigour that is required and is available. Similarly, participation in studies that do not involve software testing can open the students to consider other important topics related to human-computer interaction, including ergonomics and perception.

5.0 Conclusions

The participant pool has been very valuable to the research work conducted in the department. In terms of its use as a pedagogical tool, some changes are being considered. Participants may need more information to place their participation into the larger research context, and different mechanisms for communicating this information will be reviewed. Specifically, more detailed information for in-class presentation at the start of each semester is being developed.

Although e-mail has been used for all communication with participants regarding scheduling of sessions, various web-based solutions will also be reviewed.

Finally, a procedural simplification to enroll all classes in a semester into the participant pool may be worthwhile.

6.0 Acknowledgements

For their encouragement in establishing the Computer Science Participant Pool and in writing this paper, I wish to thank Katherine Arbuthnott and Don Sharpe from the Psychology Department and R. Brien Maguire, Head of the Department of Computer Science at the University of Regina.

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