

Project Description—Proposal Section C

ITR/PE: Digital Citizenship: Expanding Information Technology Literacy with a Service-Learning Approach

Objectives

Citizenship is increasingly mediated by digital communication (Hernon, 1998; Temin, 1997). Political parties interact with members online; interest groups use Web sites and electronic mail to woo the public; media organizations perpetually update the news on their information-rich sites; government makes vital information and documents available via the World Wide Web. On-line information can provide the basis for environmental or personal health protection (Beierle and Cahill, 2000). These and other communicative functions are all aspects of the emerging digital citizenship (Black, 1998; Davis, 1999). The rise of the “virtual individual” and the “virtual community” in cyberspace substantively changes the manner in which citizens can engage their democracy, as well as the prerequisites for equitable participation (Baddeley, 1997; Jordan, 1999; Moore, 1999).

Individuals who lack Internet access or the skills necessary to use Information Technology (IT) are on the underprivileged side of a widely recognized “digital divide” (NTIA, 2000). We know that income and education are among the variables that correlate positively with levels of access to and familiarity with the Internet (UCLA, 2000; Wilhelm, 2000). Studies consistently show race, age, language, and disabilities are also significant factors even when controlling for socioeconomic status (Cooper, 2000; Goslee, 1998; Novak and Hoffman, 1998). Less data-based information exists, however, about the effectiveness of educational interventions that seek to identify and remove these barriers in a comprehensive and systematic manner.

The primary objective of this proposed research project is to test the efficacy of service-learning programs that seek to universalize digital citizenship. To that end, we propose three related objectives:

- Define Information Technology Literacy (ITL) using broad and systematic criteria.
- Develop, implement, and evaluate “best practices” for using service-learning in the dissemination of ITL.
- Test the hypothesis that service-learning lessens the digital divide.

How will this research define ITL using broad and systematic criteria?

Existing definitions of ITL range from narrowly construed skills to broad cognitive measures. A narrow definition consists only of the basic skills necessary for using software and email, or the basic keystrokes, mouse functions, and search tools for operating Web browsers. In contrast, broader definitions include the ability and desire to access or present social, political, and economic knowledge, or to participate in association-based networking through listservs or Web-authorship. Being literate in terms of IT requires more than simply an understanding of the how-to of computer use. A defining element of ITL is the knowledge of why to use computers.

One objective of this research therefore is to identify and collect information about the criteria on which a baseline standard for ITL might be established. This requires an empirically grounded taxonomy of impediments to computer literacy, which will include but certainly not be limited to income inequality, race and gender factors, psychological barriers, and issues related to physical disability. In this context it also requires specification of an ITL curriculum suited to the service-learning methodology.

How will this research develop, implement, and evaluate “best practices” for the dissemination of ITL using service-learning?

As the review of the literature below suggests, service-learning is a catch-all category incorporating numerous pedagogical strategies that take students out of the classroom and put them into the community. Sufficient scholarship exists to identify the principles of effective service-learning projects. To our knowledge, however, the model has yet to be applied to the dissemination of ITL. Expanding ITL with a service-learning approach calls for innovation in the classroom and the community. It requires structured experimentation, reflection upon trial and error, and modification of techniques in light of community response and needs. This learning-teaching-research process can be subjected to external analysis. Finally, it involves a cyclical return to the classroom and community for further innovation.

How will this research test the hypothesis that service-learning lessens the digital divide?

The work of the research team will be facilitated by independent program evaluators charged with the responsibility of assessing the efficacy of different service-learning interventions. Through the use of controlled studies, the impact of service-learning can be measured. The use of control groups in studies of the impact of service-learning on beliefs, values, and skills (e.g., Markus, Howard, and King, 1993) is a good model for testing the impact on ITL.

Relation to Long-term Goals

The long-term goal of this study is to identify methods for narrowing the digital divide. “We must begin this millennium not as a country technologically divided,” states Vice President Gore, “but instead as one committed to creating digital opportunity for all of our citizens” (Gore, 2000). Universities and colleges are demographic centers of ITL. Educational innovation can help to disseminate knowledge out beyond the campus gates and into the communities left out of the IT transformation underway. To that end, this project proposes the complete integration of research and education in an interdisciplinary project as a means to attain long-term goals related to elimination of the digital divide. This project is a model for further educational innovation that will enhance the training of an IT workforce and citizenry both in and out of academia, thereby contributing to the goal of universal participatory ability.

Civil society, democratization, open government, and the rule of law are increasingly dependent on both the full development of ITL and the concomitant widening of access to new communications technologies. More complete digital citizenship, in this view, hinges on the development of “electronic safety nets” (Perritt, 1997). In the best cases, Deweyan IT experiments promote civic interaction and build social capital (Aikens, 1999). Questions abound about the implications for leadership, representative government, and institutional innovation. Democratic theory helps chart the rules, rights, and responsibilities of government in a digital era. At stake are issues concerning trust in government, the quality of citizen input, and the functionality of existing institutions in the new environment (Dawes et al., 1999).

Recent conferences and ongoing committee work have resulted in several publications evaluating the challenges associated with increasingly electronic forms of government. The findings include general claims about the new opportunities and demands for more efficient citizen/government interface, and specific recommendations about the types of problems that could be addressed through collaborative and cross-disciplinary efforts. Some initiatives, such as Information Technology for the Twenty-first Century (IT²), premise a “shining future” on

breaking down traditional barriers to information and government access, while noting there is much research to be done on social and economic factors (NSTC, 1999).

The President's Information Technology Advisory Committee (PITAC) maintains that IT will result in profound improvements in the workplace, health care, and government responsiveness. The 1999 PITAC report identifies 10 critical transformations related to the new role of Internet communications; however, it also anticipates the problems of using this "powerful tool for democratization" that may stem from socioeconomic factors. While free-flowing information is considered crucial, access to it, and knowledge about how to use it, will need to be equitably distributed among the population. "We should use information technology to bridge the gaps in our society," the PITAC report concludes, "not to create new ones" (PITAC, 1999, 13). The long-term goal of this research is to examine whether those "immune to progress" in the area of digital citizenship can have their "formidable barriers" to equity lessened (Wilhelm, 2000, 75).

Present State of Knowledge ***Information Technology Literacy***

Debates about establishing criteria for an ITL baseline are complex and controversial. The rapid pace of technological change makes it problematic to state definitively that certain skills are essential to underpin universal digital citizenship (McNair, 2000). Nonetheless, the presence of a moving target does not justify inaction. Given that nearly all observers agree there is a digital divide, researchers are working to identify the core elements of ITL—such as lifelong learning—as well as the techniques most likely to foster their widespread dissemination. As Stephen McNair notes, this may involve fundamental shifts in the role of teachers and learners.

While the sufficiency of seeking computer literacy has been questioned (see the NRC study cited at length below), we argue that retention of a literacy focus is fundamental to making an impact on the digital divide. The concept of ITL is embedded in broader and more established efforts to universalize prose and quantitative literacy. The U.S. Department of Education estimated in 1992 that about eight million adults could not perform simple literacy tasks while over one in five had only the most rudimentary reading and writing skills (NCES, 1992). Nearly half of the adult population "were apt to experience considerable difficulty in performing tasks that require them to integrate or synthesize information from complex or lengthy texts," and as a result were more likely to work part-time, earn less income, vote less often, and rely on non-print sources of civic information. Given the severe social and economic impact of non-IT illiteracy, efforts to target ITL will likely consider the steady growth in adult education as one viable avenue for making systematic inroads (Ginsburg, Sabatini, and Wagner, 2000; Kim and Creighton, 1999).

Significant national attention has been focused on the possibility of Internet-facilitated lifelong learning as one strategy for giving citizens the tools necessary for literacy, productivity, and citizenship in the information age. According to the Web-Based Education Commission (WBEC), chaired by U.S. Senator Bob Kerry:

A vastly expanded, revitalized, and reconfigured educational research, development, and innovation program is imperative. This program should be built of a deeper understanding of how people learn, how new tools support and assess learning gains, what kinds of organizational structures support these gains, and what is needed to help the field of learning move forward. (WBEC, 2000, iv)

As the WBEC report points out, this can involve the creation of new “learning communities and tools for collaborative knowledge building and dissemination among researchers, teachers, and developers” (131). We concur, but go further by suggesting a real-world emphasis on learning communities must include undergraduate students as well as existing community-based organizations in this innovative nexus.

Studies of the digital divide that focus primarily on physical access to the Internet are proliferating and their results are generally consistent. Perhaps best known is the series of *Falling Through the Net* reports from the NTIA. As early as 1995, the original NTIA report noted the simultaneous growth in computer ownership and usage as well as the persistence of digital divide indicators. This paradox remains, and in some cases has been exacerbated, for the so-called “digital have nots,” despite some evidence of recent gains for particular groups (NTIA, 1999).

Other survey data have been useful for fleshing out the characteristics of the population of non-users of the Internet, as well as particular obstacles and concerns that explain non-use. For example, the Pew Internet and American Life Project (Lenhart, 2000) recently reported that among the half of the U.S. population lacking Internet access, a solid majority lacked even a firm interest in doing so. Also notable was the so-called “gray gap,” which showed the likelihood of Internet holdout status was greatest among those over the age of 65. Among the foremost reasons for ambivalence were concerns about privacy, irrelevance, cost, and perceptions of the steep learning curve required to use IT.

Despite data consistently showing persistent stratification in terms of IT access, there is nonetheless a debate about whether the digital divide is a matter for public policy. Critics of the digital divide concept as a “trendy phrase” argue that market forces invariably will make interfaces cheaper, more widely accessible, and easier to use in due course (Cornfield, 2000; Crandall, 2001). In this view, marketing techniques such as the “Web-on-Wheels”—rather than policy interventions—hold out the possibility for market-based IT diffusion that is “soulful and relevant” (Editorial, 2000). Digital divide skeptics prefer to frame the issue as simply the “have-nows” versus the “have-laters” (Symposium, 2000).

While this ongoing public debate about the digital divide is infused by competing governance ideologies, we maintain that a focus on ITL reveals a research problem that is far more complicated than debates about the various pathways to universal IT access. We find sufficient evidence in the literature to argue forcefully that improving ITL “is not simply a matter of running wire and providing public computers—it is also a matter of ensuring that people have the requisite skills to use the technology and that they see the relevance of technology in their lives” (OECD Secretariat, 2000; Seiden, 2000).

To that end, we associate the need for this research with an evolving movement jointly engaging both the public and private sectors. According to Michael Morino, founder of the Morino Institute, there is a need to use innovative IT research and education to eliminate new and existing social divisions, for example, through the creation of a domestic “Digital Peace Corps” (Morino, 2000). Such non-incremental experimentation in ITL dissemination links available community infrastructure to the latest innovations in IT education. As the next section suggests, we feel service-learning is a uniquely well-suited intervention to increase the capacity of individuals and organizations to build social capital through innovations in ITL dissemination.

There is some evidence (Marcias et al., 2000) that ITL programs with a strong inducement to community “buy-in” are more likely to succeed. The question remains, however: What exactly do the target communities need to buy into? There is no unchallenged model of

ITL that will serve all communities equally well. Significant debate continues over which skills comprise the core of digital citizenship (Clement and Shade, 2000). Less controversial, however, is the idea that the digitally illiterate “are looking for training which is delivered in their own time, at their own pace and in a familiar environment” (Loader, Hague, and Eagle, 2000, 97; also Houle 1996).

Perhaps the most useful point of departure for reaching the research objectives is the 1999 National Research Council (NRC 1999a) report, “Being Fluent with Information Technology.” The NRC report challenges researchers to look beyond a reductive skills-based notion of computer literacy. Invoking “fluency” in place of literacy, the authors call for a higher baseline level of IT competency, one that creates the ability for lifelong independent learning and adaptation. Fluency broadens the scope of cognitive development. Simple computer literacy skills are trumped by more challenging notions of “FITness,” or fluency with information technology. Instead of treating skills for using computer software applications as an endpoint, the NRC report posits a richer range of concepts and capabilities designed to create a deeper understanding of IT. “Skills with specific applications,” note the authors, “are thus necessary but not sufficient for individuals to prosper in the information age” (NRC 1999a, 1-5).

Among the many virtues of the FITness concept are its adaptability to multiple tools and changes over time. Without a doubt, a static definition of computer literacy is ill-suited to meet the rapid shifts in IT. Furthermore, the more dynamic notion of fluency makes individual adaptability and problem-solving paramount. The example of a person using a word processor and hitting the print icon, then watching in vain with no results, is an apt one. A person with FITness would possess the conceptual ability to identify possible barriers to completing the task. To the extent the NRC report pushes ITL researchers to consider the challenges of educating the IT illiterate in matters of underlying form, it is a powerful guidepost. By the same token, FITness that promotes awareness of the links between citizenship and ITL is precisely what this research aims to deliver. Nonetheless, we are somewhat more skeptical than the NRC authors that the full array of capabilities, concepts, and skills can be made universal. At the very least, there are intermediate steps, specifically more universal ITL, that we feel are prerequisites to embarking on a program of FITness for all.

Finally, we are in agreement with the NRC report’s conclusion that implementation needs will vary across different segments of the population. As the review of service-learning approaches below suggests, there is clear precedent for making the university an established outpost for project-based learning designed to benefit students as well as the service recipients. A service-learning approach to ITL dissemination promotes innovation in the learner-teacher model, interdisciplinary collaboration, and adaptation of the curriculum to incorporate IT at the core of the learning process.

Service-Learning

Universities play diverse roles, meeting community and national needs. Higher education institutions bring a unique constellation of talent and resources to bear on the social, political, and technical challenges of the day. Through research, experimentation, and real-world community involvement, scholarship contributes to common sense decision-making, the cultivation of civic responsibility, and the formulation of rational public policy.

Service-learning is a pedagogical approach that promotes civic-minded partnerships between academic institutions and communities. Legislative and professional developments spurred interest in service-learning during the 1990s. The Community Service Act of 1990 and the National Community Service Act of 1993 lent a federal impetus to the expansion of service-

learning programs (Markus, Howard, and King, 1993). Organizations such as “Learn and Serve America,” which is an extension of the Corporation for National Service, provide grants for service projects. Learn and Serve America has helped “nearly one million students from kindergarten through college meet community needs, while improving their academic skills and learning the habits of good citizenship” (Learn and Serve, 2000). Meanwhile, university and college presidents created Campus Compact, which now represents members working on service issues at over 500 campuses nationwide (Campus Compact, 2000). Similarly, since the mid-1980s, the Campus Outreach Opportunity League (COOL) has been linking students at hundreds of campuses with communities through a service model (COOL, 2000).

One primary goal is to empower communities to identify pressing needs that college and university students attempt to meet as part of their education. The pedagogy of service-learning creates innovative and challenging community-based opportunities, which demand that those students think “outside the box” of the academic classroom. A second objective is to link the mission of higher education explicitly to the “theory and practice of democratic citizenship” (Barber and Battistoni, 1993, 235). Many colleges and universities now endorse the basic premise that service and citizenship reinforce the commitment of students and higher education to civic-minded activity (Battistoni, 1997).

Service-learning is often broadly defined, allowing for considerable variation during implementation. Core principles are nevertheless discernable. According to Jacoby (1996, 5), service-learning “is a form of experiential education in which students engage in activities that address human and community needs together with structured opportunities intentionally designed to promote student learning and development.” These activities generally rely on two guiding principles: reflection and reciprocity. The experience of service is a necessary, although not sufficient, condition to foster innovative learning opportunities. Structured classroom reflection upon service activities creates a feedback loop that links the community intervention to an analysis of class-related theories and the design of future practice. Reciprocity exists to the extent that the community being served is able to define the scope of the service tasks and influence the manner in which service becomes part of the academic curriculum (Cuoto, 1996; Jacoby, 1996).

As a recent study by RAND-affiliated researchers points out, the concept of service in the community is not new to higher education. It is a well-established practice to encourage those privileged with the opportunity to pursue advanced learning to return something to the community through civic involvement. The report notes service-learning serves this goal and is “well-suited to incorporating other strategies that are associated with educational improvement, including collaborative learning and interdisciplinary education” (Gray et al., 2000, 32). While some difficulties arise for faculty involved with service-learning in terms of coordination, time demands, and evaluation of student work, there is some evidence that the professional satisfaction outweighs these burdens (Hammond, 1994).

A key question concerns the measurement of outcomes. The literature on service-learning, while emphasizing the need for reciprocity in practice, tends to look most intently at the effect on the students rather than the recipients of the service (Giles and Eyler, 1994). When researchers are assessing the impact of service on “the cognitive dimensions of citizenship” (Eyler and Giles, 1999, 18), for example in the analysis of indicators such as development of social problem-solving skills or the sense of citizenship, it is often through a student-centric lens. If, as Eyler and Giles (1999, 153) suggest, service-learning is to be a building block in the

creation of social capital, future research will need to devote greater attention to the study of effects upon service recipients as well.

While some obstacles exist to demonstrating conclusively positive outcomes in students who are service providers, the measurement of positive outcomes amongst service recipients is considerably less problematic (Center for Human Resources, 1999). In short, we have reason to believe that service recipients can be shown to have attained substantial benefits from the interventions. Service-learning creates multiple constituencies, and therefore diverse forms of measurement are needed to assess effectively the impact of the program. The need to define clearly measurable, context-specific outcomes is paramount. One study of assessment methods suggests several useful community indicators may be identified, such as perceived capacity of the program to serve clients (Driscoll et al., 1996).

The literature on service-learning also suggests there is a strong case to be made for the interdisciplinary linking of political science and education scholarship. In part, this is due to the tendency to embed the experience of service in the broader study of democracy, civic responsibility, and innovative pedagogy (Mendel-Reyes, 1998). “Higher education must thus go beyond imparting information,” write the editors of one service-learning collection, “to the active engagement of analytical and communicative skills that will allow any adult to adapt, participate, and succeed in a rapidly changing world” (Reeher and Cammarano, 1997, 1). Thus, a “learning by doing” approach is grounded both in the cultivation of the sense of citizenship that links students to communities and the unique nature of hands-on versus book-learning education models (Rimmerman, 1997, 19).

The American Political Science Association (APSA) devotes considerable attention to service-learning on its Web site (APSA, 2000). According to Battistoni and Hudson (1997), “political science has maintained as one of its prime objectives the linkage between ‘real world’ experience and theoretical understanding.” Political science is not alone in this regard. The American Association of Higher Education (AAHE) lists studies from 18 disciplines at its service-learning site (AAHE, 2000). The American Association of Community Colleges (AACC) also hosts a “Service-Learning Clearinghouse” at its Web site (AACC, 2000). While resources for initiating service programs are easily accessible online (e.g., <http://www.cns.gov/>, or <http://nicsl.jaws.umn.edu/>), as are data concerning the extent of service-learning in the United States (Shumer and Cook, 1999), there are few studies that explicitly link expansion of ITL to the implementation of a service-learning regime. To the extent that this linkage does appear, it focuses on efforts to increase student notions of citizenship through Internet use in the classroom (Ball, 1997; Canfield, 1997).

General Plan of Work

The proposed study will be the result of a collaborative effort between Drake University and Iowa State University. Communication between the Drake and ISU investigators will be maintained through regular telephone and electronic (email, Web page, and Web cam) contact. Additional communication will be managed through innovative applications of Web camera technology that will be adapted to later use in citizen contacts for participants in three experimental groups who will be exposed to service-learning as a means to enhance the citizen role in government, politics, and public affairs.

Communication with members of the relevant experimental and control study groups will be maintained to the extent possible through the resources and good offices provided by public libraries, community colleges, agencies that service the under-served population, and other

points of contact with the populations from which our samples are drawn. We also will use the Iowa Communication Network (ICN) for this purpose; ICN is a state-wide fiber optics system linking public schools, agencies, and other facilities through live, interactive, two-way television, which has been used extensively for conferencing and instruction.

A post-doctoral student, experienced in teaching and with a primary research emphasis in instructional technology, will help teach courses on service learning and instructional technology literacy at Drake University. Support for this endeavor will be provided by Drake University and at Iowa State University through the Research Institute for Studies in Education (RISE), the Center for Technology in Learning and Teaching (CTLT), and the Department of Curriculum and Instruction (C&I). RISE staff are experienced in evaluating the effectiveness of service-learning activities, and have broad background in survey construction, focus groups, data analysis, statistical methods, and public agency report preparation. This focus on instructional technology and service learning is consonant with the “new media” focus of the administration of Drake University, and extends Iowa State University’s established record of research and teaching excellence in instructional technology. As the state’s land grant institution, Iowa State University emphasizes the motto “science with practice” and strives to make real its title of a university of science and technology.

The primary purpose of the classroom activity, led by the post-doctoral student with faculty assistance, will be to team up undergraduates enrolled in the course with under-served individuals and groups. Undergraduate work-study students experienced in applications of technology and teaching technological literacy will facilitate this collaboration. A leading goal of this collaboration between university students and participants in the “real world” in need of enhanced computer and technological literacy is workforce development, consistent with the needs of a rural state with a relatively thin population base and a low official rate of unemployment. Statements from the governor of Iowa, Tom Vilsack, attest to the need for workforce development as a means to attract and retain workers, and hence population, to the state. Similar goals are manifest in the commitments of leading officials of other states to economic development through broadening the technological skills base of the workforce and by expanding the workforce to incorporate well-trained, motivated, and empowered members of groups not yet fully integrated into the development process and its outcomes.

Our research will be driven in part by the need to develop a taxonomy of ITL skills. Using categories such as beginning, intermediate, and advanced levels of ITL at the outset, the research will help to define specific points and nuances of ability and deficiency in the technological knowledge and computer literacy base of the groups that will be included in the study. One major goal of the project is to produce a robust and flexible taxonomic system to guide future research in the ever-shifting area of technological literacy as well as in future studies of the consequences of educational interventions designed to extend the benefits of technological knowledge and applications.

A combination of structured citizen surveys and focus groups will be used interactively to provide the data to be analyzed regarding program impact. This reflexive dual methodology will provide a continuous learning cycle that will help to restructure the analysis based on fresh waves of data and modified innovations. We intend to measure the impact of the program implementation on both citizens and students, in consonance with a key objective of service learning. The emphasis, however, will clearly be on program consequences for citizen participants contrasted against citizen nonparticipants who are selected from geographic areas as similar as possible to those who do participate.

In addition to data collected from survey and focus group methods, participants' social indicators data will be monitored and updated regularly, including measures of behavior and attitudes regarding key aspects of civic participation such as: the frequency of contact with public officials; extensiveness and depth of the use of IT to collect information relevant to citizen roles; voting participation; contact with candidates for public office and/or campaign organizations; frequency of interaction with public associations, interest groups, and other civic organizations; and use of print, electronic, and other visual media to acquire information regarding public affairs.

Disproportionate stratified random sampling (e.g., Levy and Lemeshow, 1991) will be used to select the participants for three experimental groups and three parallel control groups drawn from urban, suburban, and rural areas in and around Des Moines, which is located in central Iowa. All participants in the experimental groups will be selected from technologically under-served segments of the population within central Iowa. The structure of our sample, and hence of the subsequent data analysis, will be designed to mirror the general contours of the contemporary population distribution within the United States.

Detailed 2000 micro-level census records will be used to select appropriate geographic segments and to identify relevant demographic characteristics. Although Iowa does not possess a large population of members of racial or ethnic minority groups, our research design is structured to optimize the availability of populations that "look like America" across urban, suburban, and rural communities. In so doing, we will facilitate comparisons across geography and degrees of urbanization that follow closely the contours of societal structures within the United States at the beginning of the new millennium. Geographic information system (GIS) databases will be used to facilitate the process of selecting appropriately representative samples from census-linked records, and appropriate assistance will be sought when needed from the Survey Section and the Computing Section of ISU's Statistical Laboratory.

The structure of the sample groups relevant for implementation of the study is outlined in Figure 1. A total of about 1,800 participants are envisioned, divided as equally as possible into groups of approximately 300 participants each selected from each of three different residential locations representing different degrees of urbanization (urban, suburban, and rural), including within each level of urbanization both participants who are exposed to the benefits of service-learning and participants not exposed to the benefits of service learning. This yields a total of six comparison groups. In Figure 1, these groups are distinguished by the prefix letter designations--SL (service-learning) and NSL (non service-learning)--to differentiate between groups exposed to the service-learning intervention and groups not exposed to that treatment. The groups are also distinguished by the suffix numerical designations 1 (for urban residential location), 2 (for suburban residential location), and 3 (for rural residential location).

Figure 1
Structure of Experimental and Control Groups

	Residential Location		
	Urban	Suburban	Rural
Service Learning (treatment group)	Group SL1	Group SL2	Group SL3
Non-Service Learning (control group)	Group NSL1	Group NSL2	Group NSL3

Groups SL1, SL2, and SL3 will comprise the treatment groups of the experiment. Group SL1 will consist of approximately 300 residents of an urban community, in Des Moines, Iowa. SL2 will consist of approximately 300 residents of a suburban community near Des Moines, Iowa, such as Urbandale or Clive. Group SL3 will consist of approximately 300 residents of rural communities in the vicinity of Des Moines, Iowa. The participants in Groups SL1, SL2, and SL3 will be exposed to the service learning treatment administered through Drake University and Iowa State University.

Groups NSL1, NSL2, and NSL3 will comprise the control groups of the experiment. Group NSL1 will consist of approximately 300 residents of an urban community in Des Moines, Iowa, who were not selected to participate in SL1. NSL2 will consist of approximately 300 residents of a suburban community near Des Moines, Iowa, such as Urbandale or Clive, who were not selected to participate in SL2. NSL3 will consist of approximately 300 residents of rural communities in the vicinity of Des Moines, Iowa, who were not selected to participate in SL3. The participants in Groups NSL1, NSL2, and NSL3 will not be exposed to the service learning treatment administered through Drake University and Iowa State University.

To minimize contamination of the control groups through inadvertent exposure to the treatment administered through service-learning and related activities, the samples for each group will be selected to the extent possible from nonadjacent census tracts using information available from the 2000 national household census. For that purpose, census data, and relevant ancillary data, will be provided through the Census Services center at Iowa State University (303 East Hall, in the Department of Sociology—Willis Goudy, Director or will be obtained directly from the Bureau of the Census or from published sources). Efforts at maximizing information flow will be extensive and regular in the process of administering the program treatment to participants in the service learning groups, so it will be essential to avoid as much as possible any carryover to the control group participants from the public interaction efforts that are integral to the service learning function and to our treatment design. Avoiding geographic proximity seems a reasonable precaution toward achieving this goal of isolating treatment effects from control group. As appropriate, adjustments will be made to the scope and details of the service learning functions to limit this threat to validity. In particular, it will be essential to implement clearly defined and well-articulated treatment effects and to do so consistently over the duration of the study.

Outcomes for the participants in all six groups included in the study will be measured repeatedly over time. We anticipate the following timetable.

Summer and Fall, 2001	<ul style="list-style-type: none"> ➤ Recruit and train students. ➤ Make appropriate contacts with partner agencies and community groups. ➤ Conduct initial evaluation of program feasibility. ➤ Establish Web site to document and update program progress. ➤ Interface with other researchers in Internet studies in various fields (political science, computer science, sociology, education).
Spring, 2002	<ul style="list-style-type: none"> ➤ Pilot test for program implementation. ➤ Focus groups; identify participants for each group. ➤ Evaluation of initial results. ➤ Make necessary adjustments in program scope and implementation.
Summer and Fall, 2002	<ul style="list-style-type: none"> ➤ First wave of surveys administered. ➤ Analysis and evaluation of findings from first round of data collection. ➤ Make changes as appropriate based on evaluation results.
Spring, 2003	<ul style="list-style-type: none"> ➤ First full implementation of the experiment. ➤ Continuous focus group activity to monitor progress of treatments. ➤ Continuous adjustments based on participants' responses and based on evolving needs from rapid change in technology. ➤ Plans made for sharing results with cognizant agencies, groups, and professional associations.
Summer and Fall, 2003	<ul style="list-style-type: none"> ➤ Second wave of surveys administered. ➤ Analysis and evaluation of findings from second round. ➤ Comparisons with first-round results. ➤ Continued focus group monitoring. ➤ Make adjustments in light of participant attrition and changing circumstances. ➤ Present available results to media sources, public entities, and other interested groups. ➤ Present scholarly papers based on program results and data analysis, and begin drafting journal articles or other scholarly product.
Spring, 2004	<ul style="list-style-type: none"> ➤ Conduct final focus group assessments of program effectiveness. ➤ Construct policy recommendations based on the accumulated quantitative and qualitative database. ➤ Prepare final report. ➤ Complete scholarly materials for publication review and submit to appropriate outlets.

It is important to note that the proposed timetable builds in continuous evaluation, based on preliminary results initially and based on regular updates as the study unfolds. These evaluation efforts, led by RISE staff, are meant to establish a feedback loop to guide midcourse adjustments to program implementation and effects, and to establish a feedforward process that can lead to enhancements of this and similar programs for studying the digital divide.

This study design permits statistical analysis, using sophisticated linear models methods (e.g., Bowerman & O'Connell, 1990) and advanced structural equations models (e.g., Bollen, 1989) in two dimensions: (a) comparing across experimental and control groups, and (b) comparing program effects over time.

Methods based on analysis of covariance (ANCOVA) will be employed as the primary statistical procedures to make controlled comparisons between the experimental and control groups at specific points as the study unfolds. The essence of ANCOVA is to test for the statistical significance of one or more main effects due to the experimental treatment while controlling simultaneously for the presence of potentially confounding influences (covariates). Repeated measures analysis of variance (ANOVA) also will be used to provide a rigorous, controlled interpretation of changes in experimental effects over time. Repeated measures ANOVA permits the statistical analysis of multiple outcome measures that are measured repeatedly over time, in an extended pre-post design.

Informed by the results of these linear models procedures, we also will endeavor to develop a predictive causal model, or structural equation model (SEM), in which post-implementation results are compared to previous-wave results, controlling for relevant demographic and attitudinal traits. Among the key demographic variables to be measured are: gender, age, current employment status and job description, educational attainment, degree and types of previous exposure to technology and public affairs, income, and occupational prestige. Attitudes toward technology will be measured by existing instruments supplemented by survey items specially tailored to the needs of this study. One major advantage of SEM analysis is the ability to decompose the total effects relating predictor variables to outcomes into separate direct and indirect effects. Based on the extant digital divide literature, it is anticipated that attitudinal variables will mediate or moderate the relationship between demographics, experimental treatment, and experimental controls for residential location, and outcome measures of program effects.

Broader Impacts

Service-learning is a well-established component of the educational process, but as yet has not been applied systematically to research studies of the IT context. This project is innovative and high-risk, particularly in that it endeavors to expand the benefits of service-learning to efforts that are directed toward enhancing citizen literacy in IT. In addition, the project intends to incorporate IT into citizen participation in governance and public decision-making processes to the extent possible, especially for segments of the population that traditionally are left behind, or left out altogether, from the potential benefits of technological innovation. There is potential for synergy with the Partners in Economic Progress (PEP), an established 501 (c) 3 nonprofit organization that operates a computer laboratory at Drake to address the specific infrastructure needs of the Central Iowa African American community.

Teaching people in disadvantaged circumstances how to make best use of computer access is instrumental for enhancing the ability to make functional use of technology to endeavor to improve people's lives. Thus, it is crucial to note that the focus of this proposed study is quite

distinct from the emphasis in other investigations on achieving more universal access, which is fundamentally a political and resource allocation question. In contrast, the focus in this proposal very clearly is placed on educational innovation, with a major goal of establishing a pedagogical methodology and mode of delivery for enhancing the appreciation among members of underserved populations of the more efficient access to government services that is available through the Internet and the consequent advantages for IT for democratic governance. We are endeavoring in this study to universalize the economic and personal gains to individual users that are available more readily now to those of greater financial means, and wish to demonstrate how the process and outcomes of governance may be made more democratic for those not used to having their needs satisfied by public actors and agencies.

In brief, the proposed study sets up a central research problem that integrates the practice and processes of scientific discovery with those of teaching, training, and learning. This investigation is designed to provide a maximally hands-on exercise in the practical consequences for government, education, and community power of the Internet revolution. We hope thereby to achieve a synergy that will lead to multiple and major enhancements of life chances for currently disadvantaged societal groups. This research agenda will substantially contribute to the important national goals of making IT work better and for more people than it currently does (NRC 2000).

A major objective is to enhance the existing infrastructure for research on the digital divide and to provide instrumentation that can be used in future such studies. One means of achieving that objective is to use the connection between Drake University and ISU to develop a statewide Iowa digital government organization (ex., idg.o). We seek to lay the foundations in this proposed work for larger-scale and long-term programs supporting statewide interdisciplinary, and government-university collaboration. It is anticipated that our results will be fully scalable, capable of being applied on a national, or even global scale, to different societal and cultural contexts that those provided in Iowa.

New disciplinary departures are inherent in the proposed Drake-ISU collaboration, as may be seen on an institutional level from the linkage of Drake's evolving "new media" initiative with Iowa State's established emphasis on "science with practice" and instructional technology. The interdisciplinary nature of the work and the research team is also clear. The proposed research calls for collaboration between faculty members at Drake University who combine political science, environmental policy, education, and IT interests. In addition, the senior ISU researcher has faculty connections among education, statistics, and political science. Cross-disciplinary research involving undergraduates fits into the strategic vision for Drake University. As a result of its ongoing program review, Drake faculty and administrators have a mandate to provide greater emphasis on active learning, discovery, and collaborative inquiry, as well as an increased number of learning-communities on campus. New Drake initiatives call for the creation of a constellation of interdisciplinary centers, including a Center for Science, Mathematics and Education, a Center for International Studies, a Center for Collaborative Inquiry, and a Center for Technology Studies.

The interdisciplinary aspects also are evident in the evaluation components of the study. Evaluation of the project will be headed by an ISU research institute (RISE) with over 25 years' experience in evaluating education programs that regularly establish and fosters links with engineering, agriculture, instructional technology, and other facets of applied science. The institutional development and research associated with this project puts both Drake and Iowa

State on a joint path to contribute to the National Research Council's goals (NRC 1999b) for transforming undergraduate education in science, math, engineering, and technology.

What is novel about the service-learning component of the proposed study is that it is designed to focus the intended effects of program implementation on the recipients of the service, rather than on the students who participate in the learning experience, as is more common in the service-learning research literature. The primary objective is to enhance the opportunities for democratic governance to reflect the needs and interests of groups who currently are not given equal weight in public policymaking processes and outcomes. The effects on participating service-learning students should not be discounted, but the evaluation of such effects will not constitute a major theme of this study.

The scholarly output from this study is intended for presentation at major professional conferences such as the American Political Science Association, the American Education Research Association, the Association for the Study of Higher Education, and the Joint Meetings of the American Statistical Association. Based on these delivered papers and other related research, publication opportunities will be pursued at the earliest opportunity in refereed scholarly journals in political science, education, and public policy or public administration. An edited symposium on the policy aspects of the results of this research and of other related studies of the digital divide may be compiled for a leading refereed journal in the field of public policy. In particular, the *Policy Studies Journal* and the *Policy Studies Review* regularly publish special issues addressing major topics in public policy.