Recruiting, Training and Mentoring Undergraduate Social Science Students to Study Cyberinfrastructure as a Socio-Technical Innovation

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Fall, 2017, Chapman University; Orange, California

Introduction

The Internet started as an experiment for scientific communication and military information in the late 1960's, with the introduction of the ARPANET (Naughton, 2016, p. 8). Since its public introduction in the 1990's, the Internet has greatly impacted the economy, politics, education, society, and many other influential areas, beyond its technical origin (p. 11-12). Kee et al (2011) cautioned that "cyberinfrastructure (CI)," as a parallel case of innovation today, will do the same in the near future. In order to better prepare for this future, social science plays a critical role in generating understanding of cyberinfrastructure beyond its technical origin, as this platform brings together a range of big data, supercomputers, specialized software, remote instruments, dispersed experts, and much more. The purpose of this poster is to examine how to train social science undergraduate students to study the socio-technical phenomena of cyberinfrastructure for the future. More specifically, this poster pursues the research question, "*What strategies can best recruit and train social science students to study cyberinfrastructure, given the opportunities and challenges it brings?*"

Strategy #1: Extensive Recruitment

Establishing a strong recruitment strategy, with its focus on CI, is key to building a team of impactful undergraduate social science researchers. According to Hiltrop (1999), organizations that successfully attract top talent are those that offer individuals the opportunity to engage in challenging work, develop skills, advance his or her career and many other benefits that do not involve stressing monetary gain (p. 424-426). A similar approach should be taken when recruiting undergraduate social science researchers because studying the concept of CI presents the student with an opportunity to develop skills, enter into a field with career opportunity and engage in challenging work. That said, the recruiter must first think about the characteristics that are necessary for a social science student to desire challenging work. Some of these characteristics include, but are not limited to, the following:

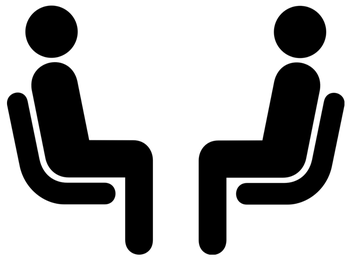
1. **The student expresses an interest in subjects such as virtual organizations, organizational communication, organizational capacity and big-data technologies.**
2. **The student has conducted notable social science research in the past.**
3. **The student has strong conceptual and analytical skills. Conceptually, studying CI will challenge the student think about ideas and topics in a new way. Analytically, studying CI will require the student to inspect issues and work to solve them.**

Next the recruiter should discuss with the student, in person, a potential interest in studying CI. The recruiter should explain to the student the facets below, which suggest that CI studies is a growing area with career opportunities:

1. **The concept of CI.**
2. **The role of the social sciences in CI.**
3. **The purpose of the recruiter's research team.**
4. **Why the recruiter thinks the student would be an effective candidate for the application process.**
5. **The market advantage of joining a research team that studies the concept of CI.**

Last, in the event that the student begins the application process, the recruiter should establish a formal interview so that the candidate learns about the skills that the candidate will develop by studying CI. The interview should consist of questions that gauge these abilities of the student:

1. **The ability to comprehend the concept of CI.**
2. **The ability to analyze the social impact of CI.**
3. **The ability to produce a valuable research question, in relation to the concept of CI.**



Strategy #2: Experiential Training

After recruiting an undergraduate social science researcher (trainee), team research assistants and lead professors (trainers) should work together to facilitate the training process. One obstacle during the training process is ensuring that the trainee fully comprehends the concept of CI. The trainers of our research team overcame this obstacle by assigning readings, that pertain to CI, and engaging in a discussion with the trainees about what he or she read. These reading assignments and discussions have great effect on the trainee's ability to grasp CI because, in my experience as a trainee, the assignment empowers the individual to think critically and analyze the topic. However, the readings and discussions do not fully ensure that the trainee completely understands the socio-technical aspects of CI, because the assignment only allows the student to theorize about the concept. This theorization is limiting to the trainee, in that, he or she does not explore how the concept is applied to individual occupations. To enhance the trainee's conceptualization of CI, requiring him or her to attend a **CI conference** would bolster comprehension for the following reasons:

1. **By attending, the trainee is exposed to communities of people who use CI everyday.**
2. **Attending conferences presents opportunities for the trainee to socialize and learn from those who have hands-on experience with the technology and those who can offer new perspectives about the concept of CI.**
3. **In conversing with professionals who use CI, the trainee has the opportunity to explore the various ways that CI is being used to solve present day issues.**

This suggestion is rooted in Kolb's Experiential Learning Theory, which argues that "'learning is the process whereby knowledge is created through the transformation of experience'" (Healey & Jenkins, 2000, p. 185). Accordingly, in requiring the trainee to partake in the experience of a CI conference, he or she may attain knowledge that is different from knowledge that derives from readings and discussions.

Strategy #3: Peer Mentorship

A second obstacle, during the training process, is teaching trainees how to conduct research about the concept of CI. To combat this conflict, our trainers set aside meeting times specifically for explaining the research process. In these meetings, trainers teach trainees various concepts and technical skills. These skills include data collection, data analysis, grounded theory and research design. In addition, training took place outside of scheduled meeting times so that trainees could clarify questions about CI ideology and research methodologies. Established and extra meeting times are effective because, reflecting from experience as a trainer, the trainees are taught the necessary skills to successfully complete an individual research project. However, to improve this strategy for coaching new members to research the concept of CI, trainers should try the tactic of **peer mentorship.** By establishing a mentorship relationship, a multitude of positive outcomes can result for both the mentor and trainee. Some of these outcomes include the development of leadership skills, a mutual motivational attitude between mentor and trainee, a potential increase in learning, and a cultivation of teamwork (Smith, 1990, p. 51). These outcomes appear beneficial to the training process for four reasons:

1. **In developing leadership skills, the mentor and trainee can take initiative on the complex issues and implications that must be addressed while researching the concept of CI.**
2. **Having a motivational attitude while researching the concept of CI could lead to higher quality results.**
3. **Researching the concept of CI demands the student to be able to process high volumes of information and technical skills. Through mentorship, this learning process could be amplified.**
4. **An atmosphere of teamwork, given by peer mentorship, could contribute to the motivational attitude to accomplish novel tasks that are proposed by researching the concept of CI.**

Therefore, a peer mentoring relationship poses as a valuable addition to established and extra meetings.

Conclusion

This study set out to articulate strategies to recruit and train social science students to study the technical innovation of cyberinfrastructure, in preparation of its socio-technical impacts in the future. We identified extensive recruitment, experiential training and peer mentorship as significant strategies for developing social science students who study cyberinfrastructure. These strategies are unique to CI studies because they address the opportunities for social science students to enter into the research field of CI, meet and learn from individuals who are in the field of CI and meet and learn from other individuals who study the concept of CI. The strategies also address the challenges of recruiting effective social science students, ensuring that the student comprehends the concept of CI, and enhancing that the student's research work. It must be recognized that these strategies are only necessary for recruiting and training social science students to understand CI, and they are not relevant to a social science research project on other innovations and/or a technical project on CI. These strategies also imply that these are necessary techniques for training and recruiting social science students, but they are not sufficient for successfully recruiting and training the students. To that point, future research must continue to explore the area of training and developing undergraduate social science researchers who study CI in order to progress the capabilities of the student, and to further prepare the student to embrace the innovative technology of cyberinfrastructure.

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This material is based upon work supported by the National Science Foundation under Grant No. #1453864. IRB Approved: #1516H017.

This poster was presented on December 6th at the 2017 Chapman University Student Research Day, Orange, CA.