Discovering Informal Learning Cultures of Blind Individuals Pursuing STEM Disciplines: A Quantitative Ethnography Using Listserv Archives

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Abstract: This study is proposed to discover the collective knowledge sharing patterns and informal learning cultures of blind individuals pursuing Science, Technology, Engineering, and Mathematics (STEM) disciplines captured through computer-mediated mailing listservs. Using the world largest online mailing lists for the blind, this research will conduct longitudinal quantitative ethnography for the three STEM-oriented listserv archives between December 2008 and December 2018, to develop a comprehensive understanding of learning experiences voiced by blind individuals.

Goals of the Research

The purpose of this quantitative ethnography is to discover the collective knowledge sharing patterns and informal learning cultures of blind individuals pursuing STEM disciplines, as captured through computer-mediated mailing listservs. More specifically, the following three research questions are proposed to achieve this goal: (1) What are the commonly challenging issues of blind learners that provoked distributed expertise depending on each subject of STEM found in the blind mailing lists? (2) What is the culture sharing pattern of solving problems regarding STEM accessibility issues among blind mentees and mentors on the mailing listserv? And (3) How do blind individuals exchange accessible ways of learning software and hardware engineering collaboratively in the STEM-related mailing lists?

Background

Over the past decade, the importance of Science, Technology, Engineering, and Mathematics (STEM) subjects has received a lot of research attention in formal and informal learning settings. Despite its growing importance and positive effect on learning, many blind students who are increasingly integrated into regular classrooms are often left without accessible resources and instructions (Beck-Winchatz & Riccobono, 2008; Jones, Minogue, Oppewal, Cook, & Broadwell, 2006). For instance, STEM content relies heavily on visual models, and the majority of STEM teachers and college instructors have little experience in teaching blind students (Jones et al., 2006). Hence, having other blind peers who share similar learning experiences and blind mentors who can serve as role models is critical for blind learners to address their unique challenges and succeed in STEM subjects (Beck-Winchatz & Riccobono, 2008). With the support of the Internet and assistive technology (e.g., screen reading software and refreshable braille display), blind individuals all over the world have increasingly become connected to each other, and the mailing list is one of the widely used accessible media among blind people to communicate and share tips with others. In other words, much informal learning and knowledge sharing among blind individuals have been accumulated through computer-mediated mailing list archives, which provide great investigative value in addressing the proposed research questions.

Methodology

Data Collection

The target community of this quantitative ethnography is the National Federation of the Blind (NFB), which is one of the world largest blind communities. Longitudinal text data that contains members' communication between December 2008 and December 2018 will be obtained by the publicly downloadable mailing list archives on their website (https://www.nfbnet.org/mailman/listinfo). Among 257 mailing lists, only the following three archives will be included in this study: (1) Science and Engineering; (2) Computer Science; and (3) BlindMath. To clearly address any ethical issues regardless of the openness

of the mailing archives, the data collection will be carried out with appropriate procedures from the ethical code of research approved by the Penn State institutional review board. All personally identifiable information (e.g., names; email addresses; email signature lines; and other sensitive or private portions) will be systematically either removed or replaced with pseudonyms for the data analyses and report procedures. In any event where the researcher feels the need to include a specific case of certain individuals' characteristics or their words at any stage of this research, he will ask permissions of each individual beforehand, following the Penn State IRB informed consent process.

Data Analysis

The overall research procedure will follow the five steps of "Knowledge discovery in databases (KDD)" proposed by Fayyad, Piatetsky-Shapiro, and Smyth (1996), as follows: (1) data selection; (2) data cleaning; (3) data transformation; (4) data mining, and (5) results evaluation and interpretation. Table 1 illustrates what the tidy data structure would look like after going through steps 1 through 3. In the data mining phase, I will perform the following three analyses: First, structural topic modeling (Roberts, Stewart, Tingley, Airoldi, & others, 2013) – which is one of the natural language processing algorithms that probabilistically discovers latent structural topics within a large corpus of documents – will be employed to identify common themes within the three mailing list archives. Second, descriptive statistics (i.e., counting and central tendency analysis) will be performed to systematically capture the frequency and variation of message exchange patterns within each listserv over time. Last but not least, directional network analysis will be carried out to elicit the communication patterns among subscribers within each listserv. All of these computational results, moreover, will be repeatedly triangulated with the researcher's interpretive reflexivity as one of the blind members of the listserv.

Table 1. Sample data structure.

From	To	CC	Subject	Content
Sender's name along with email address (will be changed when reporting)	Recipient's name along with email address (will be changed when reporting)	Copied members along with their email addresses (will be replaced with pseudonyms)	Message subject	Message body

Expected Finding

The expected findings will include all answers to the set of proposed research questions concerning the informal learning experiences of blind individuals pursuing STEM subjects.

Expected Contributions

Combining computational results quantified by structural topic modeling, descriptive statistics, and network analysis with qualitative observation driven by the author's insights as a lifelong blind learner, this research will contribute to a comprehensive understanding of how blind people learn STEM in general; and what challenges and solutions have been discussed among blind people to engage them in STEM education specifically.

References

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