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# Learning from Engineers to Develop a Model of Disciplinary Literacy in Engineering

Amy Wilson-Lopez

Utah State University, amy.wilson-lopez@usu.edu

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## Data Management Plan

This plan describes data, metadata, and secondary products that will be generated and outlines how these products will be managed during the project

### **1. Expected Data**

Several types of **engineer data** will be produced in relation to this project:

- video-recordings of engineer think aloud protocols (digital MPEG HD format);
- audio-recordings of engineer think aloud protocols (digital MPEG HD format);
- audio-recordings of interviews with engineers (digital WMA format);
- written transcriptions of interviews with engineers (digital DOCX format);
- written transcriptions of selected excerpts from video/audio-recordings of engineer think aloud protocols (digital DOCX format);
- field notes describing the engineers' work context (digital DOCX format);
- copies of engineer texts (digital PDF format).

Two types of **metadata** will be produced in relation to this product:

- qualitative codes of data entered into NVIVO or other qualitative analysis package;
- files in which engineer/company names correspond with engineer/company numbers to protect their confidentiality.

Two types of **secondary products** will be generated from this project:

- a model of disciplinary literacy in engineering suitable for use by K-16 instructors;
- research-oriented and practitioner-oriented articles in peer-reviewed journals.

### **2. Standards for Data Format and Content**

**Participant Data:** We will not post participant data on an open-access repository for at least two reasons. First, uploading large audio- and video-files to an open-access repository is unreasonably expensive in terms of labor and maintenance. Second, public access to video- and audio-files would violate nondisclosure agreements put in place with participating companies. Instead, participant data will be uploaded and indexed on USU's private online repository, USU Box. This repository is secure, requiring a VPN access and password to log in. It is also globally accessible. Researchers who request access to the repository will be granted access to the data after they obtain approval from the USU Institutional Review Board and sign nondisclosure agreements from the participating companies.

All identifying information will be removed from hard copies of engineer texts and transcriptions before they are scanned and uploaded to the repository. Each engineer will be given an identifying number. All texts will be kept in the folder in the repository that corresponds to each engineer/company number. These measures will maintain confidentiality for the engineers/companies.

Because this study is exploratory, we will collect data from a relatively small sample. Consequently, standards used for cataloguing large data sets will not be applied. Instead, Ms. Betty Rozum, Associate Librarian and Data Services Coordinator at Utah State University's Merrill-Cazier Library, will provide feedback on the repository to ensure that its manner of organization is clear to external researchers.

We will keep a file that correlates engineer/company names with their numbers on a password-protected hard drive in a locked filing cabinet in a locked office. Any data that includes identifying information related to engineers/companies, such as audio recordings and video-recordings in which faces are visible, will also be kept on this hard drive. Participant consent forms will be stored with the hard drive in this locked cabinet in the locked office.

**Metadata:** All metadata will be kept on a password-protected hard drive in a locked filing cabinet in a locked office.

**Secondary Products:** Secondary products will be widely disseminated to a broad audience via popular digital and print platforms (e.g., project website, TeachEngineering and other peer-reviewed web platforms, widely circulated practitioner journals, high-impact research journals).

### **3. Policies for Access and Sharing**

We will make access to the secure repository available upon request to any researchers who want to view it one year after the project has been completed. As noted previously, all identifying information will be removed from engineer texts and transcriptions before they are uploaded to the repository. However, it will be difficult to remove all identifying information from audio and video-recordings. For this reason, researchers will not be granted access to the repository until they 1) obtain approval from USU's IRB and 2) obtain permission from the companies. The IRB will allow external researchers to view the data if their research purpose and design are meritorious and if they have received training on protecting human subjects. Companies may require that researchers sign nondisclosure agreements prior to gaining access to the data.

The results of data analyses will be shared through publications and conference presentations. All participant identifiers will be removed from all data excerpts prior to publication. If journal editors request access to raw data or metadata, we will make requested data available after removing engineer/company identifiers.

### **4. Policies for Re-Use, Re-Distribution, and the Production of Derivatives**

Secondary products generated by the grant will be widely disseminated. Instructional materials related to the model of disciplinary literacy developed during this project will be published on the project website. Instructional materials that are developed will include a statement to the effect that the teachers may use the materials in their own instruction, copy the materials, and distribute them freely; however, they may not sell them or otherwise use them to make a profit. Researchers may likewise re-use or re-distribute any studies published from this grant, as long as their re-distribution adheres to the particular guidelines of the peer-reviewed journals in which these studies are published.

### **5. Plans for Archiving Data**

Hard copies of participant data will be returned to engineers or destroyed immediately after identifiers have been removed and after they have been scanned and uploaded to the repository. A secondary copy of these data will be kept on a password-protected hard drive in a locked cabinet in a locked office in a location that is safeguarded against fire and water damage. All data will remain in the secure online repository and hard drive for five years after the project has concluded in order to enable the research team and other researchers to conduct analyses if requested. At this time, the data will be removed from the repository, and the consent forms and all other data and metadata with engineer/company identifiers will be destroyed and/or deleted from the hard drive.