Type of Contribution: PAPER

Aligning Information Literacy Terminology to STEM Disciplinary Language Used in the Scientific Method

Brianna Buljung, Seth Vuletich, Lisa Dunn (Colorado School of Mines, USA)

Keywords: information literacy, science literacy, scientific method, ACRL Framework, UNESCO MIL Framework

Introduction

Librarians on college campuses often struggle to incorporate information literacy into science and engineering curriculum. Most information literacy instruction takes place in classes aligned to the humanities and social sciences. However, student and faculty researchers in Science, Technology, Engineering and Mathematics (STEM) disciplines also need to develop and use effective research habits and skills. Inconsistent terminology between librarians and STEM faculty makes communication of value of information literacy a significant challenge. Aligning the language used by library science professionals to that of STEM faculty can bridge this gap and help explain the value of information literacy instruction.

This study will map two significant information literacy frameworks to a standard example of the scientific method. The two frameworks are the Association of College and Research Library's (ACRL) *Framework for Information Literacy in Higher Education* and the United Nations Educational, Scientific and Cultural Organization's (UNESCO) *Global Standards for Media and Information Literacy Curricula*. The ACRL Framework is intended for use in higher education and the UNESCO Standards, while broader, can also be applied to higher education.

This paper will map prominent information literacy frameworks to the scientific method in order to create a model that can be adopted by science and engineering libraries for use in instruction development. Individually, concepts from ACRL and UNESCO frameworks will be mapped to the scientific method. Then, both will be combined to create a model. The exercise of mapping information literacy terminology to a commonly accepted scientific framework will help librarians align their language to that of faculty and students on campus. It will also demonstrate the role that research skills and habits can play in scientific work. The resulting model will provide a point from which STEM librarians can engage with faculty and assess the overall composition of their information literacy program.

Theoretical Framework

This literature review provides a sampling of the sources reviewed in the full research paper. This project lies at the intersections of science literacy and information literacy. According to the American Association for the Advancement of Science, a "science-literate person is one who is aware that science, mathematics, and technology are interdependent human enterprises with strengths and limitations; understands key concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes." (F. James Rutherford and Andrew Ahlgren 1990). Information literacy, as defined by ACRL is "the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning." (Association of College & Research Libraries 2016) Aspects of information literacy are connected to science literacy as researchers use existing scientific knowledge as a foundation to build upon.

The full literature review will discuss the use of mapping in information literacy programs. Frameworks are often used to guide the design and assessment of individual information literacy lessons. They can also be used on a programmatic level to scaffold and assess a cohesive instruction program. Typically, mapping is used to align lessons to an institution's curriculum or as a strategic planning tool (Archambault and Masunaga 2015; Ziegler 2019). Mapping prominent information literacy frameworks to other disciplinary models, such as the scientific method has not been widely studied in the literature. The review will also explore communicating the value of information literacy to STEM faculty. While this topic has some coverage in the literature, using scientific tools to find common ground with faculty has not been widely explored (Guth et al. 2018; Cope and Sanabria 2014).

The complete literature review in the final paper will explore the intersections of information literacy and science literacy, the use of mapping in information literacy programs, and methods for communicating the value of information literacy instruction to faculty. It will demonstrate the need for a model that bridges the communication gap between STEM faculty and library science professionals.

Research Question

This study seeks to address the following research question:

1. How can prominent information literacy standards be aligned to the scientific method to create a model for communicating the value of information literacy to faculty?

Methodology

The scientific method used in this study is a basic example of the method as a cycle (Figure 1) (ArchonMagnus 2015). The cycle model, was selected because it most closely relates to the research lifecycle commonly used in information literacy instruction. The scientific method is itself a form of the research lifecycle, that helps scientists and engineers navigate the process of obtaining new information. Both are iterative processes in which different steps are revisited as needed throughout the duration of the project.

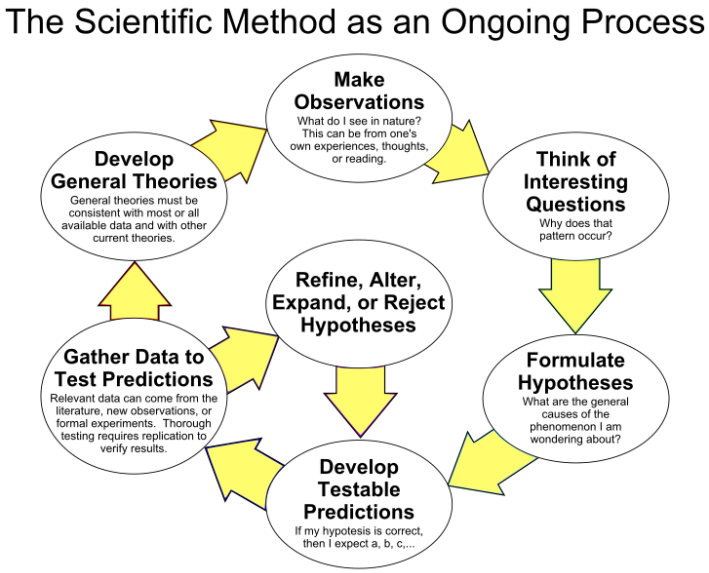

Figure 1: Scientific Method example used in the mapping project.

The mapping process will consist of two steps. Initially, the two identified information literacy frameworks will be aligned to the scientific method individually. This step will be conducted independently by each author resulting in six maps. Each author brings different academic and professional backgrounds to their information literacy instruction. They have varying levels of experience with the scientific method and its application in STEM disciplines. Two authors have an educational background in STEM and all have at least one year of practical experience in STEM librarianship. Then, the six individual maps will be combined into a single model. Significant points of discussion and disagreements between individual maps will be noted for further exploration.

Research Results

This extended abstract contains a sampling of the full research results that will be described in the final research paper. These results are a proof of concept for the larger study. In Figure 2, the eight knowledge practices of the *Research as Inquiry* frame of the ACRL Framework are mapped to our selected representation of the scientific method.

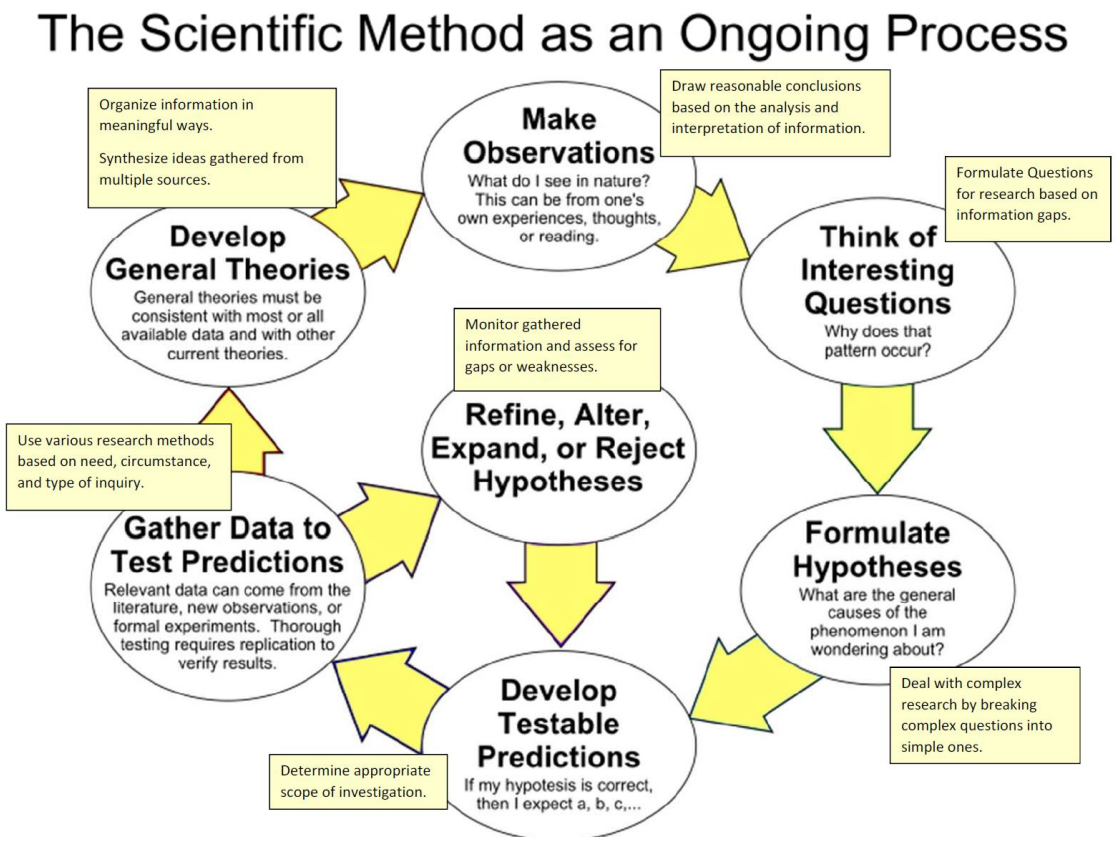

Figure 2: *Research as Inquiry* knowledge practices mapped to the scientific method.

In this instance, all eight knowledge practices are able to be mapped relatively easily to the steps of the method. Both the frame and the method even align to demonstrate the iterative nature of research. “Monitor gathered information and assess for gaps or weaknesses” aligns to the point in the scientific method when a scholar can reflect and refine or alter their hypotheses. The full study will expand on this proof of concept to other ACRL Framework frames and the UNESCO Global Standards.

Discussion

This section also contains a sampling of the full discussion that will be in the final research paper. Even in the initial stages of research, some interesting findings have been noted. First, the selected information literacy frameworks are written from a conceptual approach, emphasizing growth from novice to expert researcher. However, the scientific method is written from a process approach, helping researchers to navigate the steps of a specific project. Therefore, the six frames of the ACRL Framework cannot be directly mapped to the scientific method. Instead, the knowledge practices that are part of each frame will be analyzed. The knowledge practices are means in which a student or novice research can apply the concept of that particular frame.

This study provides an initial proof of concept for aligning terminology from STEM disciplines with that of information literacy. It focuses on just two information literacy frameworks that are used in higher education. To more broadly encompass science literacy and the teaching of research skills, it should be expanded to include additional frameworks. Science literacy frameworks, such as the PISA *2015 Assessment and Analytical Framework* are largely focused on primary and secondary education settings (Organisation for Economic Co-operation and Development 2017). This different focus makes aligning them to standards like the ACRL Framework imperfect. To connect with faculty working at lower undergraduate levels, using the model to align significant science literacy frameworks will be a necessary step in future stages of research.

Conclusions

This research project demonstrates that prominent information literacy frameworks can be mapped to the scientific method to align information literacy concepts to commonly used STEM terminology. The complete mapping can be used to engage with faculty and students across disciplines to communicate the value of information literacy instruction. It can serve as a model for mapping other national and international standards to various depictions of the scientific method.

References

Archambault, Susan Gardner, and Jennifer Masunaga. 2015. “Curriculum Mapping as a Strategic Planning Tool.” *Journal of Library Administration* 55 (6): 503–19. https://doi.org/10.1080/01930826.2015.1054770.

ArchonMagnus. 2015. *English: This Image Describes the Scientific Method as a Cyclic/Iterative Process of Continuous Improvement. This Image Is an SVG Adaptation of the Original JPEG Image by Whatiguana.* Own work. https://commons.wikimedia.org/wiki/File%3AThe_Scientific_Method_as_an_Ongoing_Process.svg.

Association of College & Research Libraries. 2016. “Framework for Information Literacy for Higher Education.” http://www.ala.org/acrl/standards/ilframework.

Cope, Jonathan, and Jesús E. Sanabria. 2014. “Do We Speak the Same Language?: A Study of Faculty Perceptions of Information Literacy.” *Portal: Libraries and the Academy* 14 (4): 475–501. https://doi.org/10.1353/pla.2014.0032.

F. James Rutherford and Andrew Ahlgren. 1990. *Science for All Americans*. New York, NY: Oxford University Press. http://www.project2061.org/publications/sfaa/online/sfaatoc.htm.

Guth, LuMarie F., Judith M. Arnold, Veronica E. Bielat, Maria A. Perez-Stable, and Patricia Fravel Vander Meer. 2018. “Faculty Voices on the Framework: Implications for Instruction and Dialogue.” *Portal: Libraries and the Academy* 18 (4): 693–718. https://doi.org/10.1353/pla.2018.0041.

Organisation for Economic Co-operation and Development. 2017. “PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic, Financial Literacy and Collaborative Problem Solving.” PISA. Paris, France. https://www.oecd.org/education/pisa-2015-assessment-and-analytical-framework-9789264281820-en.htm.

Ziegler, Amanda. 2019. “‘I Wanna Be in the Room Where It Happens’\ldots: Using Curriculum Mapping to Support the Information Literacy Goals of Online Programs.” *Journal of Library*

and Information Services in Distance Learning 13 (1–2): 226–34. https://doi.org/10.1080/1533290X.2018.1499260.