Cultivating Plain Language Skills for Engineering Students

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Abstract

While engineers are learning the vocabulary of the profession, understandably, they want to practice, and perhaps show their professors that they are proficient. This leads to student writing that is overly complicated and full of jargon. The resulting document is often one that would not be clear to the public, or even to a professional outside of the narrowly focused field of the particular engineer. After graduation, engineers' writing becomes exponentially more important. Often approval of projects relies on residents' or clients' understanding of engineers' work. For example, an engineering firm might design several alternatives for a new road or bridge, but the community may not approve the best design because the engineers were not clear in their presentation of the data.

The plain language movement arose from the legal field and the need to provide more understandable documents free of legal jargon. It has since been adopted by many other fields, especially public health and other healthcare professions, where understanding information about a treatment plan or how to take medications can have serious or even fatal consequences. As engineers are also often involved with projects which impact public and environmental wellbeing, encouraging engineering students and professionals to think about how best to explain projects and concepts in a culturally and linguistically appropriate way, as well as how to ask for feedback, local knowledge, and other collaborative communications is an important skill.

At Merrimack College, the science and engineering librarian had been trained in plain language through a Plain Language for Health workshop offered by the Center for Health Literacy Research and Practice at Tufts University School of Medicine. She used these skills to create a plain language workshop appropriate for engineering students. The junior civil engineering students had met with the librarian early in the semester to discuss library resources and research paper topics, and so had a rapport with her. Later in the semester, the librarian came again to the class to present the workshop, detailing the importance of cultivating a sense of cultural humility and using plain language, and to run through several examples of how plain language techniques could be applied to civil engineering. Students were then encouraged to use the plain language techniques in subsequent assignments.

This paper and presentation will discuss the importance of introducing new engineers to plain language resources and methodology, as well as some resources that instructors can use in their classrooms. An example of a classroom exercise will be demonstrated.

Background

Plain language is "clear, concise, well-organized, and follows other best practices according to the subject or field and intended audience" [1]. It allows the reader to (a) find what they need, (b) understand what they find the first time they read or hear it, and (c) use what they find to meet their needs [2], while being understandable, actionable, and culturally relevant [3]. Definitions vary slightly, but in general, plain language documents are written appropriately to the audience and can be understood the first time they are read or heard: prioritizing important information, in

words that will be clear to the intended audience. Plain language writing is therefore context specific – vocabulary that will be clear to lawyers, physicians, and pilots will not always be appropriate for general audiences to understand the first time they read it without looking up words.

Presenting important documents in plain language, and in multiple languages where appropriate, can improve accessibility for all people to "technical, civic, legal, and scientific discourse" [4]. Using plain language in documents can increase understandability and reduce barriers to engagement. Plain language is therefore a social justice tool.

Air safety and aviation professionals noticed the need for more clarity in communication, especially in a global and diverse field with severe consequences to misunderstandings. The International Civil Aviation Organization (ICAO) required air traffic controllers and pilots to be certified in aeronautical communication by March 2011 – although tests for certification did not exist in 2004 when the ICAO published the requirements [5]. The industry scrambled to meet the requirements, and have still not been entirely successful according to one review, including inadequate testing and policy implementation [5]. However, with these first steps, the ICAO publicly recognized the importance of improving communication; measuring success will follow.

The American Society of Civil Engineers (ASCE) Code of Ethics [6] includes responsibilities (4b) to "make clear to clients and employers any real, potential, or perceived conflicts of interest;" and (4d) "present clearly and promptly the consequences to clients and employers if their engineering judgement is overruled where health, safety, and welfare of the public may be endangered." Both of these, by including "clear", indicate that plain language usage is ethical. Other professional engineering organizations do not explicitly include "clear" or similar language in their code of ethics, however do include statements to "hold paramount the safety, health and welfare of the public" [7], [8], [9], [10], emphasizing the need for engineers to be well versed in crafting communications to the public that can be easily understood the first time it is read or heard.

How can we know if plain language techniques are catching on and the importance of clear communication is resulting in more accessible documents? To know if the use of plain language techniques is increasing, we could (1) see if plain language guidance documents exist, and (2) see how often they are used.[1] Reviews of plain-language guidelines in the literature have been conducted for health fields [11], [12], regulation writing and other legal documents [13], [14], and research summaries [15]. These fields overlap with engineering.

In 2017, IEEE Transactions on Professional Communication published a special issue on plain language [16]. An integrative literature review in the issue described how "plain language" as a movement has evolved over the past 75 years from a sentence-by-sentence "readability" concern, to a full-text-and-visual analysis of usability, accessibility, and trustworthiness of documents [17]. While the overall interest in plain-language theory and use of the terms "plain language"

[1] A non-plain-language way to present this same sentence may be: One potential way to investigate the increase in usage of plain language techniques, would be to catalog plain language guidelines, determining (1) the existence thereof, and (2) the prevalence of usage.

and “plain English” have been on the rise [17], usage in specific fields is challenging to track. Ultimately, it is evident that educational resources provided in plain language contribute to improved accessibility and inclusivity, but how to measure the impact is beyond the scope of this paper [18].

Knowing that plain language is important, and that government agencies require it, it is vital that engineering students be exposed to the concept of plain language and given instruction and practice in its usage. The next section describes one institution’s attempt to do just that.

Course Set-up

The Science and Engineering Librarian at Merrimack College in North Andover, Massachusetts attended a Communicate Health [19] training session in Plain Language for Health offered by the Center for Health Literacy Research and Practice at Tufts University School of Medicine to attain skills in presenting plain language concepts. Several years in a row, the librarian partnered with the instructor of a junior-level civil engineering course, Environmental Engineering, to support student writing and plain language skills. Students were assigned several major writing assignments in the class, including:

- a variety of laboratory writeups, including 3 traditional “experiment” type writeups, and 3 “field report” type writeups based around field trips to a wastewater treatment plant, a drinking water treatment plant, and a waste-to-energy plant;
- a 2-page (approximately 750-1000 words) ‘white paper’ regarding an environmental regulation; and
- a 5-6 page (at least 2000 words, before references) ‘research paper’ regarding an environmental engineering topic of the student’s choosing.

The librarian visited the class early in the semester to review how to use the library’s website, databases, and other resources to prepare for the two papers. After the visit, students were required to make an appointment with the librarian early in the semester to discuss potential research paper topics and sources. We hoped that this would reduce the resistance students tend to have towards both starting projects early [20], [21], asking for help with assignments [22], [23], and utilizing the important library resources and the reference librarian in general [24], [25].

Several weeks into the semester, the librarian returned for a second time to the classroom. This was the plain language presentation and activity developed specifically for engineering students.

Description of Classroom Exercise

The librarian started the class with an icebreaker that got the students writing, thinking, and talking about literacy in the United States. Students learned that 54% of US adults need materials written at or below the 6th-grade level to be understood [26]. Next, she presented that the overall goal for the class session was to learn about plain language and creating culturally sensitive materials to effectively communicate environmental health information to audiences with literacy and language challenges. With the student outcomes of:

- Recognize differences between cultural competency and cultural humility,
- Demonstrate ability to find MedlinePlus language resources,
- Demonstrate ability to communicate in plain language through written exercises, and
- Recall a resource to find additional information on plain language.

The MedlinePlus reference in particular, is relevant to the Environmental Engineering course, as the course deals with management of water quality, wastewater, hazardous waste, air quality, etc. Many of the students' research projects are related to public health issues. Also, the MedlinePlus "Health Information in Multiple Languages" [27] web document provides good examples of plain language documents as well as plain language resources written in various languages, many of which pertain to engineering such as carbon monoxide generator and furnace safety, decontamination, lead poisoning, radiation emergencies, child safety, disaster preparation and recovery, as well as emergency planning including sections specific to natural disasters such as flooding and hurricanes. These resources are introduced to highlight the importance of communicating environmental health information in multiple languages [28], [29].

The librarian followed this opening with an active and engaging discussion of the importance of plain language resources in various settings and the standards and guidelines [30], [31], and a discussion of the differences between cultural competences and cultural humility [32], [33]. She showed portions of a video helping to better explain the concept of cultural humility [34] and how it applies to their careers as future engineers [35]. The introduction portion of the class activity concluded with a think-pair-share exercise to solidify what was learned thus far.

The next portion of the class time was based on resources from the plainlanguage.gov website [36] that can easily be adapted for teaching. The topics included a discussion of the Plain Language Act signed by President Obama in 2010 and a brief history of the movement [1], as well as some examples of documents using "good" plain language text, and some that are poorly written, confusing, or full of jargon. Short active exercises were included throughout, encouraging the students to consider their audience, organize documents with important topics first, and use "you" pronouns to directly address the audience. Using active voice (rather than passive voice) and short sentences (rather than long) are also preferred techniques. Tables and bulleted lists are of particular use for engineers, helping to summarize a great deal of information in a clear and concise way, when used effectively.

A worksheet was created to help students practice the presented skills. Appendix A contains an example of what such a worksheet might look like. Worksheets can be created and adapted to be relevant to the students' field of interest. There are many examples of before and after text that are useful for training purposes on the plainlanguage.gov website [2] including many that are applicable to engineering such as from the Environmental Protection Agency, the Federal Emergency Management Agency, and the National Highway Traffic Safety Administration. Providing examples related to engineering helped classroom engagement. Depending on time, having students put their "after" plain language modified examples on the board and going over them together is an option.

Resources for Educators

Many resources exist for educators that would like to include plain language concepts in their classroom. These include online handouts, books, and conferences or trainings. A sample of these are included below.

- https://www.plainlanguage.gov/ [2]- This official US government website provides links to the relevant laws and requirements, guidelines and trainings, as well as justification and examples. It is a good place to start.
- https://centerforplainlanguage.org/learning-training/ [37]- The Center for Plain Language provides a wide variety of examples and a checklist to guide plain language writing. The organization also provides annual awards and reports detailing the compliance of the federal government to plain language requirements.
- https://writingcenter.catalyst.harvard.edu/plain-language [3]- An explanation of plain language, as well as a checklist and additional information are available on this useful website.
- https://medlineplus.gov/all_easytoread.html [38]- MedlinePlus' plain language writeups are helpful examples of documents that provide clearly worded information that is both useful and accurate. The materials assessment tool provided can be used to evaluate and improve the clarity of documents. Additionally, it is useful to show how the entire MedlinePlus website converts to Spanish and to show the "Health Information in Multiple Languages" section.
- https://wsdot.wa.gov/about/get-help-your-language [39]- The Washington State Department of Transportation is one example of an agency in the process of translating resources into multiple languages.

The authors hope that the ASEE presentation associated with this paper will also result in resources available: colleague/peer support, brainstorming activities, and other ways to support each other and our students in creating plain language documents.

Conclusion

Plain language skills are important for many professionals, certainly including engineers. To develop these skills, we must first be aware of what "plain language writing" is, and then practice writing in plain language. It is also important to have access to resources that will help with writing and practicing these skills, many are freely available online.

The described activity introduces young professionals (engineering students) to plain language concepts and resources. It will be up to them and to their supervisors to insist that this form of writing is necessary, and for the general public to insist on engineering reports to be provided in plain language.

This paper provides resources for instructors to use in developing their own activities, but these resources are not exhaustive in the least. Many others are being added regularly, and may be of more help to any given instructor. The authors encourage you to explore the topic, and start the discussion with your colleagues and with your students.

References

[1] *HR 946, Public Law 111-274, Plain Writing Act of 2010*, Oct. 13, 2010. [Online]. Available: https://www.govinfo.gov/app/details/PLAW-111publ274

[2] plainlanguage.gov, "What is Plain Language?" 2024. [Online]. Available: https://www.plainlanguage.gov/about/definitions/

[3] Harvard Catalyst, "Plain Language." The Harvard Clinical and Translational Science Center, Writing and Communication Center, 2024. [Online]. Available: https://writingcenter.catalyst.harvard.edu/plain-language

[4] N. Jones and M. Williams, "The Social Justice Impact of Plain Language: A Critical Approach to Plain-Language Analysis," *IEEE Trans. Prof. Commun.*, vol. 60, no. 4, pp. 412–429, Dec. 2017, doi: IEEE 10.1109/TPC.2017.2762964.

[5] J. C. Alderson, "Air Safety, Language Assessment Policy, and Policy Implementation: The Case of Aviation English," *Annu. Rev. Appl. Linguist.*, vol. 29, pp. 168–187, 2009.

[6] American Society of Civil Engineers, *ASCE Code of Ethics*, Oct. 26, 2020. [Online]. Available: https://www.asce.org/-/media/asce-images-and-files/career-and-growth/ethics/documents/asce-code-ethics.pdf

[7] American Institute of Chemical Engineers, *AIChE Code of Ethics*. [Online]. Available: https://www.aiche.org/about/governance/policies/code-ethics

[8] American Society of Mechanical Engineers, *ASME Society Policy : Ethics*. [Online]. Available: https://www.asme.org/getmedia/3e165b2b-f7e7-4106-a772-5f0586d2268e/p-15-7-ethics.pdf

[9] IEEE, *IEEE Code of Ethics*. [Online]. Available: https://www.ieee.org/about/corporate/governance/p7-8.html

[10] National Society of Professional Engineers, *NSPE Code of Ethics*, 2024. [Online]. Available: https://www.nspe.org/resources/ethics/code-ethics

[11] M. Grene, Y. Cleary, and A. Marcus-Quinn, "Use of Plain-Language Guidelines to Promote Health Literacy," *IEEE Trans. Prof. Commun.*, vol. 6, no. 4, pp. 384–400, Dec. 2017, doi: IEEE 10.1109/TPC.2017.2761578.

[12] E. Solomon *et al.*, "Understanding the Use of Optimal Formatting and Plain Language When Presenting Key Information in Clinical Trials," *J. Empir. Res. Hum. Res. Ethics*, vol. 17, no. 1–2, pp. 177–192, Aug. 2021, doi: https://doi.org/10.1177/15562646211037546.

[13] B. Emerson and C. Blake, "Plain Language in Regulatory Drafting," Dec. 2017. [Online]. Available: https://www.acus.gov/sites/default/files/documents/Plain%20Regulatory%20Drafting_Final%20Report.pdf

[14] M. Tartaglia, "Getting a Movement to Move: The Plain Language Movement," *Rev. Cuatrimest. Las Fac. Derecho Cienc. Económicas Empres.*, vol. 94, pp. 178–208, Apr. 2015.

[15] M. Stoll, M. Kerwer, K. Lieb, and A. Chasiotis, "Plain language summaries: A systematic review of theory, guidelines, and empirical research," *PLoS One*, vol. 17, no. 6, pp. 1–28, Jun. 2022, doi: https://doi.org/10.1371/journal.pone.0268789.

[16] N. Matveea, M. Moosally, and R. Willerton, "Plain Language in the Twenty-First Century: Introduction to the Special Issue on Plain Language," *IEEE Trans. Prof. Commun.*, vol. 60, no. 4, pp. 336–342, Dec. 2017.

[17] K. A. Schriver, "Plain Language in the US Gains Momentum: 194-2015," *IEEE Trans. Prof. Commun.*, vol. 60, no. 4, pp. 343–383, Dec. 2017, doi: IEEE 10.1109/TPC.2017.2765118.

[18] H. Persson, H. Åhman, A. A. Yngling, and J. Gulliksen, "Universal design, inclusive design, accessible design, design for all: different concepts--one goal? On the concept of accessibility--historical, methodological and philosophical aspects," *Univers. Access Inf. Soc.*, vol. 14, no. 4, pp. 505–526, Nov. 2015, doi: 10.1007/s10209-014-0358-z.
[19] "About Us," CommunicateHealth. Accessed: Jan. 03, 2025. [Online]. Available: https://communicatehealth.com/about-us/
[20] P. E. Johnson Jr., C. J. Perrin, A. Salo, E. Deschaine, and B. Johnson, "Use of an explicit rule decreases procrastination in university students," *J. Appl. Behav. Anal.*, vol. 49, no. 2, pp. 346–358, Jun. 2016, doi: 10.1002/jaba.287.
[21] A. Miyake and M. J. Kane, "Toward a Holistic Approach to Reducing Academic Procrastination With Classroom Interventions," *Curr. Dir. Psychol. Sci.*, vol. 31, no. 4, pp. 291–304, Aug. 2022, doi: 10.1177/09637214211070814.
[22] C. Pellegrino, "Does Telling Them to Ask for Help Work?: Investigating Library Help-Seeking Behaviors in College Undergraduates," *Ref. User Serv. Q.*, vol. 51, no. 3, pp. 272–277, 2012.
[23] M. Micari and S. Calkins, "Is it OK to ask? The impact of instructor openness to questions on student help-seeking and academic outcomes," *Act. Learn. High. Educ.*, vol. 22, no. 2, pp. 143–157, Jul. 2021, doi: 10.1177/1469787419846620.
[24] A. Yevelson-Shorsher and J. Bronstein, "Three Perspectives on Information Literacy in Academia: Talking to Librarians, Faculty, and Students," *Coll. Res. Libr.*, vol. 79, no. 4, Art. no. 4, May 2018, doi: 10.5860/crl.79.4.535.
[25] J. Fagan, "Students' Perceptions of Academic Librarians," *Ref. Libr.*, vol. 37, no. 78, pp. 131–148, Mar. 2003, doi: 10.1300/J120v37n78_09.
[26] "Literacy Statistics 2024- 2025 (Where we are now)." Accessed: Jan. 03, 2025. [Online]. Available: https://www.thenationalliteracyinstitute.com/post/literacy-statistics-2024-2025-where-we-are-now
[27] "Health Information in Multiple Languages: MedlinePlus." Accessed: Jan. 03, 2025. [Online]. Available: https://medlineplus.gov/languages/languages.html
[28] D. Brugge *et al.*, "The Role of Environmental Health Literacy When Developing Traffic Pollution Fact Sheets for Puerto Rican Adults," *Environ. Justice*, vol. 11, no. 1, pp. 40–46, Feb. 2018, doi: 10.1089/env.2017.0008.
[29] S. Finn and L. O'Fallon, "The Emergence of Environmental Health Literacy—From Its Roots to Its Future Potential," *Environ. Health Perspect.*, vol. 125, no. 4, pp. 495–501, Apr. 2017, doi: 10.1289/ehp.1409337.
[30] "Ten Attributes of Health Literate Health Care Organizations | Request PDF," ResearchGate. Accessed: Dec. 13, 2024. [Online]. Available: https://www.researchgate.net/publication/325801139_Ten_Attributes_of_Health_Literate_Health_Care_Organizations
[31] "Cultural and Linguistic Competency | Office of Minority Health." Accessed: Dec. 13, 2024. [Online]. Available: https://minorityhealth.hhs.gov/cultural-and-linguistic-competency
[32] M. Tervalon and J. Murray-García, "Cultural Humility Versus Cultural Competence: A Critical Distinction in Defining Physician Training Outcomes in Multicultural Education," *J. Health Care Poor Underserved*, vol. 9, no. 2, pp. 117–125, May 1998, doi: 10.1353/hpu.2010.0233.

[33] K. A. Yeager and S. Bauer-Wu, “Cultural humility: essential foundation for clinical researchers,” *Appl. Nurs. Res. ANR*, vol. 26, no. 4, pp. 251–256, Nov. 2013, doi: 10.1016/j.apnr.2013.06.008.
[34] Vivian Chavez, *Cultural Humility (complete)*, (Aug. 09, 2012). Accessed: Dec. 13, 2024. [Online Video]. Available: https://www.youtube.com/watch?v=SaSHLbS1V4w
[35] S. Kurtz-Rossi, D. Brugge, and S. Baedorf Kassis, “Health Literacy and Broadly Engaged Team Science: How One Study Team Used Plain Language Principles to Share Findings with Affected Communities,” in *Broadly Engaged Team Science in Clinical and Translational Research*, D. Lerner, M. E. Palm, and T. W. Concannon, Eds., Cham: Springer International Publishing, 2022, pp. 167–174. doi: 10.1007/978-3-030-83028-1_18.
[36] “plainlanguage.gov | Home.” Accessed: Dec. 13, 2024. [Online]. Available: https://www.plainlanguage.gov/
[37] “Plain Language Learning.” Accessed: Dec. 13, 2024. [Online]. Available: https://centerforplainlanguage.org/learning-training/
[38] “Easy-to-Read Health Information: MedlinePlus.” Accessed: Dec. 13, 2024. [Online]. Available: https://medlineplus.gov/all_easytoread.html
[39] “Get help in your language | WSDOT.” Accessed: Jan. 03, 2025. [Online]. Available: https://wsdot.wa.gov/about/get-help-your-language

Appendix: Sample Classroom Worksheet

Review the following sentences.

First, decide for yourself the key point or points of the sentence. Can the sentence be made more clear?

Then, discuss with your neighbor. Together, can you come up with a more accessible way to express the same point?

(1) "Other studies have described information literacy as a socially situated practice that is a catalyst for learning, necessary for individuals to become socially and civically involved in their communities and crucial for success in the working world where people are accustomed to rapid technological change."

From (Yevelson-Shorsher and Bronstein, 2018).

(2) "Cultural humility is a lifelong process of self-reflection and self-critique whereby the individual not only learns about another's culture, but one starts with an examination of her/his own beliefs and cultural identities (Tervalon & Murray-Garcia, 1998)."

From (Yeager and Bauer-Wu, 2013).

(3) "Radiotelephony communication takes place between pilots and air traffic controllers, with standard phraseology at the core, and operational exchanges in plain English when phraseology is inadequate; such radiotelephonic communication is used almost exclusively for air–ground communication, to direct, inform, question, request, and respond, where the air traffic controller directs and controls pilots.

From (Alderson, 2009).

(4) "Scientific and technological developments also contributed to the evolution of communication modalities related to environmental risk that are not dependent on reading ability.

From (Finn and O'Fallon, 2015)