

Vital Skills in Engineering: Communication

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Through the course of a four year NSF project, we interviewed over 140 engineers and conducted case studies of six engineering firms from varying industries. Over 2000 engineers or engineering graduates also responded to surveys. All of this data enabled us to draw conclusions about the ways of thinking, skills, values and identities of practicing engineers. This report on communication is one of a series of brief reports on ideas for further enhancing the connection between engineering courses and engineering practice.

This front page details data from engineering graduates on the importance of communication and what it means to them. The back provides practical suggestions for incorporating these ideas in courses.

Engineering communication is an essential skill

Strong communication skills are a part of practically every interaction in engineering work. It is no wonder communication consistently ranks among the top three skills essential to the profession. Our surveys showed that communication skills were ranked as an essential skill by 62% of engineers, more than any other skill, and that fully 90% listed it as essential or important on the job.

"Engineering is the easy part. It's the people that are difficult." --Practicing Mechanical Engineer

62%
of
engineers claimed communication
to be important to work

Engineering communication is lacking in engineering education

Though it was a surprise when engineers consistently ranked *communication as one of the top three areas where their engineering education was lacking*, the data is compelling. When asked to list where undergraduate engineering education needed improvement, participants ranked communication skills ahead of having more internships and hands-on projects. Engineering students are learning the technical skills they need in the classroom, but they need more communication training; one engineer put it this way:

"But in here on any given day, for example, I probably don't spend more than two or three hours on looking at technical stuff. A lot of my time gets spent on interacting with people in marketing, sales, field support, and even other engineers in different disciplines. I'm an electrical engineer, but, you know, I have to work with mechanical and other engineers that are here to understand the big picture. And then, a lot of writing, documentation, and a lot of presentations." -- *Practicing Electrical Engineer*

Communication must be made explicit in engineering pedagogy

The culture of engineering education must shift to include essential communication skills as part of the toolbox for successful engineering. To build communication skills and confidence in students, educators must explicitly label the moments when, where, and how communication influences the success of the technical solution. Mentoring students in the technical aspects no longer provides a complete education. Introduce communication exercises into existing content of engineering courses by creating authentic communication cycles surrounding technical work. Whenever possible, that cycle should contain written, oral, and visual communications that mirror expectations and best practices found in engineering workplaces.

Integrate engineering communication

By making the development of communication skills a regular part of every class's curriculum, engineering faculty will prepare their students to succeed.

Change up assignments to thoroughly integrate communication skills into engineering problem-solving tasks. Explicitly label the audience, purpose, and career necessity in assignments so that students see connections with communications they will create and contribute to in their later careers.

Effective communication skills are not built during a single class or exercise, but through continual practice. As more engineering instructors integrate communications expectations into their curriculum, they prepare students for on-site work and make them better communicators now.

Use established rubrics for assessment & feedback

While many engineering faculty understand the need for integration of communication practice into the curriculum, they are uncertain about how to assess the material that students produce. Crafting an assessment rubric (whether written or oral) can be an easy and invaluable way to provide the feedback that students crave. The main components of any communication rubric consist of evaluations of how well the communication addressed **audience** needs and achieved its **purpose**. Instructors may also choose to comment on issues such as format, language use, or style. [See a description of rubrics and some examples here.](#)

Link to Project Site

If you're looking at this report on paper, our project website is hplengr.engr.wisc.edu/resources.htm

Links to Resources

Rubrics: [Example 1](#) [Example 2](#) [Example 3](#)
[Better Power Point presentations \(Michael Alley\)](#)

Communication Assignments

1. Recast assignments to mimic real-world needs.

Give students [practice writing to external audiences](#) with high expectations. Instead of asking students to document their work simply for the instructor, reframe the audience as an interested client or government agency. Developing a rubric to mirror those audience expectations requires the instructor or students to research them and understand how the work will truly be judged. [Here is a template](#) for a major technical report including expectations on content and format that allow for quick and uniform assessment and feedback on student work.

2. Require formality. Ask students to [practice professional communication](#) in all activities of the class. Putting a [professional touch on simple communications](#), such as email, daily elevator reports, or team requests, can help students develop attention to audience needs at a different level than more traditional academic formats of self-reporting often call for. Create a rubric for rapid assessment of these recurring practices.

3. Assign a presentation. Practicing engineers constantly present in meetings, design reviews, client interactions, and other venues. To better prepare future engineers for such demanding formats, include presentations as part of the course [and support students in doing them well](#). For single authors, allow for 5-10 minute talks; team talks are best assessed in 15-20 minutes. For less formal presentations, [elevator talks \(< two minutes\) provide a brief, high-level description of work for an executive audience](#). Feedback from their peers and their instructor provides students with goals for improvement ([rubrics can also be used by peers](#)).

4. Assess efficiently. Instructors often fear assessing written work because of the time commitment traditionally required. However, rubrics and selective assessment of error patterns can reduce feedback time dramatically. Selective assessment involves reading a piece, listing the errors/issues in order of significance, then demonstrating an example of the error and potential solution with a focus on only one (or few) key learning outcomes.



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