

Creating a Communications Curriculum for the Modern Engineer

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Mr. Danny Rubin, Rubin

Danny Rubin is the founder of Rubin, a leading provider of online curriculum for business communication skills. Rubin, the company, provides its signature curriculum, called "Emerge," to engineering schools nationwide. Emerge features in-demand communication topics like email etiquette, phone etiquette, networking, LinkedIn and more. Danny began his career as a local TV news reporter and national news consultant for NBC's "Meet the Press." He's a graduate of the University of Virginia and also received a master's in broadcast journalism from the University of Maryland - College Park.

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Abstract

Successful engineering requires communication skills. Clear communication is necessary for selling ideas, working on teams, reporting results, and negotiating a career. While engineers do learn how to write lab reports and other technical documents, many engineering faculty do not include professional communication skills in their courses. It is often assumed that students are capable of writing professional emails, communicating with team members, keeping minutes for a meeting, or summarizing a meeting with little or no formal instruction. When communication education is included, it is included as an add-on and often only addressed at the level of proficiency of the instructors (who are typically not experts in professional communication).

The purpose of this paper is to outline a multi-course effort at Michigan State University to meaningfully integrate a professional communication curriculum into their core engineering classes. The paper outlines the development of a multi-course syllabus and leveraging an existing communications education solution. Careful work is done to integrate communication education into the course objectives and curriculum rather than treating it as an add-on.

Evidence of successfully achieving student outcomes is measured with student surveys and questionnaires.

Background

One of the key skills an engineer must develop is the ability to communicate. They must communicate to their employer, their team, their customers, and a range of other audiences. They must communicate clearly in both technical (e.g. reports) and professional (e.g. emails) areas. While most engineering schools offer excellent technical communication curriculums, many schools presume that education in professional communication skills are handled by the English department or developed naturally.

Professional communication development should be a central component in our engineering programs [1]. Most engineering students do not develop appropriate communication skills naturally. This is particularly true in the 21st century as the emergence of short-form communication like texts and Twitter stymie the development and practice of professional writing. For engineers in particular, teamwork is an important area for focused professional communication development [2]. Consigning instruction in professional writing to English departments can be interpreted by students as a statement that writing is a topic for non-engineers.

As professionals, we know that communication skills are important for functioning as an engineer. The ABET accreditation criteria contain two specific instances of professional communication skills [3]:

ABET Criteria 3 – Student outcome 3 – an ability to communicate effectively with a range of audiences

ABET Criteria 3 – Student outcome 5 – an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

What are Professional Communication Skills?

In this paper, we define professional communication skills as distinct from the writing of lab reports and technical documents. Professional communication skills include the proper use of email, written and spoken communication in between team members working on a project, creating and curating a professional presence online (like Linked-In), teamwork, consensus building, and customer interfacing.

Professional communication skills are required to communicate ideas with clarity, be effective in collaborations, and present oneself in a polished professional way.

What should a Professional Communication Curriculum look like?

The goal of this paper is to outline the communication curriculum developed at Michigan State University in conjunction with Rubin Education [4], a company that has developed a standalone professional communications curriculum.

In approaching this question, Michigan State University identified three key ideas that we felt were necessary to making a Professional Communications Curriculum a success.

- 1) The curriculum should train students in best practices, offer sufficient scaffolding for all levels of learners, and provide opportunities for students to practice what they are learning.
- 2) The implementation should help engineering students value professional communication and take ownership in developing themselves as professional communicators.
- 3) Professional Communications content must have the buy-in of the faculty who are teaching the associated courses and be easily adaptable to course content and content changes.

Rubin Education

The solution to the first key idea presented itself at one of the trade booths at ASEE 2019. A communications-curriculum startup company called Rubin Education agreed to work with us to develop a communications curriculum tailored to engineering students.

This communication curriculum utilizes e-books and training videos to guide students through the best practices of professional communication. A key aspect of the curriculum is that it provides lessons in three levels. For example, in the section on “Writing a letter to thank someone after a networking meeting” the curriculum covers:

- 1) Best practices – What are the general rules of writing a proper letter? When should you send a hand written note as opposed to an email?

- 2) Examples – An example of a well written letter and identification of what makes the letter stand out.
- 3) Practice – An assignment to write your own thank you letter that is relevant to a networking experience you have had in the past.

These three features provide students with excellent guidelines for successful communication.

Implementation across the curriculum.

Students need to know that professional communication skills are important for engineers. One way to teach someone that a concept is important is to teach it frequently, in different contexts, and with different voices. Introducing professional communication in one class will not change student perception. Students often think of these classes as “worthless classes that they just have to get through so they can get to the real engineering classes”. By integrating professional communication into the structure of several classes, students begin to realize that professional communication development is something the whole department endorses and emphasizes [5].

A second way to help students value professional communication is to integrate it into the course structure. This means that the professional communications aspect of the course is treated as an integral part of the class and not an addition. As such, it appears in the course objectives and it is part of assignments rather than an additional homework set.

A third way to help students value professional communications curriculum is to make the examples real and tangible. Communicating is a regular event for students, so adding authenticity by choosing examples that are realistic helps bridge the gap between the assignments and their purpose. Most students have a Linked-In profile, but few students have had detailed instruction on how to make their profile stand out or use it to network and find employment.

Faculty buy-in.

The most significant issue with faculty buy-in is often the time commitment. However, a second challenge is that engineering faculty are engineers, not communication educators. Faculty are often excellent communicators, but they usually teach technical communications (academic papers and lab reports) and not professional communications.

In this curricula development, faculty buy-in was created by having an experienced faculty member work with interested faculty members to identify course content that was amenable to a communication component. The experienced faculty helped to create an assignment for that component that was linked to readings and homework assignments in the Rubin Education curriculum. A list of assignments (Appendix A) and content map (Appendix B) were created to help faculty see how the material was used in other classes and ensure that courses had minimal overlap in reading assignments.

The Implementation

The communications curriculum was initially developed and tested in a sophomore level mechanics course, ME222. This course was identified as a good starting point because it is one

of the first engineering courses taken by Mechanical Engineers at Michigan State University. This is the first place that the Mechanical Engineering department can create a student culture of valuing professional communication. Additionally, at Michigan State University, the sophomore year is often a year where students receive little or no writing or professional communication curriculum (Figure 1).

In the 2019-2020 academic year, a professional communication component was added to ME222. The course introduction, problem types, assignment structures were tested and modified. Student feedback was obtained through course surveys and informal discussions. Additional, engineering specific exercises were added to the Rubin Education content.

Over the summer of 2020, faculty of ME300 (Professional Issues in Mechanical Engineering), ME370 (Design I), and ME481 (Capstone design) met to discuss how to implement the content in their courses. They received a walkthrough of the Rubin Education content and one of the ME222 professors helped them work through their course content to identify the best places for a professional communication component (2-6 components were added to each course).

Faculty were given tools and instruction on how to introduce the content to their students. A multi-course syllabus was created (Appendix A) so students could see that the communication content would be a persistent part of their education. Faculty were also given a “use map” (Appendix B) so they could identify content that was not covered in other places in the curriculum.

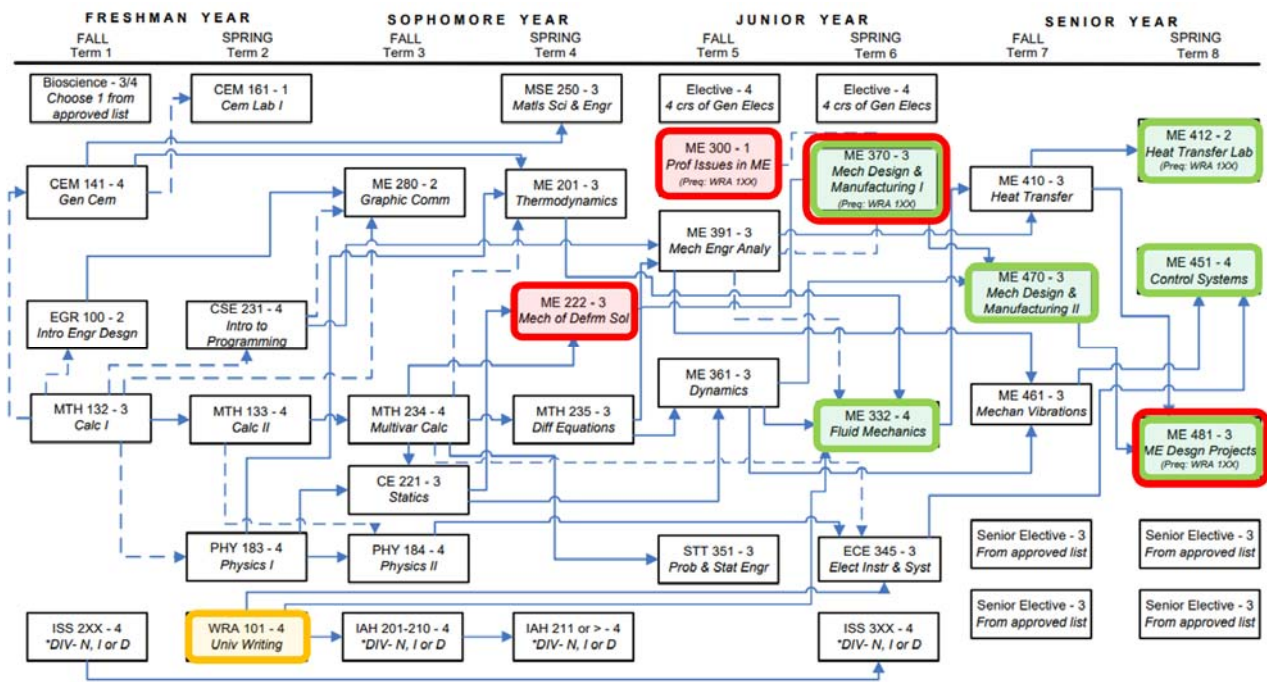


Figure 1 – Mechanical Engineering curriculum map. Yellow highlights courses that are part of the general education writing program. Green highlights courses that have technical communication components like lab reports. Red highlights the courses that were selected to be part of the first instance of the multi-course communication curriculum.

In total, 20 professional communication assignments were created across 4 ME courses spanning 4 different semesters (from a student perspective). Each assignment was developed in enough detail to hand off to another faculty member if someone else taught the course.

Example Lesson

The lesson provided below is an example taken from ME222. In this course, a full lecture is dedicated to an active learning exercise involving the lifting of a pressure vessel (Figure 2). In Figure 3, the students see the details of the communication assignment.

Experiential Learning Thursdays

TASK: Your company needs to move a 20,000 gallon pressure vessel. Your boss wants to know if she can safely move the tank while it is full or if she should empty it.

- 1) **SOLVE:** Find the most likely failure location and factor of safety for the pressure vessel when it is:
 - A. Empty
 - B. Full
- 2) **INTERPRET:** What do your results mean? What assumptions were made?
- 3) **COMMUNICATE:** Write an executive summary.


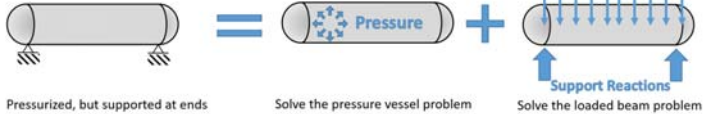


Image: <http://www.procrane.net/gallery.html>

Hint: Superposition



Pressurized, but supported at ends
Solve the pressure vessel problem
Solve the loaded beam problem

Additional Information: Tank is 36' long, 10' wide and 10' high. It is made from 1/4" thick stainless steel 304. The tank is filled to 80% capacity with crude oil and pressurized to 2 atm.

Figure 2 – Experiential learning assignment in context. This is the introductory slide for an experiential learning lecture with an integrated communication assignment. Note that solving the problem is only one of three steps and that communication is incorporated into the assignment right at the beginning.

Experiential Learning Thursdays

Communication Assignment #3

PART A:: Read Rubin Book 3: Ch8 ([Link](#))

PART B:: Complete and turn in "[How to write an executive summary](#)"

You are writing an executive summary for the pressure vessel crane lift analysis. An executive summary doesn't have mathematics, but describes the most important parts of a report. Pretend this executive summary is the text of an email you will be sending your boss. It should answer her question and explain the most important parts of the extensive report* you are attaching to the email. *You are only writing the summary, not the report.

Figure 3 – Specifics of the experiential learning assignment. The slide above contains the details of the Rubin Education assignment. The paragraph shows how the Rubin Education assignment is being modified to fit the specifics of the real class assignment.

Results:

At the end of the fall semester, 2020, students were invited to participate in an online survey to help assess the curriculum. Included below are some of highlights from student responses. While some students did express frustration at learning something they thought they already knew, many students stated that the exercises were helpful, thought provoking, or transformative.

Question 1 - Why do you think Engineers need communication skills?

- In order to work in the real world, engineers need to know how to work in groups. From my knowledge, most projects require collaboration and helping each other. We need communication skills to help get our ideas across efficiently.
- Depending on their role they need to express ideas.
- Communication is a large part of engineering so that engineers can explain solutions and processes.
- Because networking is important.
- Most engineers leave University and start out as an engineer by technical title. However, because of their skills in solving problems and managing, they often move up to an administrative or managerial position, and these skills help with that tremendously.
- An engineer needs to be able to communicate their thoughts- especially those which are more technical. Being able to explain something technical to those who don't have the knowledge you do is important.
- It is essential to be able to share your work or answers in an effective manner, so people can understand what you are doing.
- So that ideas and designs can be communicated clearly without any mix up. This will help the overall design and safety of products.

Question 2 - What did you like most about the professional communications curriculum?

- It made me examine my own writing
- I liked that they gave me updated ways to write an email and a variety of scenarios.
- I liked the tips for which words to exclude from emails. That was the main piece of helpful knowledge I gleaned.
- That we are pushed to be more than just engineers doing math and science
- I liked that it gave real world examples of how we could use the knowledge we were learning.
- I liked that the readings were generally concise and got to the point quickly.
- The Rubin communication curriculum was helpful in the aspect that it laid out the topics well and it offered useful tips to emails and other things that I was not aware of.
- Actually made you practice
- I like the example it gives you, for me I learn so much better with examples already laid out.

Question 3 - One of the goals of the Rubin content is to provide a learning resource that extends outside of the immediate classroom. Did you find the Rubin lessons helpful in another class or context (i.e. applying for a job, communicating with a student org. etc)? Please summarize.

- I used the skills I learned to write an email to a potential employer
- I found the email writing tips helpful, as I am inclined toward wordiness and uncertainty in my emails.
- Yes, while looking for internships and filling out other applications, I found myself using things from Rubin throughout the semester.
- Yes, I used the information while drafting other emails and updating my linkedin profile.
- Yes! I hold a leadership position on an engineering club here at MSU and I learned some valuable skills in the leadership department that I have now started to use in my club conversations and meetings.
- I have started using the professional email signature that I made in a Rubin lesson in real emails.
- Yes, when contacting my new boss I followed the guidelines Rubin taught me this semester.
- Yes! I first used Rubin over a year ago and now I write my emails the same way that Rubin says. I use it fairly a lot.
- Not yet, but I think it will come up in time.

Conclusions

The development and implementation of this communications curriculum benefitted from three major factors. First, the use of a fully developed “plug-and-play” educational content from Rubin Education significantly reduced development efforts and resulted in a professional product that was consistent across the courses. An additional benefit of using the Rubin Education content is the breadth of the content. It contains many specific-use modules that were not part of

this implementation. Informal discussions with students indicated that these modules (e.g. “How to prepare for a phone interview”) were used by students even though they were not assigned. Having students utilize a resource that is not assigned because it benefits their career is a major step towards life-long learning.

A second factor was faculty buy-in. Faculty teaching the courses that adopted the Rubin Education content were willing to try something new, and make the effort to integrate the curriculum into their courses. These interested faculty were provided with resources in the form of the Rubin Education curriculum and a faculty collaborator to help with development.

The third factor was a faculty champion. A member of the teaching faculty ran the initial trials, and spent time with each participating faculty member to help them develop their problems and initialize the implementation. It is anticipated that a pre-semester reminder and refresh will be necessary to maintain the curriculum moving forward.

The rollout of the communication curriculum was scheduled for rollout in the Fall of 2020. The pandemic did make faculty collaboration on the project difficult. However, the transition to online classes also helped faculty see the need for a professional communication curriculum. The transition to online classes did not affect the implementation of the Rubin Communication curriculum from the student side, because it is a fully online resource.

Future work includes expanding the rollout to include several more courses, with an emphasis on increasing the number of sophomore courses. A cycle of constant assessment and improvement will necessitate the development of specific measurements and points of measurement in the curriculum.

References

1. Cress, J. A., & Thomas, P. W. (2020, June), *Imbedding Industry Expectations for Professional Communication into Undergraduate Engineering Curricula* Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual On line . 10.18260/1-2—34749
2. Polk, T. W., & Smallwood, M. G., & Sluder, J., & Hart, R., & Pacheco, J. (2017, June), *The Impact of Professional Communications Training on Teamwork and Leadership Skills for Engineering Capstone Teams*. Paper presented at 2017 ASEE Annual Conference & Exposition, Columbus, Ohio. 10.18260/1-2--28976
3. abet.org, “Criteria for Accrediting Engineering Programs 2021-2022” Website: <https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2021-2022/> Accessed 3-3-2021
4. Rubineducation.com “About Rubin Education”, Website: <https://rubineducation.com/about/> Accessed 3-3-2021
5. Tompkins, W., & Chesler, N., & Block, W., & Masters, K., & Murphy, W., & Tyler, M., & Webster, J. (2007, June), *Development Of Professional Communication Skills Throughout The Bme Curriculum* Paper presented at 2007 Annual Conference & Exposition, Honolulu, Hawaii. 10.18260/1-2—2748

Appendix A – Multi-Course Syllabus.

Communication Multi-course Syllabus

Version 2020-2021

Student Learning Outcomes

Communication is a critical professional skill for engineers. Engineers need to network, work in teams, communicate with customers, and share results with precision and clarity. By the time you have completed these communication assignments you will be able to communicate effectively (ABET 3g) and function on multidisciplinary teams (ABET 3d). Specifically you will learn how

1. The importance of communication for the engineering profession.
2. How to network and apply for jobs.
3. How to communicate between team members.
4. How to communicate to your boss.
5. How to recap and report results.
6. Write a letter to your boss.
7. Crafting your own story.

Textbook

Communication learning guides, videos, and book are provided by Rubin Education.

[How to order the digital textbook + curriculum](#)

Student instructions for setting up an account Emerge, the online program from Rubin.

1. Visit learning.rubineducation.com and create a new account. On the new account form, enter group code: #####
2. After creating your account, you will go to a page that confirms your enrollment. Click on "Click here to view the course."
3. On the next page, click on "Go here to purchase access to the program." Complete the form fields and select your desired length of time (read special note on payment page for MSU students). Upon purchase, you will receive a unique access code.
4. Return to Emerge, click "go here to enter your access code" and paste in your access code. You will then see all Emerge material available.

Questions? Email Support@RubinEducation.com

[Payment / Purchase Options](#)

1 year / 2 year / 3 year/ 4 year OR 5 year access (Multi year savings of up to %36 percent*)
~ 16% / ~27% / ~32% OR ~36% discount (* Prices current for SPRING2021)

The Rubin textbook will be used in ME222, ME300, ME370, and ME481. Multiyear access may save you money.

Privacy Statement

Rubin Education is a FERPA compliant business. For FERPA regulations on data use please see: <https://ogc.msu.edu/topics/ferpa.html>

Key Curriculum Locations

This syllabus covers communication assignments in the following ME classes:



Other classes with significant communications components include:

ME332, ME412, and ME451 – Laboratory reports
ME470 – Design reports

Other places in you will need communication components at while at MSU:

Communicating with professors.
Participating and leading student organizations.
Career fairs and internships.
Life

Assignments – (Specific Assignments are subject to change)

Course	Reference Material	Assignment
ME222	Book 1 (<i>Wait, How Do I Write This Email?</i>) – Ch. 1	Reading based Quiz
	Book 1 (<i>Wait, How Do I Write This Email?</i>) – Ch. 2 Email etiquette - Level 1	Lab 1 – Discussion memo. Assumptions, process, lessons
	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 8	Lab 2 – Write an Executive summary
	Book 1 (<i>Wait, How Do I Write This Email?</i>) – Ch 5 (linked in) Email etiquette - Level 1 Video: Internship Opportunity	Update Linked in profile and email signature. Write a ‘request for an internship’ email.
	Book 2 (<i>Wait, How Do I Promote My Business?</i>) – Ch. 4 Project Mgmt - How to recap	Lab 4 - Write a recap email
	T.O.C for Books 1-3	Choose your own adventure. Find a chapter that looks helpful and write a summary of what you learned.

Course	Reference Material	Assignment
ME300	Book 1 (<i>Wait, How Do I Write This Email?</i>) – Ch. 4	Applying for a Job
	Book 1 (<i>Wait, How Do I Write This Email?</i>) – Ch. 9	Creativity
	Book 1 (<i>Wait, How Do I Write This Email?</i>) – Ch. 10	Communication #1
	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 1	Communication #2
	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 2	Project
	Book 2 (<i>Wait, How Do I Promote My Business?</i>) – Ch. 1	Business Conduct
ME370	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 8	Create an executive summary.
ME370	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 2	Write a brief email to assign team roles.
ME370	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 2	Write a brief email to summarize the status of your project.
ME370	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 9	Understanding team dynamics
ME370	Book 1 (<i>Wait, How Do I Write This Email?</i>) – Ch. 9	Telling your design story
ME370	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 9	Write an email introducing someone to a colleague.
ME481	Book 1 (<i>Wait, How Do I Write This Email?</i>) – Ch. 3 Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 3	Student team will write email to Industry advisor to request materials\information they need for the project. (And send a follow up email if info is not received in a timely way)
	Book 3 (<i>Wait, How Do I Lead My Team?</i>) – Ch. 8	Student team will schedule final presentation for the project with industry advisor and faculty advisor including a brief executive summary on the project.

Appendix B – Instructor use map.

Table B1: Use Map for Rubin Education Curriculum

	ME222	ME300	ME370	ME481
Book 1:				
Chapter 1: How to Write Everything Better	X			
Chapter 2: How to Send Emails Like a Pro	X			
Chapter 3: Networking Templates				X
Chapter 4: Job Search Templates		X		
Chapter 5: LinkedIn Templates	X			
Chapter 6: Handwritten Notes				
Chapter 7: Graduate School Templates				
Chapter 8: Phone Conversations				
Chapter 9: The Power of Stories		X	X	
Chapter 10: Effective Resumes		X		
Chapter 11: List Posts with a Purpose				
Book 2:				
Chapter 1: Business Writing Basics		X		
Chapter 2: Public Relations 101				
Chapter 3: Networking and Outreach Emails				
Chapter 4: Interoffice Communication	X			
Chapter 5: LinkedIn Writing Guides				
Chapter 6: Website Content				
Chapter 7: Fundraising Tactics				
Chapter 8: Public Speaking				
Chapter 9: Thank-You				
Book 3:				
Chapter 1: Writing Master Class for Leaders		X		
Chapter 2: Write to Your Team		X	X	
Chapter 3: Write to Clients				X
Chapter 4: Same Message, Different Audiences				
Chapter 5: Network Like a Leader				
Chapter 6: Handwritten Thank-You Notes				
Chapter 7: LinkedIn for Leaders				
Chapter 8: Reports and Presentations	X		X	X
Chapter 9: Lead by Action			X	
Chapter 10: Write as a Leader in a Student or Membership Organization				
Chapter 1: How to Write Everything Better				