Report Writing Seminar

Bilkent University

Fall 2021

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Seminar Schedule

- Principles of Effective Academic Writing
- Project Reports
- Citation and Plagiarism
- How to compose an academic email

Resources for academic writing

- **Science**:
  - AACC **"Clinical Chemistry Guide to Scientific Writing"**
  - Nature Education's "**English Communication for Scientists"**
- **Science and Engineering**
  - UCLA's **"Writing in the Sciences and Engineering"**
- **Computer Science**
  - Carnegie Mellon University's "**Advice on Research and Writing**" for computer scientists
- **Mathematics**
  - UCLA's **"How to Write a Clear Math Paper"**
- **Citation/Plagiarism**
  - **"Academic Integrity at MIT: A Handbook for Students"**

How to write well

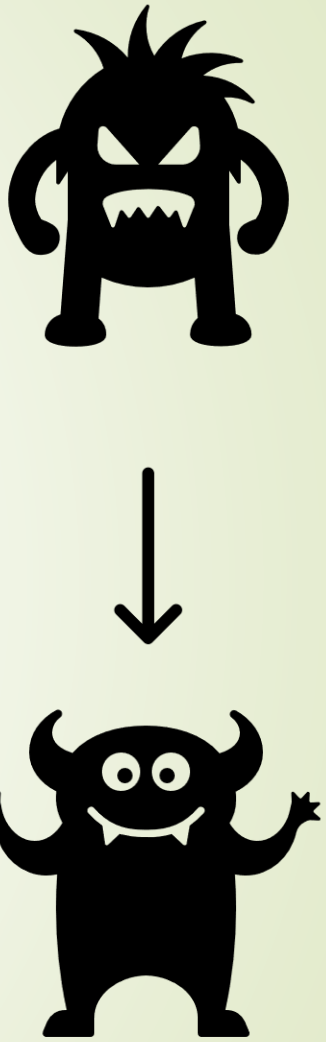
Collect Weapons

Read and research

- Gain knowledge/ confidence
- Have something to say
- Internalize good writing

Don't write to impress

- Write to communicate!
- Don't be fancy; be direct.



How can one become a better writer?

- Research
- Read closely and imitate
- Talk about your research with others
- Be direct and clear
- Engage readers (don't bore them!)
- Edit/ cut ruthlessly. Don't become attached to your words.

How can one learn to write like a native English speaker (without a proofreader)?

- Internalize authentic input
  - Read
    - Articles, news, textbooks, non-fiction, fiction
  - Binge-watch Netflix with subtitles
    - Grammar and basic vocab are the same as in academic writing
    - Will help you avoid basic mistakes (articles, wording)
    - Will help you write fluently like a native speaker

Principles of Effective Academic Writing

- Acknowledgement: Dr. Kristin Sainani, Assoc. Professor of Health Research and Policy at Stanford
  - "Writing in the Sciences" course on Coursera.com (2020)

What is good academic writing?

- Communicates ideas clearly and effectively
  - Has something to say
  - Well-organized
  - Concise and direct

What is good academic writing?

Read the following excerpts from abstracts.

- Some are from highly cited articles in top journals by leading academicians.
- Others are dissertations of graduate students (not from top universities, not native speakers of English)

Can you identify which are which?

Academicians or student?

- **Title:** ICT Experience in East Asia Modelling for Turkey
- **Abstract:** The remarkable development in ICT (Information and Communication Technology) was observed in the past decades that it has an increasing impact on economic and social activities in the world. ICT have a significant role in the economic growth for developed and developing countries. The countries have been very dynamic in recent years in East Asia. Focusing on Gross Domestic Product (GDP) per capita income distributions of East Asian countries in this study, it is aimed to show that ICY and its components are closely linked with socio-economic components in macro and micro levels. Some important findings are observed that there has been regional convergence as Beta convergence and Sigma-convergence after 1992 among East Asian countries…

Answer:

- Dissertation submitted by a PhD student from Okayama University, Japan

Academicians or student?

- **Title:** Speech synthesis from neural decoding of spoken sentences
- **Abstract:** Technology that translates neural activity into speech would be transformative for people who are unable to communicate as a result of neurological impairments. Decoding speech from neural activity is challenging because speaking requires very precise and rapid multidimensional control of vocal tract articulators. Here we designed a neural decoder that explicitly leverages kinematic and sound representations encoded in human cortical activity to synthesize audible speech… These findings advance the clinical viability of using speech neuroprosthetic technology to restore spoken communication.

Answer:

- Research article published in Nature by Neurology professors

Academician or student?

- **Title:** Violent video game engagement is not associated with adolescents' aggressive behaviour: evidence from a registered report
- **Abstract:** In this study, we investigated the extent to which adolescents who spend time playing violent video games exhibit higher levels of aggressive behaviour when compared with those who do not. A large sample of British adolescent participants (n=1004) aged 14 and 15 years and an equal number of their carers were interviewed…Following a preregistered analysis plan, multiple regression analyses tested the hypothesis that recent violent video game play is linearly and positively related to carer assessments of aggressive behaviour. Results did not support this prediction…

Answer

- Research article published in The Royal Society Open Science by Oxford Professors (Experimental Psychology)

Academicians or student?

- **Title:** Catastrophe product life cycle: A multivariative approach and dynamic analysis
- **Abstract:** This paper explores the dynamics of the growth pattern of a product brand theoretically, builds a new model called "Catastrphe Product Life Cycle" model, and tests it empirically. While observatios of discontinuous growth jumps and declines have been reported more and more in this age of information technology, the traditional PLC theory fails to explain the aforementioned phenomena because of its normative nature and its assumption of viewing product growth as a pure function of time…

Answer:

- PhD Dissertation submitted by Public Administration student from International Christian University, Japan

Academician or student?

Title: Confronting indifference toward truth: Dealing with workplace bullshit

Abstract: Many organizations are drowning in a flood of corporate bullshit, and this is particularly true of organizations in trouble, whose managers tend to make up stuff on the fly and with little regard for future consequences. Bullshitting and lying are not synonymous. While the liar knows the truth and wittingly bends it to soit their purpose, the bullshitter simply does not care about the truth. Managers can actually do something about organizational bullshit, and this Executive Digest provides a sequential framework that enables them to do so…

Answer:

- Research article published in Business Horizons, a leading business journal, by business professors

The #1 Rule

"Be Clear!

- "Clear writing will make people **take you seriously**. It is pretty easy for lazy senior scientists to brush off a paper on the subject with ambiguous results and uncertain proofs. But when you are clear they have no excuse. Don't give them one!
- "Clear writing will give you a **competitive advantage**. It is often the case that the same or nearly the same result is obtained in several papers. If your paper is clear and your competitors' are not, you will get the credit.
- "For the sake of clarity, **ignore all rules!** When the rules of style and grammar make math unclear, you should simply ignore these rules."

- From UCLA's "How to Write a Clear Math Paper"

Remember

- The point of scientific writing is to **inform**.
- Scientific literature should be **easy to understand**, **enjoyable** and **interesting** to read.
- If your reader must struggle to get through your sentences, they won't finish your paper and won't understand your ideas.
- Complex ideas **do not** require complex language

Principles of Effective Writing

- 1. **Cut** unnecessary words and phrases
- 2. Use the **active voice** (She threw the ball, *not* The ball was thrown by her)
- 3. Verbs:
  - Write with strong verbs
  - Don't turn verbs into nouns
  - Place the main verb close to the subject

- (Sainani, 2020)

Principles of Effective Writing: 1. Cut the Clutter

- "The secret of good writing is to **strip every sentence** to its cleanest components. Every word that serves no function, every **long word** that could be a short word, every **adverb** that carries the same meaning that's already in the verb, every **passive** construction that leaves the reader unsure of who is doing what – these are the thousand and one adulterants that **weaken the strength** of a sentence. And they usually occur in proportion to the education and rank."
  - William Zinsser, *On Writing Well,* 1976

Cut the Clutter

- **Wordy Example**: "This paper provides a review of the basic tenets of cancer biology study design, using as examples studies that illustrate the methodologic challenges or that demonstrate successful solutions to the difficulties inherent in biological research."
- **Editing:** "This paper ~~provides a~~ reviews ~~of the basic tenets of~~ cancer biology study design, using as examples ~~studies~~ that illustrate ~~the~~ ~~methodologic~~ challenges and ~~or that demonstrate successful~~ solutions ~~to the difficulties inherent in biological research~~."
  - Deleted repetitive and empty words, but kept the meaning
- **Rewrite**: This paper reviews cancer biology study design, using examples that illustrate specific challenges and solutions.

(Sainani, 2020)

Cut the Clutter

- **Wordy Example #2:** "As it is well known, increased athletic activity has been related to a profile of lower cardiovascular risk, lower blood pressure levels, and improved muscular and cardio-respiratory performance."
- **Editing**: "~~As it is well known~~, increased athletic activity ~~has been related to~~ is associated with a ~~profile of~~ lower cardiovascular risk, lower blood pressure ~~levels~~, and improved ~~muscular and cardio-respiratory performance~~ fitness."
- **Rewrite**: Increased athletic activity lowers cardiovascular risk and blood pressure and improves fitness (citation).

(Sainani, 2020)

Cut the Clutter

- **Wordy Example #3:** "The experimental demonstration is the first of its kind and is a proof of principle for the concept of laser driven particle acceleration in a structure loaded vacuum."
- **Editing:** "The ~~experimental demonstration~~ experiment ~~is~~ provides the first ~~of its kind and is a~~ proof of principle ~~for the concept~~ of laser driven particle acceleration in a structure loaded vacuum."
- **Rewrite:** The experiment provides the first proof of principle of laser driven particle acceleration in a structure loaded vacuum.

Example from Debra Biasca of University of Colorado, Boulder

(Sainani, 2020)

How to cut clutter: Cut unnecessary words

Acceptable example: "Brain injury incidence shows two peak periods in almost all reports: rates are the highest in young people and the elderly."

Stronger, crisper version: "Brain injury incidence peaks in the young and elderly."

(Sainani, 2020)

Unnecessary words and phrases

- As it is well known
- As it has been shown
- It can be regarded that
- It should be emphasized that
- basic tenets of
- methodologic
- important
- **Adverbs:** very, really, quite, basically, generally, etc.
- **Unnecessary jargon and acronyms:** miR, muscular and cardiorespiratory performance
- **Repetition:** studies/ examples, illustrate/ demonstrate, successful solutions

(Sainani, 2020)

Shorten long phrases (don't slow the reader down)

Wordy Version	Short Version
a majority of ----------	most
a number of ----------	many
are of the same opinion ----------	agree
less frequently occurring ----------	rare
all three of the ----------	the three
give rise to ----------	cause
due to the fact that ----------	because
have an effect on ----------	affect

(Sainani, 2020)

Shorten long phrases

- **Example:** The expected prevalence of mental retardation, based on the assumption that intelligence is normally distributed, is about 2.5%.

- **Shortened version:** The expected prevalence of mental retardation, if intelligence is normally distributed, is 2.5%.

(Sainani, 2020)

Eliminate negatives to be clearer

- She was **not** often **right.**

  -> She **was** usually **wrong**.

- She did **not want** to perform the experiment **incorrectly**.

  -> She **wanted** to perform the experiment **correctly**.

- They did **not believe** the drug was **harmful**.

  -> They **believed** the drug was **safe.**

(Sainani, 2020)

Eliminate negatives

- Not honest ---------- Dishonest
- Not harmful ---------- Safe
- Not important ---------- Unimportant
- Does not have ---------- Lacks
- Did not remember ---------- Forgot
- Did not pay attention to ---------- Ignored
- Did not succeed ---------- Failed

(Sainani, 2020)

Cutting the clutter: Let's practice

- Anti-inflammatory drugs may be protective for the occurrence of Alzheimer's Disease.
- **Rewrite:** Anti-inflammatory drugs may protect against Alzheimer's Disease.

- Clinical seizures have been estimated to occur in 0.5% to 2.3% of the neonatal population.
- **Rewrite:** Clinical seizures occur in 0.5% to 2.3% of newborns (references).

(Sainani, 2020)

Cutting the clutter: Let's practice

- Rewrite the following sentences by deleting the unnecessary words.
- Ultimately p53 guards not only against malignant transformation but also plays a role in developmental processes as diverse as aging, differentiation, and fertility.
- **Rewrite:** Besides preventing cancer, p53 also plays roles in aging, differentiation and fertility.

- Injuries to the brain and spinal cord have long been known to be among the most devastating and expensive of all injuries to treat medically.
- **Rewrite:** Injuries to the brain and spinal cord are among the most devastating and expensive.

(Sainani, 2020)

Cutting the clutter: Let's practice

- An IQ test measures an individual's abilities to perform functions that usually fall in the domains of verbal communication, reasoning, and performance on tasks that represent motor and spatial capabilities.
- **Rewrite:** An IQ test measures an individual's verbal, reasoning, or motor and spatial capabilities.

- As we can see from Figure 2, if the return kinetic energy is less than 3.2 Up, there will be two electron trajectories associated with this kinetic energy.
- **Rewrite:** Figure 2 shows that a return kinetic energy less than 3.2 Up yields two electron trajectories.
- **Or:** A return kinetic energy less than 3.2 Up yields two electron trajectories (See Figure 2).

(Sainani, 2020)

Blaise Pascal on the importance of brevity

- "I have only made this letter rather long because I have not had time to make it shorter."
  - *Lettres provincials,* 16, Dec 14, 1656

- The message:
  - Don't "pad" your writing to make it longer
  - Strip your writing of everything unnecessary
  - Cutting makes your reading more readable, engaging and powerful

(Sainani, 2020)

Principles of Effective Writing: 2. Use the active voice

The active voice:

- Improves readability
- Makes message clearer
- Emphasizes author responsibility

(Sainani, 2020)

Passive voice examples

- Recipient/ Object – Verb – Agent/ Subject
- My first visit to Boston will always be remembered by me.
  - **Active version:** I will always remember my first visit to Boston.
    - From Strunk and White, *Elements of Style*

- Cigarette ads were designed to appeal especially to children.
  - Removes responsibility. Who creates the ads?
  - **Active version**: We designed the cigarette ads to appeal especially to children.

(Sainani, 2020)

Journals want you to use the active voice

- Style Guidelines for many journals instruct authors to write in the active voice.
- Journals know that the active voice is easier to understand, and they want people to read their journals.
- *Science* Magazine:

  "Use active voice when suitable, particularly when necessary for correct syntax (e.g., "To address the possibility, we constructed a Zap library…)."

  -http://www.sciencemag.org/site/feature/contribinfo/prep/res/style/xtrml)
- Other guidelines from journals: avoid unnecessary jargon and write concisely

But I thought I couldn't say "We" in science!

- Here's a passage from an article in the 2019 Altmetric Top 100, a list of the most influential academic papers, published annually:
- "Therefore, **we postulate** that, under appropriate conditions, certain molecular and cellular functions in the large mammalian brain may retain at least partial capacity for restoration after a prolonged post-mortem interval (PMI). To test this hypothesis, **we developed** a surgical procedure…**we engineered** a haemoglobin-based, acellular, echogenic and non-coagulative cytoprotective Bex perfusate. In order to develop all aspects of this technology, **we reasoned** that…

Verselja et. al. (2019) "Restoration of blood circulation and cellular functions hours post-mortem." Nature.

It's ok to use "we" and "I"

- According to Dr. Sainani (2020):
  - Removing personal pronouns doesn't make you more objective
    - The experiments / analysis didn't occur by themselves
  - Scholars should claim responsibility by using "we" or "I"
- "After all, human agents are responsible for designing experiments, and they are present in the laboratory; writing awkward phrases to avoid admitting their responsibility and their presence is an odd way of being objective."

Jane J. Robinson, *Science June 1957*

Can I ever use the passive voice?

- Yes. Just use the passive voice sparingly and purposefully.
- **Methods (Approach)** section:
  - actions more important than agents.
  - Active, passive, or mix
- "Given that Bex perfusate includes anti-apoptotic agents, **we** next **investigated** the extent of apoptosis by assessing nuclear localization of activated caspase 3. As compared to Bex samples, **all control groups showed** an increase in the percentage of nuclei that were positive for actCASP3 in CA1 and dentate gyrus, indicating that **the Bex perfusate diminished** caspase activation."

"Restoration of brain circulation and cellular functions hours postmortem" (Vrselja et al, 2020)

- The **Introduction, Results and Discussion** may use mostly the **active** voice.

Passive to active practice

- **Passive**:
- By applying a high resolution, 90 degree bending magnet downstream of the laser electron interaction region, the spectrum of the electron beams could be observed.

- **Active**:
- We could observe the spectrum of the electron beams by applying a high resolution, 90 degree bending magnet downstream of the laser electron interaction region.

- The active version is much easier to read.

(Sainani, 2020)

Passive to active practice

- **Passive**:
- Increased promoter occupancy and transcriptional activation of p21 and other target genes were observed.

- **Active**:
- We observed increased promoter occupancy and transcriptional activation of p21 and other target genes.

- Again, the active version is so much easier to read.

(Sainani, 2020)

Passive to active practice

- **Passive**:
- The activation of Ca++ channels is induced by the depletion of endoplasmic reticulum Ca++ stores.

- **Active** (and delete extra words):
- Depleting Ca ++ from the endoplasmic reticulum activates Ca++channels.

- Using the active voice helps you cut extra words and be more direct.

(Sainani, 2020)

Passive to active practice

- **Passive**:
- Additionally, it was found that pre-treatment with antibiotics increased the number of super-shedders, while immunosuppression did not.

- **Active** (and be more direct):
- ~~We found that~~ Pre-treating the mice with antibiotics increased the number of super-shedders while immunosuppression did not.

(Sainani, 2020)

Passive to active: emphasize author responsibility

Passive: No attempt was made to contact non-responders because they were deemed unimportant to the analysis.

Active: We did not attempt to contact non-responders because we deemed them unimportant to the analysis.

It's clearer that the authors made the decisions and thus may be fallible.

(Sainani, 2020)

Passive to active: improves readability

- **Passive**: A strong correlation was found between use of the passive voice and other sins of writing.
- **Active**: We found a strong correlation between use of the passive voice and other sins of writing
- **Even better**: Use of the passive voice strongly correlated with other sins of writing.

(Sainani, 2020)

Passive to active: makes message clearer

- **Passive**: General dysfunction of the immune system at the leukocyte level is suggested by both animal and human studies.
- ?? Who has general dysfunction of the immune system at the leukocyte level??
- **Active**: Both human and animal studies suggest that diabetics have general immune dysfunction at the leukocyte level.

(Sainani, 2020)

Principles of Effective Writing
3. Verbs

Use strong verbs

- Compare:

1. "Loud music **came** from speakers embedded in the walls, and the entire arena **moved** as the hungry crowd **got** to its feet."

1. "Loud music **exploded** from speakers embedded in the walls, and the entire arena **shook** as the hungry crown **leaped** to its feet."

   Second sentence from the novel *Bringing Down the House* by Ben Mezrich

- Try to use "to be" verbs sparingly.

(Sainani, 2020)

Don't turn verbs into nouns

Instead of this noun---------- → use this verb

- Obtain estimates of ----------→ estimate
- Has seen an expansion in _____→ has expanded
- Provides an emphasis ----------→ emphasizes
- Take an assessment of ----------→ assess
- Provide a review of ----------→ review

(Sainani, 2020)

Turn nouns into verbs

From an article in the journal *Photochemistry and Photobiology* on how we apply sunscreen:

> "These findings imply that the rates of ascorbate radical **production** and its **recycling** via dehydroascorbate reductatse to replenish the ascorbate pool are equivalent at higher irradiance with the rate of ascorbate radical **production** exceeding its **recycling** back to ascorbate."

Dr. Sainani (2020) rewrites the example to improve it:

> **Rewrite**: "These findings imply that, at low irradiation, ascorbate radicals **are produced** and **recycled** at the same rate, but at high irradiation, they **are produced** faster than they can **be recycled** back to ascorbate."

- Deleted excess words
- Turned nouns into verbs
- Now it's at least understandable

Turn noun-verb phrases into verbs

Turn the following noun-verb phrases back into single verbs

- 1. Give an analysis
  - Analyze
- 2. Offer a solution
  - Solve
- 3. Serve as a catalyst
  - Catalyze

(Sainani, 2020)

Keep the main verb close to the subject at the start of the sentence

- **Subject too far from main verb:** One **study** of 930 adults with multiple sclerosis (MS) receiving care in one of two managed care settings or in a fee-for-service setting **found** that only two thirds of those needing to contact a neurologist for an MS-related problem in the prior 6 months had done so (Vickrey et al 1999).
- **Edited version:** One **study found that**, of 930 adults with multiple sclerosis (MS) who were receiving care in one of two managed care settings or in a fee-for-service setting, only two-thirds of those needing to contact a neurolotist for an MS-related problem in the prior six months had done so (Vickrey et al 1999).

(Sainani, 2020)

Can you identify the main verb?

- The lower external joint moments at the knee and hip joints, the lower mechanical work at the knee joint during stance, the lower energy loss in the prosthetic ankle joint, and the lower total body mechanical work in each ground contact lead to the assumption that running with dedicated prostheses allows the double transtibial amputee sprinter to run at the same level of performance as able-bodied controls, albeit, at lower metabolic costs.
- Answer: lead

What **not** to do: Write sentences that are **hard to read**

- From an article in *Cell,* a top Biology journal with a high impact factor:

"**Dysregulation** of physiologic microRNA (miR) activity has been shown to play an important role in tumor **initiation** and **progression**, including gliomagenesis. Therefore, molecular species that can regulate miR activity on their target RNAs without affecting the **expression** of relevant mature miRs may play equally relevant roles in cancer."

- What did the authors intend to say?
- Nouns rather than verbs (dysregulate, initiate, progression, expression)
- Vague words: Reader can't get a concrete image.
- Unnecessary jargon and acronyms: Slow down reading.

More issues…

- "Dysregulation of physiologic microRNA (miR) activity has been shown to play an important role in tumor initiation and progression, including gliomagenesis. Therefore, molecular species that can regulate miR activity on their target RNAs without affecting the expression of relevant mature miRs may play equally relevant roles in cancer."
- Passive Voice: awkward, hard to read because it's not the way we talk
- Subject too far from main verb: Hard to follow. Until you get to verb, reader doesn't know where you're going with the sentence.

Rewrite

Original: "Dysregulation of physiologic microRNA (miR) activity has been shown to play an important role in tumor initiation and progression, including gliomagenesis. Therefore, molecular species that can regulate miR activity on their target RNAs without affecting the expression of relevant mature miRs may play equally relevant roles in cancer."

- Professor Sainani (2020) rewrites the passage to improve it:
- **Rewrite:** "Changes in microRNA expression play a role in cancer, including glioma. Therefore, events that disrupt microRNAs from binding to their target RNAs may also promote cancer."
- Shorter, easier to understand
- Still conveys the same ideas

Practice improving passages

"The fear expressed by some teachers that students would not learn statistics well if they were permitted to use canned computer programs has not been realized in our experience. A careful monitoring of achievement levels before and after the introduction of computers in the teaching of our course revealed no appreciable changes in students' performances."

- Issues in first sentence:
  - Subject is too long and far from the main verb.
  - Main verb is a boring passive verb.
  - Subject is a verb (to fear) turned into a noun (the fear)
  - Negatives (not)
- Issues in second sentence:
  - Subject is too long and far from the main verb
  - Main verb is a boring verb
  - Subject is a verb (to monitor) turned into a noun (a careful monitoring)

Edited version

- Is this easier to understand?
- "Many teachers feared that the use of canned computer programs would prevent students from learning statistics. We monitored student achievement levels before and after the introduction of computers in our course and found no detriments in performance."
- Turned nouns (**fear** and **monitoring**) back into verbs (**fear** and **monitored**)

(Sainani, 2020)

Practice improving passages

- "Review of each center's progress in recruitment is important to ensure that the cost involved in maintaining each center's participation is worthwhile."
- Issues:
  - Long subject: "Review of each center's progress in recruitment"
  - Verbs as noun (review)
  - To be verbs (is)
  - Vague adjectives (important, worthwhile) What makes it important?
  - Clunky phrase: involved in maintaining
- **Improved version**: "We should review each center's recruitment progress to make sure its continued participation is cost-effective."

(Sainani, 2020)

Practice improving passages

- It should be emphasized that these proportions generally are not the result of significant increases in moderate and severe injuries, but in many instances reflect mildly injured persons not being seen at a hospital.
- Issues:

  "It should be emphasized that" – delete

  "these proportions" – vague

  "generally" – adverb, delete

  "the result of" – due to

  "in many instances" – often, or cut

  "not" – change to positive

  "not being seen" – to be

(Sainani, 2020)

Writing Project Proposal Reports and Progress Reports

1. Expected Content of Project Proposal Reports and Progress Reports

2. Examples of Project Reports
   - Content
   - Language

Resources for project report writing

- Tools for Report Writing – Bilkent Industrial Engineering Dept.
- Writing Effective Project Reports by Gordon B. Hazen (Industrial Engineering, Northwestern Univ.)

- Read good industrial engineering articles to:
  - Get ideas for projects
  - Learn how to write

  Google Scholar

  Microsoft Academic

  Science Direct

  Web of Science (webofknowledge)

  Scopus

Project Report General Content

Project proposal report structure

from Bilkent University Industrial Engineering Dept.

***Create your own section titles to reflect your project, not generic titles**

1. System Description

- Company and current operations
  - Services, manufacturing processes, etc.
  - **Numeric** information
  - Information **relevant to your problem** definition

Project proposal report structure, ctd.

2. Current **System Analysis** and **Problem Defintion**

A. System Analysis

- **Describe of current operations** related to the problem
- **Describe symptoms/complaints** that lead to the problem
- **Data analysis** (numerical information and charts)

B. Problem Definition

- **State Problem** as a **consequence of** your **system analysis (A)**
- **Precise** description with **IE Jargon**

Project proposal report structure, ctd.

3. Review of Resources

- Brief **Literature Review** needed to complete study
  - Info relevant to the problem statement
  - Background to understand/approach the problem
  - Textbooks, academic books and papers
  - Publicly available data
  - Tools needed to complete project
  - Cite and put in reference list

Project proposal report structure, ctd.

4. Proposed Solution Strategy

Your **strategy** to **tackle the problem** defined

A. Critical Assumptions: You may consider a subset of the real system. State critical assumptions of this subset.

e.g., forklift operators follow the shortest paths in warehouses

B. Major Constraints: Other constraints set by the company

e.g., buses have capacity of 23

C. Objectives:

e.g., minimize costs, reduce inventory levels, improve vehicle utilization

Critical objectives: Measurable, important benchmarks that track progress toward goals

D. Solution Approach: How you plan to achieve objectives/satisfy company expectations

e.g. linear programming model, forecasting model, inventory model, heuristic algorithm

Project proposal report structure, ctd.

5. Outcome and Deliverables

A. Outcome: The output that the company can use to achieve objectives

e.g., production plans, inventory policy, vehicle routes

B. Deliverables: Tools for company to implement your solution approach.

- **Decision Support System** that asks for inputs, runs approach, provides output
- **User Manual**

C. Benefits to Company: Benefits from using your solution

- **Expected benefits** compared to current system
- **Target Improvement** levels
- How project will **eliminate problems** in current system
- Should be line with **Objectives**
- Cases in which **critical assumptions** not met
- Benefits for future scenarios

Project proposal report structure, ctd.

6. Project Plan and Work Package Assignments

- Plan with timing acceptable to all stakeholders
- Detail level increases as progress progresses
- State intended work packages
- Assign person/people to each work package
- Timetable for completion of work packages (how and when)
- Consider assignment deadlines

7. References: List of references **cited** in your report

Progress report structure

***You may discard information that is now irrelevant to your project**

1. System Description: No major changes. Update if needed.

2. Current System Analysis/Problem Definition:

- Minor/major updates based on company input
- Further analysis based on new datasets

3. Review of Resources:

- Extend with new resources (cite and reference list)
- Delete irrelevant resources (remove from reference list)

Progress report structure ctd.

4. Proposed Solution Strategy

- Update **Critical Assumptions, Major Constraints, Objectives**
- **Solution Approach:** Progress

  I. **Conceptual Model:** High-level abstraction of solution approach.

  Flowchart with interaction of major elements, inputs/outputs of system

  II. **Mathematical Model(s)**

  III. **Solution Method:** Tools to obtain results from Mathematical Models

  Preliminary Results

- **Verification:** Is the model working as intended?
- **Validation:** Are your model results under a given set of conditions similar to results obtained to results obtained in real system under same conditions

Progress report structure ctd.

5. Outcomes and Deliverables

- Update **Outcome** if needed
- Make progress on **Deliverables**
- **Benchmarking and Benefits to Company:** Compare results of model under different conditions. Provide a benchmarking plan

6. Project Plan and **Work Package** Assignments: Update based on your progress

7. Appendix: material relevant to findings but not necessary to understanding report

Example Report: "Design and Application of Inspection System for Mechanics Department"

- **Company's system**: Arçelik Dishwasher Factory. Lack of control system to calculate performance of processes and quality of products affects the productivity process negatively.
- **Project objective**: Prevent data loss and prepare the necessary infrastructure for quality and improvement workers by designing and implementing a fast and user-friendly control system.
- **Proposed system**: The system is developed on Microsoft.NET platform using VisualBasic.NET programming language and Oracle 9.2 database.
- **Evaluation and results**: A sample efficiency improvement study was conducted. The proposed system improved efficiency by 8% in terms of time and 3% in terms of productivity.

Project Team: K. Arman, A. Ayhan, A. B. Çolak, A. H. Demirci, F. Ergen, D. Ölez

Industrial Engineering. Bilkent Univesrity

Industrial Engineering project example: Evacuation Planning

Title: "Optimizing Infrastructure Enhancements for Evacuation Planning"

- **Issue**: Emergency services are inadequate for large-scale evacuations in cities
- **Objective**: Mitigate issue with infrastructure upgrades (e.g. adding lanes, raising bridges/ roads)
- **Problem:** Convergent Evacuation Network Design Problem (CENDP)
- **Proposed approaches**:
  - MIP model for deciding most effective infrastructure upgrades
  - Benders decomposition approach to plan upgrades and evacuation routes and schedule evacuations
- **Evaluation method:** Tested approaches on case study for flood plain West of Sydney
- **Results:** Benders decomposition performed significantly better than the MIP model

- **Authors**: K. Kumar (**Ghent University**), J. Romanski (**Brown University**), P.V. Hentenryck (**University of Michigan**)

Evacuation Planning : **Importance of topic/Issue**

With rapid **population growth** and increased **urbanization**, emergency services in various cities around the world worry that the current **transportation infrastructure** is **no longer adequate** for **large-scale evacuations** (Feneley 2015)

Evacuation Planning: **Solutions in the literature** and their shortcomings

Yet little research on evacuation planning includes the possibility of improving road infrastructure. **Some studies use contraflow** in order to increase road capacities (Wolshon 2001; Theodoulou and Wolshon 2004; Even, Pillac, and Van Hentenryck 2014; Kim, Shekhar, and Min 2010). **However, Wolshon (2001) warns** that the presence of **contraflow lanes can lead to congestion** due to drivers' unfamiliarity with lane reversal.

Evacuation Planning: **The objective**

In this paper, we attempt to **fill this gap in the literature**. We study how to **upgrade the road network** in order to **maximize the number of evacuees** reaching safety given an infrastructure budget.

Evacuation Planning: The **approach**

To decide which infrastructure enhancements to perform, we present **two approaches**:

- 1) **A MIP model** whose decision variables are the infrastructure investment, the evacuation paths, and the evacuation schedule;
- 2) **A Benders decomposition** whose master variables are the investment decisions and the evacuation paths and the subproblem variables denote the evacuation schedule.

Evacuation Planning: **Evaluation and Results**

- **Evaluation of Approach:**

  The **approaches were tested** **on a case study** for a flood plain West of Sydney where the road infrastructure has not kept up with population growth, creating significant concerns from emergency services (Feneley 2015).

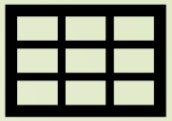
- **Results of Evaluation:**

  Experimental **results show** that the **Benders decomposition performed significantly better than the MIP model**, evacuating as much as **28.9% more** people on the instances with higher population growth.

Potential **benefits** of approach

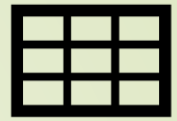
Overall, our results show that **Benders decomposition provides a novel tool for emergency services** that seek to **improve their road infrastructure** to meet the evacuation needs coming from increased urbanization.

Tables and Figures



- Should be able to stand alone
- Use fewest figures and tables needed (be concise)
- Don't present same data in both a figure and a table
- Keep it simple and clear

Tables vs. Figures



- Figures
  - Visual impact
  - Show trends and patterns
  - Tell a story
  - Highlight a result
- Tables
  - Precise values
  - Many values

(Sainani, 2020)

How to Write Results

- Do not just read out raw data
- Complement information in tables and figures
  - Report percent change or percent difference
- Repeat/highlight only most important numbers

(Sainani, 2020)

Results example

"The total **suicide rate** for Australian men and women **did not change between 1991 and 2000** because marked decreases in older men and women (**Table 1**) were offset by increases in younger adults, especially younger men."

Table 1 is a list of suicide rates from 1991 to 2000 by gender and age. Summarizes trends in data set for reader. No specific numbers.

(Sainani, 2020)

Evacuation Planning **table/results**

	Benders Decomposition					MIP	
Instance	**CPU (s)**	**LRMP (%)**	**BD (%)**	**BD10 (%)**	**Gap (%)**	**Perc. Evac.**	**%Imp**
HN-1.7							
300 min	779.7	100	98.2	94.5	1.8	87.5	12.2
360 min	885.6	100	99.2	97.7	0.8	99.2	0.0
420 min	386.9	100	100	100	0	99.0	1.0
HN-2.0							
300 min	763.1	100	96.1	92.9	4.0	89.4	7.5
360 min	3585.3	100	98.6	97.5	1.4	91.7	7.5
420 min	2559.5	100	99.5	99.2	0.5	87.9	13.1
HN-2.5							
300 min	29.8	100	88.9	88.9	12.5	78.6	13.1
360 min	524.4	100	96.9	96.9	3.2	82.5	17.4
420 min	1069.9	100	97.0	96.3	3.1	80.7	20.2
HN-3.0							
300 min	616.7	100	81.5	80.2	22.6	65.6	24.3
360 min	1884.1	100	86.5	84.2	15.6	67.9	27.5
420 min	931.3	100	90.9	87.1	10.0	70.6	28.9

Table 1: Results for the HN-1.7, 2.0, 2.5, and 3.0 Instances.

Evacuation Planning **table/results**

- **Table Explanation: Table 1 compares** the **percent evacuated** by the **Benders decomposition** and the **MIP model** (1 h) on four population instances and three flood scenarios. The CPU times correspond to when the best FSP value was found by the Benders decomposition. The LRMP is the last Restricted Master Problem solution, and BD is the Benders decomposition solution. Column BD10 is the best Benders decomposition solution after 10 minutes. The gap is between the LRMP and best BD and is calculated as z(LRMP(G,H,B))−z(BD(G,H,B) z(BD(G,H,B). Column %Imp is the improvement of the Benders approach over the MIP model in percentage.

- **Results in Table**: The **duality gaps** are quite small for instance HN-1.7, but **increase with the population growth**. The **Benders decomposition** provides **significant improvements compared to the MIP model**: The difference in quality grows as the population increases and the **Benders decomposition evacuates about 30% more people on the last instance**. The Benders decomposition after 10 minutes also improves the MIP in all but one instance, evacuating up to 23% more people.

Figure/Results example: Evacuation Planning

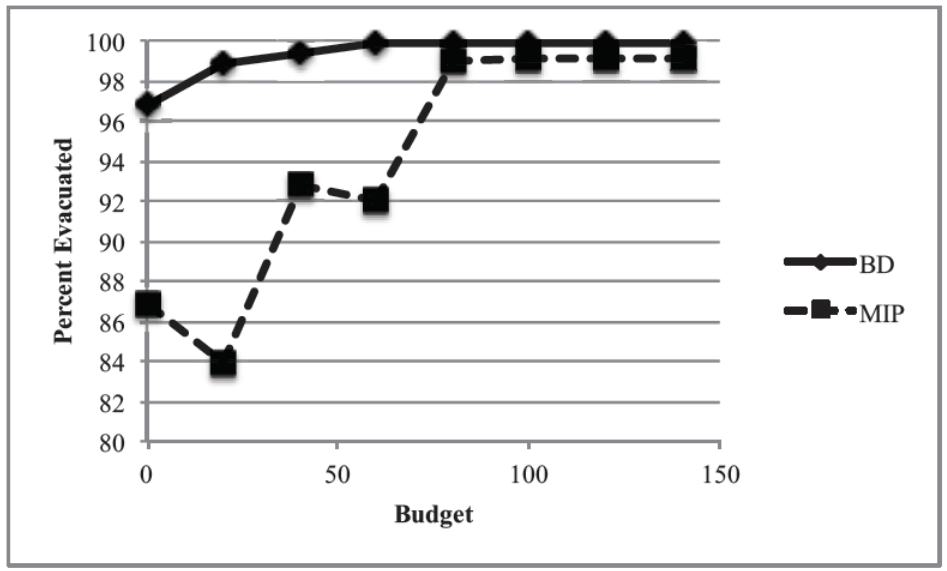


Figure 2: Perc. of People Evacuated for Given Budgets.

Figure explanation: **Figure 2 shows the effect of varying the budget parameter** for Instance 1.7 with a flood arriving at the 360 minute mark, a profile emergency services are keen to study.

Results in Figure: The **graph shows** that the **performance of MIP model degrades** substantially **when the budget is tight** and performs reasonably when the budget is sufficiently large to evacuate everyone. **In contrast**, the **Benders formulation produces excellent results for all budgets**.

Significance of Results: This **confirms the findings of Table 1**, where the quality differences between the Benders decomposition and the MIP model increase with population growth. This is **especially relevant**, since **infrastructure improvement projects traditionally operate under tight budgets.**

Citation and Plagiarism: Why do we cite?

- To show you've done research
- To give credit to others
- To point readers to useful sources
- To allow readers to check sources if they have questions
- To provide a context for your problem and approach

Citation and Plagiarism: How do we cite?

- **In-text citation**:

  In the body of your paper, show where the information comes from

  - Example:

    Current neural network research is largely focused on the fields of 'deep learning'[1,2] and 'deep reinforcement learning' [3, 4].

- **Reference list**/Bibliography/Works Cited:

  At the end of your paper, give complete information about the source.

  - Example:

    1. Goodfellow, I., Bengio, Y. & Courville, A. *Deep Learning* (MIT Press, Cambridge, 2016).

Citation and Plagiarism

- **Summary**: Main idea in your own words
  - One sentence may summarize multiple works
- **Paraphrase**: Main idea and details in your own words
- **Quotation**: Exact words
  - Use sparingly when exact words are important

Citation examples: Summary

- **Original**: America has changed dramatically during recent years. Not only has the number of graduates in traditional engineering disciplines such as mechanical, civil, electrical, chemical, and aeronautical engineering declined, but in most of the premier American universities engineering curricula now concentrate on and encourage largely the study of engineering science. As a result, there are declining offerings in engineering subjects dealing with infrastructure, the environment, and related issues, and greater concentration on high technology subjects, largely supporting increasingly complex scientific developments. While the latter is important, it should not be at the expense of more traditional engineering.

  Rapidly developing economies such as China and India, as well as other industrial countries in Europe and Asia, continue to encourage and advance the teaching of engineering. Both China and India, respectively, graduate six and eight times as many traditional engineers as does the United States. Other industrial countries at minimum maintain their output, while America suffers an increasingly serious decline in the number of engineering graduates and a lack of well-educated engineers. (169 words)

  (Source: Excerpted from Frankel, E.G. (2008, May/June) Change in education: The cost of sacrificing fundamentals. *MIT Faculty Newsletter*, XX, 5, 13.)

- **Summary**: MIT Professor Emeritus Ernst G. Frankel (2008) has called for a return to a course of study that emphasizes the traditional skills of engineering, noting that the number of American engineering graduates with these skills has fallen sharply when compared to the number coming from other countries.

From Academic Integrity at MIT: A Handbook for Students

Citation examples: Paraphrase

- **Original**: Because of their unique perspective, Americans fear globalization less than anyone else, and as a consequence they think about it less than anyone else. When Americans do think about globalization, they think of the global economy as an enlarged version of the American economy.

  (Source: Thurow, L. (1993). *Fortune Favors the Bold* (p. 6). New York: Harper Collins.)

- **Paraphrase**: Lester Thurow (1993) maintains that because Americans see globalization simply as a bigger form of their own economy, they are less concerned about it than is the rest of the world.

- From Academic Integrity at MIT: A Handbook for Students

Citation examples: Quotation

- **Original**: Because of their unique perspective, Americans fear globalization less than anyone else, and as a consequence they think about it less than anyone else. When Americans do think about globalization, they think of the global economy as an enlarged version of the American economy.

  (Source: Thurow, L. (1993). *Fortune Favors the Bold* (p. 6). New York: Harper Collins.)

- **Quotation**: Economist Lester Thurow (1993) has asserted that the American reaction to globalization is different from that of the rest of the world in that "American's fear globalization less than anyone else, and as a consequence . . . think about it less than anyone else" (p. 6).

From Academic Integrity at MIT: A Handbook for Students

Evacuation Planning **Literature Review:** Context for the problem

- **Chen and Miller-Hooks (2008) used Benders decomposition** for quickest flow problem in a building evacuation problem with shared Information. **Andreas and Smith (2009) solved** a variant of the quickest flow problem, using arc traversal penalty functions in order to encourage earlier evacuation… **The work by Even, Pillac, and Van Hentenryck (2015) is particularly relevant to this paper.** They propose a two-stage approach for zone-based evacuation planning, where the first stage is a **tree design problem** which gives an upper bound to the number of evacuees reaching safety by aggregating the arc capacities. The tree design problem chooses the evacuation paths for the zonebased evacuation planning, while the second stage schedules the evacuation over these paths. **The Benders decomposition presented in this paper transforms this two-stage approach into a Benders decomposition approach** and **generalizes the tree design problem into a** restricted **master problem** which also includes decisions for infrastructure enhancement.

Plagiarism includes

- Using someone's ideas without giving credit to them (even if you summarize/paraphrase)
- Cutting and pasting sentences or phrases without quotation marks (even if you cite)
- Slightly rewriting or re-arranging words (even if you cite)

To avoid plagiarism

- Understand ideas well enough to put them in your own words.
- Draw your own conclusions – don't just trust others.
- Don't copy structure, re-arrange words, or use thesaurus

Plagiarism example

- **Michelle Obama 2008**: "You work hard for what you want in life; that your word is your bond and you do what you say you're going to do; that you treat people with dignity and respect…"
- **Melania Trump 2016**: "From a young age, my parents impressed on me values that you work hard for what you want in life; that your word is your bond and you do what you say and keep your promise; that you treat people with respect."

- **Michelle Obama 2008**: "We want our children – and all children in this nation – to know that the only limit to the height of your achievements ins the reach of your dreams and your willingness to work for them."
- **Melania Trump 2016**: "We want our children in this nation to know that the only limit to your achievements is the strength of your dreams and your willingness to work for them."

Plagiarism example

- **Original Version** (Wikipedia): Ernest Miller Hemingway (July 21, 1899-July 2, 1961) was an American author and journalist. His economical and understated style had a strong influence on 20th century fiction, while his life of adventure and his public image influenced later generations.
- **Plagiarized Version**: Ernest Hemingway's thrifty and understated style strongly influenced 20th century fiction. His audacious lifestyle and public image also influenced later generations.

- The plagiarized version could have been written without knowing anything about Hemingway
- Research and understand enough that you can write in your own words.
- If you do use someone else's ideas or words, cite.

Plagiarism example: Published by scientists

- **Original passage** (Klibnski et al. 1995)

"One possibility is that the dose of estrogen effective in treating postmenopausal women is inadequate in a younger population. Second, whether continued improvement in bone mass can be seen in patients treated for a duration of time longer than the current study is unknown. A third possibility is that patients were not compliant with hormone therapy…A fourth and likely explanation is that estrogen therapy alone cannot correct the multiple factors contributing to bone loss in women with anorexia nervosa…"

- **Plagiarized passage** (Munoz et al. 2002)

"One possibility is that the estrogen dose which is effective in treating postmenopausal women is inadequate in a younger population. Second, whether continued improvement in bone mass may be seen in patients treated for longer period of time than the current study is unknown…A third and more likely explanation is that estrogen therapy alone cannot correct the multiple factors contributing to bone loss in women with AN…

- These two papers were almost identical, except for the data found…

Plagiarism example: more subtle

- Original paper (2004): "Although earlier registry-based analyses of second neoplasms after breast cancer (BC) did not detect an increased risk of cutaneous melanoma (CM), [1][2] several more recent registry-based[3][4 and hospital-based[5] studies have documented a a statistically significant increased risk of CM after BC with standardized incidence rations (SIRs) ranging from 1.4 to 2.7."
- Second paper (2009): "Recent registry-based [1.2] and hospital-based [3,4] studies have documented a statistically significant increased risk of CM after BC with standardized incidence ratios (SIRs) ranging from 1.4 to 2.7."
- References 1,2,3, and 4 are identical.
- Don't trust secondary sources
- Dig through literature and summarize if yourself

Email Etiquette

The Greeting:

- Formal: Dear Professor / Dr. / Ms. / Mr. [Last Name]
- Familiar: Hello Professor / Dr. / Ms. / Mr. [Last Name]

Introduce yourself:

- Name, year, major, course etc.

Proofread

- Use grammar/spellcheck
- Ask a friend to proofread

The Closing

- Best regards, Kind regards, Sincerely, Thank you,

  [Your Name]

From Purdue University's page on Email Etiquette(2020).

More email tips

Keep it brief and to the point

- Professors are busy
- One message per email – subpoints will be overlooked
- One topic per paragraph

Show appreciation

- Thank the teacher for their time
- Professors are busy

Format

- Don't indent paragraphs
- Space between paragraphs

Example email to a professor

Dear Professor Smith,

My name is Emma Jones and I am a sophomore in your Tuesday/Thursday General Physics Class.

I am writing because in class yesterday you mentioned some open positions in your research lab. I found the summary of your project very interesting, and I would like to talk to you about possibly joining the lab. Is there a time in the coming weeks that we could meet?

Thank you for your time and I look forward to hearing from you soon.

Best regards,

Emma Jones
Applied Physics, Class of 2022

From Purdue University's page on Email Etiquette(2020).

Asking to meet for questions about a class: **Effective** email

Subject: Question about [Specific Class Topic/Homework Assignment/Reading]

Dear [Professor/Dr.] [Professor's last name],

My name is [your name]; I am in your [class title] class. I am having trouble understanding [specific class topic/homework assignment/reading]. Unfortunately, I have a regular conflict with your office hours, but would greatly appreciate some guidance on this. Would it be possible to set up a time to meet with you, at your convenience? I am available [dates and times during the week during which you are available].

Thank you,

[Your name]

Northwestern University (n.d.) *Writing Effective Emails to Faculty*

Asking to meet for questions about a class: **Ineffective** email

Subject: readings

Hey [Mr./Ms.] [Professor's name],

I was wondering if I could meet with you. I'm having trouble understanding the readings from your class and need a good grade. Can I come by?

Thanks, [Your Name]

Northwestern University (n.d.) *Writing Effective Emails to Faculty*

Asking for a recommendation letter: **Effective** email

Subject: Recommendation Letter Request

Dear [Professor/Dr.] [Professor's last name],

My name is [your name]; I am in your [class title] class. I am really enjoying the class so far, especially [aspect of class you enjoy].

I am applying for [job/school/scholarship/etc.], and since I enjoy your class and would like to continue in this field, I would greatly appreciate meeting with you at your convenience to discuss the possibility of receiving a letter of recommendation from you. Unfortunately, I have class during your office hours, so I am wondering if we could meet at another time. The letter is due in [length of time at least 3 weeks from email date]. Would it be possible for us to meet? I am available [dates and times during the week during which you are available].

I have attached my resume for your convenience, if you would like to see it.

Thank you,

[Your name]

Northwestern University (n.d.) *Writing Effective Emails to Faculty*

Asking for a recommendation letter: **Ineffective** email

Subject: Need Letter of Recommendation

Hey [Mr./Ms.] [Professor's name],

I was wondering if I could get a letter of recommendation from you. I'm applying for [job/school/scholarship/etc.], and it's due next week. Please let me know if you can do this.

[Your name]

Northwestern University (n.d.) *Writing Effective Emails to Faculty*

Asking to meet for a general conversation: **Effective** email

Subject: Informational Meeting

Dear [Professor/Dr.] [Professor's last name],

My name is [your name]; I am in your [class title] class. I would greatly appreciate the chance to meet and speak with you about [topic you are interested in—professor's research, career path, etc.], as I [am interested in the topic/am looking to potentially pursue this line of work/have a background in the topic/etc.]. Would it be best for me to come in during your regular office hours, or would you be available to meet for a one-on-one appointment? I am available [dates and times during which you are available], and would love to get coffee, meet in your office, or meet at some other convenient location for you.

Thank you,

[Your name]

Northwestern University (n.d.) *Writing Effective Emails to Faculty*

Asking to meet for a general conversation: **Ineffective** email

Subject: Meet Up?

Hey [Mr./Ms.] [Professor's name],
I was hoping we could meet up to chat about your work. Are you free next week? [Your name]

Northwestern University (n.d.) *Writing Effective Emails to Faculty*

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