# Interventions for Engineering Communication Development

A collaborative project between Queen's University and the University of Toronto funded by the Engineering Information Foundation Grants Program.

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Queen's University

UNIVERSITY OF TORONTO

# Interventions for Engineering Communication Development

This series of interventions is to be used as a facilitator guide for individuals responsible for developing the communication skills of engineering students at post-secondary institutions. 

Queen's University

University of Toronto

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Interventions for Engineering Communication Development

# Intervention Learning Outcomes

| Learning Outcomes |
| --- |
| By the end of this intervention students will be able to: |
| 1. Improve recognition, comprehension, and usage of professional language.<br>2. Develop awareness of distinction between every day and professional language.<br>3. Organize and structure content to serve rhetorical purposes.<br>4. Self-assess professional language proficiency.<br>5. Develop confidence in comprehending and using professional language both orally and in writing.<br>6. Find and use resources to support self-learning goals. |

# INDIVIDUAL MODULE PLAN DEVELOPMENT

After each student has completed the required diagnostics, the facilitator should be able to clearly identify areas that each student will need to improve upon. These modules are not intended to have every student take each module, but rather, a customized selection of the modules. Below you will find a recommendation of what students should take which modules based on the area for improvement presented in the diagnostics. In some instances, the facilitator may deem that the student should enroll in all modules and this is fine. However, ensure that your selection of recommended modules is aligned with the results of the diagnostics.

| **Individual Module Planning** | |
|---|---|
| If a student is identified to have a weakness in _____, we should encourage them to enroll in the Module _____ workshop at its next offering. | |
| Grammar/Lexicogrammatical | Module 1, 5 |
| Delivering a public speech or presentation | Module 2, 4 |
| Vocabulary/Concision/Audience | Module 3, 4, 5 |
| Sentence structure/Concision | Module 4, 5 |
| Wordiness and redundancy/Lexicogrammatical | Module 5 |
| Identifying relevant vs irrelevant information/Rhetorical/Audience | Module 6, 4, 5 |
| Composing formal, technical, and/or professional writing/Rhetorical/Argument/Audience | Module 7, 4, 6 |
| Oral communication | Module 8, 4 |

Queen's UNIVERSITY

UNIVERSITY OF TORONTO

# Diagnostics

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# English Proficiency Test

# PURPOSE AND USE OF THE ENGLISH PROFICIENCY TEST

The English Proficiency Test (EPT) is a short exam that assesses a student's ability to understand, analyze and summarize information in a report. This test is aimed at students who perform poorly in English or otherwise exhibit language difficulties.

## HOW DOES THE EPT WORK?

In this test, a reader reads a situation aloud to the class. Both useful and irrelevant information is presented, so students need to take notes, identify their most important findings and then summarize them into an email to a specific individual. It is very important for students to have the skills that are necessary to organize and present technical information in a professional context, so using the EPT as a diagnostic will help the instructor identify if the students can demonstrate English proficiency in listening comprehension and written expression.

The facilitator can gain information on a student's ability to identify the most important findings (ability to understand spoken English), to structure a manuscript (organize technical information), and to ensure that they will produce an adequate technical document in English. The facilitator will have the opportunity to find out whether students have the skills to organize technical information and summarize it in an email. In addition, the facilitator can see the professionalism of a student's writing and identify whether students need to improve their English language skills.

Other aspects of correct language use that the instructor can see through the EPT are: skills in taking notes, summary writing, and correct use of grammar, transitional words, prepositions, conditional sentences, tenses, spelling, vocabulary, etc.

# Instructions for Facilitating the English Proficiency Test

1. Preparation:
    a. Selecting a time and room
    The facilitator should book a room for about 2 hours at a specific time and let students know where and when the test will take place.

    b. Organizing proctors (people)
    Depending on the number of students who will take the test, the facilitator will decide whether he/she needs extra help with proctoring the test. In general, if there are less than 50 students in the room, the facilitator can both be the reader and the proctor. If there are between 50-150 students, two people will be needed; one reader and another proctor. If there are over 150 students in the room, three people will be needed; one reader and two proctors.

    c. Preparing writing materials
    The materials the facilitator needs are:

    - The Instructions sheet that will be read aloud to the students
    - The Script that will be read aloud to the students
    - 1 Exam booklet for every student
    - Extra pencils
    - Extra lined paper

2. Delivery of the English Proficiency Test:
    a. Give each student a booklet
    Just before the test begins, the facilitator should give one booklet to each student in the room.

    b. Ensure all students have proper writing materials
    All students need to have is a couple of pencils and an eraser.

    c. Instruct students to read the first page of the EPT exam booklet
    Students should read very carefully the instructions given on the first page of the exam booklet.

    d. Read the Instructions for the EPT
    All students should be listening carefully to the instructions.

e. Read the Script

The reader can start reading the script after students have read the instructions on the first page of the booklet. Readers are to read the test twice, clearly and at a reasonable pace. Please watch your speed and annunciation. The second time the test is read, you can finish with you can begin writing now. Once the reading is complete, no questions are allowed.

f. Begin the test

After the second reading, students can start writing the test. Ensure you note the time the exam officially starts.

# INSTRUCTIONS TO BE READ TO STUDENTS

Please announce the following information to the students:

1. This examination is 1 hour and 15 minutes in length. No aids are allowed. Cell phone must be on silent and not within reach during the exam. The only items allowed on the desk in front of you are your writing utensils, and the paper copy of your EPT (notes, rough draft, and final draft pages & extra pages in case you run out).

2. This test will be read aloud twice. Please read the instruction sheet carefully before you begin.

3. Please add your name on all sheets now (give a few minutes to the students to do this).

4. Your report should be written in sentence form -- not point form. If you need extra paper please feel free to use the back of the final draft or if you run out, or you may get an extra piece of paper from the proctor.

5. You have 1 hour and 15 minutes to write the test.

# ENGLISH PROFICIENCY TEST ASSESSMENT

In this test, a reader reads a situation aloud to the class in which they describe both useful and irrelevant information. Students are told to take rough notes and then compile their notes into a formal letter to a specific individual.

The memo must:

- be written in a letter format (formal letter sent by email)
- be written in clear, concise, technically precise, well-formed sentences
- be written in paragraphs (no point form)
- clearly present the information given
- delete irrelevant information
- place information in a suitable order
- use proper punctuation and spelling

The test should be scored in two categories using the rubric below:

| | Fail (F) | Marginal Pass (M) | Pass (P) |
|---|---|---|---|
| 1. Content | Critical information required to achieve purpose of email missing; email difficult to follow. | Some important content was missed, or extraneous information included; illogical order. | Email provides required information in logical order to intended audience. |
| 2. Correctness | Numerous grammar errors and frequent spelling errors; lack of paragraphs; not in letter format; disorganized sentence structure. | Occasional punctuation/ grammar/ spelling errors (1-2 per paragraph), not so well-organized paragraphs & sentences. | Well-formed sentences, organized paragraph/ sentence structure, very few minor grammar/ punctuation errors. |

On the marking sheet provided for your stack of tests, assign a Fail (F), Marginal Pass (M), or Pass (P) to the two categories.

- For category *1. Content*: place a "1" in the appropriate column for PASS, MARGINAL PASS, or FAIL on the attached sheet.
- For category *2. Correctness:* place a "2" in the appropriate column for PASS, MARGINAL PASS, or FAIL on the attached sheet.

There may be occasions where a second grader may be required to confirm the outcome of the test. Follow these instructions in this instance.

* If a paper receives a PASS (P) in both categories by the first grader, it is deemed to have passed.

* If a paper receives a (P) in one category and a MARGINAL PASS (M) in the other category, it will be reviewed again by a second grader.

* If a paper receives a (M) in both categories, it will be reviewed again by a second grader.

* If a student receives a (P) in one category and a FAIL (F) in the other category, it will be reviewed again by a second grader.

* If a student receives a (M) in one category and a (F) in the other category, it will be reviewed again by a second grader.

* If a student receives a (F) in both categories, it will be reviewed again by a second grader.

The second grader's mark is the final mark.

# ENGLISH PROFICIENCY TEST RUBRIC TEMPLATE

Use this rubric to grade each EPT. You may only use the Grader 1, but you may also require the Grader 2 rubric. Highlight the appropriate column for each category.

Grader 1:

| | Fail (F) | Marginal Pass (M) | Pass (P) |
|---|---|---|---|
| 1. Content | Critical information required to achieve purpose of email missing; email difficult to follow. | Some important content was missed, or extraneous information included; illogical order. | Email provides required information in logical order to intended audience. |
| 2. Correctness | Numerous grammar errors and frequent spelling errors; lack of paragraphs; not in letter format; disorganized sentence structure. | Occasional punctuation/ grammar/ spelling errors (1-2 per paragraph), not so well-organized paragraphs & sentences. | Well-formed sentences, organized paragraph/ sentence structure, very few minor grammar/ punctuation errors. |

Grader 2:

| | Fail (F) | Marginal Pass (M) | Pass (P) |
|---|---|---|---|
| 1. Content | Critical information required to achieve purpose of email missing; email difficult to follow. | Some important content was missed, or extraneous information included; illogical order. | Email provides required information in logical order to intended audience. |
| 2. Correctness | Numerous grammar errors and frequent spelling errors; lack of paragraphs; not in letter format; disorganized sentence structure. | Occasional punctuation/ grammar/ spelling errors (1-2 per paragraph), not so well-organized paragraphs & sentences. | Well-formed sentences, organized paragraph/ sentence structure, very few minor grammar/ punctuation errors. |

# Accident Report

# English Proficiency Test Materials

# ENGLISH PROFICIENCY TEST SCRIPT

## ACCIDENT REPORT

Facilitator: You will read this script aloud to the students two times. It is critical that you read this script very slowly to allow students time to process the information and make notes while you are reading.

SCRIPT:

You work as a safety inspector in the Department of Environmental Health and Safety at Queen's University. This office is responsible for enforcing compliance with the Ontario Health and Safety Act. You have been assigned the task of organizing information that has been collected as the result of an accident that happened in a lab on campus. You must summarize the information in a report to your supervisor. Your supervisor is Russell Burns, the Director of Environmental Health and Safety (his last name is spelled B U R N S).

On Monday September 9, 2017 at 6:30pm, a student was performing a chemical reaction in room 83, which resulted in an explosion. The building is located behind a student residence. The student was in the lab with several others at the time of the accident. Everyone had to be evacuated from the building and from the nearby residence for several hours. Two students had to be sent to the hospital for treatment of their injuries.

The students were admitted to hospital and treated for first- and second-degree burns. They were released at approximately 10:00pm. The doctor treating the burns said it could have been fatal but given both students were wearing protective equipment it helped reduce the severity of their injuries.

Residence students who were evacuated understood the precaution, however were upset at being asked to leave during the university study period for exams.

Students who work in the lab and the lab manager report that it is a requirement to wear a protective lab coat and goggles in the lab, but students feel that the university should provide additional protective materials.

The lab manager, Mark Jones (spelled J O N E S) stated “that this type of reaction has been performed in the lab for many years and is standard in most chemistry labs around the world”. He also stated that a commission has been established to investigate the proper placement of waste containers and the training of staff and students regarding proper disposal of chemical waste.

Waste containers in the lab are colour coded to aid in proper disposal of materials. Proper placement of these containers is key to minimizing risk to staff and students.

Jones said the department is also looking at the possibility of unpredictable reactions occurring in the labs and hopes the investigation will lead to further improvements in standard laboratory procedures. "The fact is you can't predict the unpredictable," he said. "Something happened in that laboratory that was totally unpredictable, and so we look at whether we can minimize even the smallest risk.

Overseeing the investigation into the explosion is the Director of the Department of Environmental Health and Safety, Russell Burns, (spelled B U R N S) and the university Fire Marshall, Brian Cook (spelled C O O K). While they have not yet determined the cause of the explosion, they believe the explosion resulted from residue in a waste container which was next to the acids.

This incident has provided officials with a good opportunity to re-evaluate procedures and safety protocol. Recommendations to improve safety are being considered such as; simple procedural changes like how to label containers and small layout issues to contribute to a safer lab.

"Even freak accidents have root causes," Director of Environmental Safety Russell Burns said. "There are always things you can improve to try to minimize risk."

You should start writing your email now.

# English Proficiency Test

Duration: 1 hour and 15 minutes

## INSTRUCTIONS

Please put your name on each sheet.

### Format

You are a summer student working for Green Consultants. You have been asked to write a detailed report about your inspection of Rosewood Mall and submit it to your supervisor, Melanie White. She will decide whether or not the firm will conduct a more in-depth inspection. The detailed information about the inspection will be read aloud.

### Your Task

Your task is to write a report and send it by email to your supervisor containing the results of your inspection. The report should clearly present the information that you have been given.

You should:

1. Address the email To: Fr: Subject…etc
2. take notes from the information provided,
3. record only the important information,
4. place the information in a chronological order,
5. write a clear, concise, technically precise report in complete, well-formed sentences on the lined answer sheet with the heading "Final Submission"
6. punctuate your report and use paragraphs appropriately

### When Complete

Make sure you have put your name on all of the sheets. Hand in your rough work and your final submission as you leave the exam hall.

## English Proficiency Test

Duration: 1 hour and 15 minutes

NOTES AND ROUGH WORK

## English Proficiency Test

Duration: 1 hour and 15 minutes **Final Graded Copy**

To:_____

Subject:_____

Body of Email:

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Final Submission Page 2

Final Submission Page 3

Final Submission Page 4

Final Submission Page 5

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# ENGLISH PROFICIENCY TEST
# ACCIDENT REPORT EXEMPLARS

# Fail Exemplar

Spelling and grammar issues

**Faculty of Engineering & Applied Science, English Proficiency Test**

Score 0

ration: 1 hour and 15 minutes **Final Graded Copy**

To: Melanie White

Subject: The inspection of Rosewood Mall

Body of Email:

Dear ~~Melanie~~ White

My name is Shihao Lu, a summer student working for Green Consultants. I am writing this report to you ~~for~~ the results of my inspection of Rosewood Mall.

awkward wording

Fisrtly, I reviewed the building plan and the related papers about the Rosewood Mall to have a general background about it at 10 am on October 23. The building has three levels which are food area, hotel, gym, office, public library and many stores.

include articles

include

The building was built ~~in~~ Jun 1977 and it had repair many times. The ownership changed many mes last ten years. Many owners wanted to repair the building, but they did not do it due to ~~the~~ budget problem.

in

been repaired

has

over the

problems

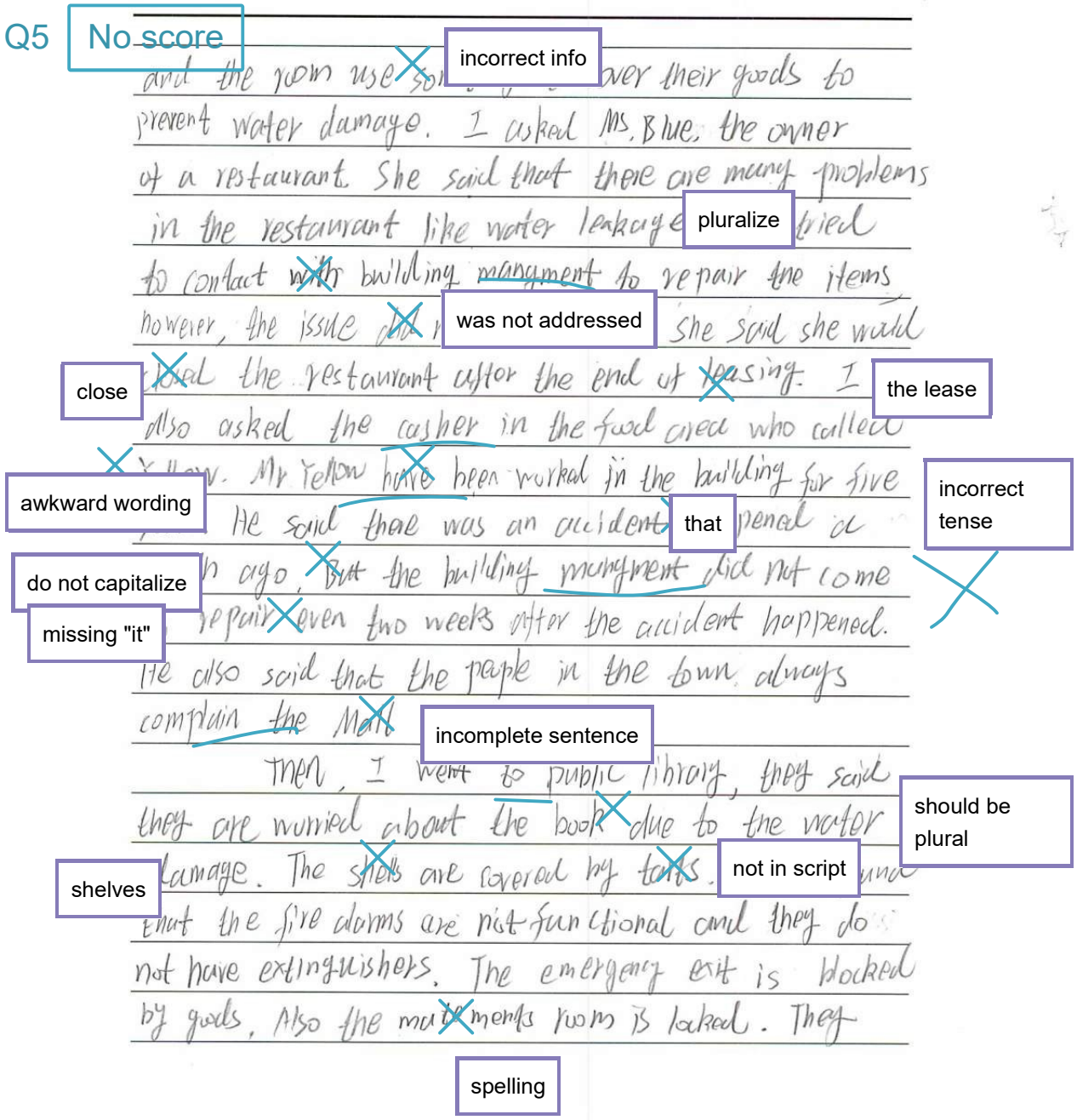
I went to the Mall at 1 pm on August 23. I found that there are many serious problems on the ground floor like water leakage and water pooling. There are many rooms closed, but one of them opened.

incorrect info

awkward wording, info not in script

**Final Submission Page 2**

Q5 No score



said that there is no need to check the room since it had been checked by the other inspector from other company in May.

I went to the parking area. It also has water damage problem. And also there are some dissolve DEC salt.

These are all of the informations that I collected during the inspection of Rosewood Mall.

Sincerely

# Marginal Pass Exemplar

Score 1

**Faculty of Engineering & Applied Science, English Proficiency Test**

ration: 1 hour and 15 minutes **Final Graded Copy**

To: Melanie White

Subject: Inspection report of Rosewood Mall

Body of Email:

Dear Ms. White,

This is my inspection report. I inspected Rosewood Mall on August 23, 2017. There are lots of problems that need to be solved as soon as possible.

I got to the mall at 1pm on August 23. I started the inspection from the ground floor. There was a serious problem that the roof was water leaking awk Lots of buckets were put on all levels to catch the leaking water. Many businesses closed; one store opened and put tarps to protect their goods. incorrect missing "that" ound the walls were rusted. It could cause breathing issues for customers.

I asked some staff about the mall conditions and issues in their areas. Ms. Blue, who was the owner of a restaurant, said the building had not been attended by the management. There were lots of problems, including

**Final Submission Page 2**

Q5 No score

the leaking proof. blocked drains in bathroom, and the window leaking. Mr. Yellow was a worker in a burger store. He said the pieces of concrete fell from ceiling a month ago. He reflected this problem 2 weeks ago, but the inspector never came. The management did not response to the incident.

As for the Public Library, many shelves had been covered by tarps, because of the concerns about the conditions of the books. In addition, the fire alarm was not functional and the fire extinguishers missed. Emergency exit was blocked by construction materials. On the top floor, I wanted to check for ~~the room which fast~~ was locked. I called the mall manager to ask for assessment ~~to the room~~, but he said it was not necessary because the mall had passed the inspection in May by other engineering company.

wc

missing article

awk paragraph structure

missing article

awk

missing word

wc

wc

The roof top was a parking area. The concrete expansion joints were loose, because of ~~The~~ the water damage ~~caused the water went through and made the leakage.~~ ~~the roof~~

In conclusion, there were lots of problems in the mall. They should be corrected immediately, and I think we had better inspect again in the future.

Regards,

# Pass Exemplar

Score 2

**Faculty of Engineering & Applied Science, English Proficiency Test**

ration: 1 hour and 15 minutes **Final Graded Copy**

To: Melanie White

Subject: Rosewood Mall Inspection

Body of Email:

Hello Ms. White,

On August 23rd, I arrived at Rosewood Mall to complete an inspection regarding the state of the building. Rosewood Mall was built in 1997, and has had several renovations and management changes over the past 10 years. Additionally, there were several records of unfinished maintenance projects due to budget constraints.

Rosewood Mall has three floors and a 2-level rooftop parking garage. I began my inspection on the main floor. The first issue I noticed was a serious water leakage problem, which I suspect originated from the roof. There were buckets scattered throughout the mall to catch falling water. Additionally, the few stores that remained open within the mall had spread out tarps to protect their merchandise. There were prevalent signs of mold and rust near the water-damaged areas, which can be a source of airborne pollutants that may cause breathing issues for both customers and staff.

sp

As my inspection continued, I spoke to various employees within the mall. The first person I interviewed was Jennifer Blue, the owner of Blue's Bistro.

Jennifer explained how the building had various issues that were routinely ignored by mall management, including a leaky roof, frequently backed up bathroom drains and window leaks that rotted the windowsills, causing moisture problems. Jennifer had not been warned about these conditions previous to signing the lease, and despite attempting to work with management on these issues, constantly has her complaints dismissed. The water leakage in her restaurant requires customers to use umbrellas when in the take-out line. These issues are so severe that Jennifer does not plan on resigning her lease.

The next person I interviewed was John Yellow, a long-time employee at Donkey Burger in the mall's food court. He mentioned that one month ago, a slab of concrete the size of a plate fell from the ceiling and into a trash can. The mall promised that an inspector would arrive within the following two weeks, however nobody ever came. The mall did not respond further to the issue. John confirmed the mall's pattern of unresponsiveness, mentioning that the residents of the city have been complaining for some time on the state of the mall without any response.

My inspection continued at the public library, where I saw many shelves covered with tarps. The librarian confirmed that these tarps were in place to protect the condition of the books from any water damage. My inspection

of the library showed that several fire alarms were not functional, while the sprinkler system was not up to building codes. Additionally, there was a missing fire extinguisher, and a pile of construction materials blocking an emergency exit.

I attempted to enter a maintenance room on the top floor in order to inspect the roof support beams for rust, however this room was locked. Upon phoning Orange Incorporated, the company managing Rosewood mall, I was told that accessing the maintenance room is unnecessary, as the mall had already passed inspection from another engineering firm.

I ended my inspection on the rooftop parking garage. There, I found a loose expansion joint in the concrete floor. This area showed signs of water damage, and the crack appeared to be an entry point for water into the mall.

Upon inspecting Rosewood Mall, I have found several concerns with the quality of the building. There are copious examples of water damage throughout the mall, poor air quality, neglect towards fire safety in the library, and an overall unresponsiveness in the mall's management. The state of the mall is compromising the safety and quality of life of its employees and customers. Therefore, I recommend a more in-depth inspection of Rosewood Mall.

Thank you,

# Inspection Report

# English Proficiency Test Materials

# ENGLISH PROFICIENCY TEST SCRIPT

## INSPECTION REPORT

Facilitator: You will read this script aloud to the students two times. It is critical that you read this script very slowly to allow students time to process the information and make notes while you are reading.

SCRIPT:

You are a summer student working at Green Consultants. Green Consultants is an Engineering firm that inspects buildings and decides whether they are structurally sound. Your Supervisor Melanie White, (spelled W H I T E) has asked you to inspect Rosewood Mall. **Your job is to write a detailed report that highlights any major problems and the condition of the mall building. Your report is to be submitted to Ms. White and will include your recommendation as to whether or not the firm will need to conduct a more in-depth inspection.**

On Thursday August 23, at 10:00am, you reviewed the building plans and related building documents for Rosewood Mall. The mall has three levels and contains a food court, hotel, gym, theater, offices, a public library, and many retail stores. The roof of the building is used for parking and holds a two-level parking garage. The mall was built June 10, 1977 and has had several renovations over the years. You found that most of the building's architecture was distinctive of the period it was built in. In reviewing real estate records, you found that the mall had changed ownership several times over the last ten years. There were several records of maintenance projects, but many appeared to have not been finished due to budget problems.

You arrived at 1:00pm in the afternoon of August 23rd. Your inspection began on the ground floor and the first thing you noticed was a serious water leakage problem, which you suspected was coming from the roof. There were buckets scattered around all levels of the mall to catch water leaking. Many of the businesses were closed, but the ones that were open had put tarps out to protect their goods. Near the water damaged areas, you noticed mold and rust on the walls. This could contribute to airborne pollutants and cause breathing issues for staff and customers.

You spoke with several mall staff regarding the condition of the mall and issues they were having in their area. The owner of a restaurant called Blue's Bistro, Jennifer Blue (spelled B L U E), said the building generally had many problems that had not been attended to by the Management. She mentioned the leaking roof, frequently backed up drains in the bathrooms, and window leaks that rotted the window sills and created moisture problems. Her restaurant had tried to work with management on getting these items repaired however none of the complaints have been addressed. She said she was not warned about the conditions before she signed the lease, and that at times customers had to use umbrellas to stand at the take-out counter. She also said she plans to close the location as soon as the lease ends.

In the food court, you talked to the cashier of Donkey Burger, named John Yellow (spelled Y E L L OW). Donkey Burger serves the most delicious burgers and you decided to grab a meal for the way home. John has worked at Donkey Burger for 5 years now and he was quite proud that he had been chosen employee of the year. He told you that about a month ago, a chunk of concrete about the size of a plate fell through the restaurant ceiling and landed in the garbage bins. The mall promised that an inspector would come in two weeks after the incident, but the inspector never came. The mall management did not respond any further to the incident. John said that residents of the town had been complaining about the mall for some time, but that the management was always unresponsive.

Next, you went into the public library in the mall. You noticed that many shelves had been covered completely with tarps. You talked to the librarian and he told you that the library was worried about the condition of the books.

You continued your tour and found that several fire alarms were not functional, along with the sprinkler system not being up to building code. There were missing fire extinguishers, and an emergency exit was blocked by some piled construction material.

There was a maintenance room on the top floor that might have been able to give you a look at the roof support beams to check for rust. However, it was locked. You called the mall management, which was a company called Orange Incorporated. You asked about getting access to the

maintenance room, but they assured you that it was unnecessary. They insisted that the mall had passed an inspection in May by another engineering firm.

When you arrived at the rooftop parking lot you noticed an expansion joint in the concrete floor that appeared to be loose. There was water damage, indicating that water often ran through this crack and into the mall. There was also residue buildup that appeared to be from dissolved de-icing salt during the winter. You noted these final details and returned to your office to write your report.

You should start writing your email now.

# English Proficiency Test

Duration: 1 hour and 15 minutes

## INSTRUCTIONS

Please put your name on each sheet.

### Format

Assume that you are a safety inspector who has just completed an inspection of a lab at Queen's University. You will be given information about your safety inspection when the test begins.

### Your Task

Your task is to write a report in proper email format to the Director, Russell Burns of the Environmental Health and Safety Department. The report should include the detailed information collected as a result of the investigation. The report should present the information in a clear and accurate format.

You should:

1. Address the email To: Fr: Subject…etc
2. take notes from the information provided,
3. record only the important information,
4. place the information in a chronological order,
5. write a clear, concise, technically precise report in complete, well-formed sentences on the lined answer sheet with the heading "Final Submission"
6. punctuate your report and use paragraphs appropriately

### When Complete

Make sure you have put your name on all of the sheets. Hand in your rough work and your final submission as you leave the exam hall.

## English Proficiency Test

Duration: 1 hour and 15 minutes

NOTES AND ROUGH WORK

## English Proficiency Test

Duration: 1 hour and 15 minutes **Final Graded Copy**

To:_____

Subject:_____

Body of Email:

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Final Submission Page 2

Final Submission Page 3

Final Submission Page 4

Final Submission Page 5

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# ENGLISH PROFICIENCY TEST
# INSPECTION REPORT EXEMPLARS

# Fail Exemplar

FAIL: Content errors and missing content.
Some spelling and grammar issues.

Q4 0

**Faculty of Engineering & Applied Science, English Proficiency Test**

Duration: 1 hour and 15 minutes — **Final Graded Copy**

To: Dr. Burns

Subject: The Investigation Result About An Explosion Accident

Body of Email:

Dear Dr. Burns,

I am writing to report some details about an explosion accident which occurred in a building behind the Students' residence

The explosion happened when students performed a chemical reaction in Room 83 of the building. All students and staff evacuated from the building; however, two students got injuried. Doctors said the injury was not fetal to them and provided protective equipment to reduce the damange.

Some measures need to be taken to aviod such an explosion. Firstly, the protective codes and glasses are required during the experimetal research. It is better to provide additional protective materials. Moreover, manager Jaones suggested we should establish some equipment to dispose the waste. In addition, we should follow the labotory procedure strictly and predict the reactions; therefore, the risk can be minimized. Lastly, some safety measures should

Content issues for this entire passage

Content issues

Q5 No score

be taken such as putting the labels on the containers
In conclusion, the accident made some students
get injuried although it was not fetal. we should
attach a great importance on chemical reactions during
the lab and take measures to avoid such accidents
in the future.
sincerely,

Some content missing. Too brief.

# Marginal Pass Exemplar

Q4 1

**Faculty of Engineering & Applied Science, English Proficiency Test**

Duration: 1 hour and 15 minutes — **Final Graded Copy**

To: Russell Burns,

Subject: September 9 2017 Lab Accident Report.

Body of Email:

Hello Mr. Burns,

Here are the findings of my investigation into the September 9th lab accident.

Describe the accident

I first spoke with the doctor who treated the hospitalized students ~~who~~ the ~~reported~~ that the accident could have been fatal had the students not been wearing personal lab safety equipment. Students in lab should ~~be~~ continue to be forced to wear lab gear, and reminded of the dangers of not complying.

with 1st and 2nd degree burns

Secondly, I spoke to Mr. Jones, the lab Director. Mr. Jones stated that he had established a commission to investigate ways to make his labs more safe. He said that his team was currently looking at

Q5 No score

how to improve the waste disposal systems in the lab. These improvements included moving waste disposal bins to better locations, colour coding waste disposal bins, [redacted] and educating students and faculty about how to remove dangerous waste safely. Mr. Jones also stated that his team [redacted] was aware of the risk of unpredictable reactions; adding that although he could not predict the unpredictable, he could [redacted] mitigate the risks and prepare for accidents.

Finally, I spoke to Mr. Cook, the Fire Marshall about his joint investigation with yourself into the accident. Mr. Cook concluded that the explosion had been caused by the reaction of waste in a waste bin with an acid on the table next to the bin. Mr. Cook also stated

Q6 No score

~~Final Submission~~ Page 3

that he viewed the accident as a chance to improve ~~procedures~~ procedures, including simple procedures like the labelling of containers, and improving the layout of the labs.

This content is slightly inaccurate (it was not said explicitly by the fire marshall)

These are the findings of my investigation, I look forward to speaking with you further about this accident.

Sincerely,

Include more content from the initial script. Specifically, describe the accident in more detail

# Pass Exemplar

To: Russell Burns, Director of Environmental Health and

From: Safety Inspector

Subject: Safety Inspection of Lab Following Explosion

Q4 2

Dear Russell Burns,

My name is Iain Kaufman-O'Keefe and I am a safety inspector in the Department of Health and Safety at Queens University. My job is to report my findings from an inspection of a chemistry lab on campus, following an incident that occurred on Monday, September 9th 2015 at 6:30 pm. The accident that transpired in room 83 of the chemistry building was an explosion resulting from a student performing a chemical reaction. At the time several students and staff were present in the lab and as a result of the explosion the lab building and surrounding residence were evacuated. As well two students were taken to hospital with 1st and 2nd degree burns. The students were released from hospital shortly after and are going to be fine. According to Mark Jones, the Lab Manager, the reaction that the students were attempting had been preformed at Queens for many years and in many different Universities.

The doctor at the hospital said that the protective equipment the students were wearing helped reduce the injuries that the students suffered. One of the main safety precautions in the lab is the requirement to wear a lab coat and goggles at all times. Something that the university should look into according to students and staff is the introduction of extra safety equipment to further reduce injuries in case of an accident. Furthermore, following the accident, a commission tasked with investigating waste container placement and training on proper waste disposal, could help reduce the chance of an accident in the future. The waste containers are a critical piece of safety equipment that reduce hazard to students and staff and are clearly labeled and colored.

The cause of explosion is still not completely understood but could be attributed to an unpredictable/freak accident. Even safe reactions like the one attempted in the lab can be unpredictable in some circumstances. According to an investigation by the University Fire Marshal, lead by Bryan Cook, the explosion had no root cause but originated in a waste container located next to the acids in the lab. As a result, recommendations such as more procedure on how chemicals are labeled in the lab as well as better waste disposal are needed. Freak accidents happen, however, more steps can be taken to ensure they happen less often, while reducing injuries when they do happen. Hopefully this summery of my investigation of the lab accident and its causes allows you to make recommendations that keep an accident like this from happening again.

Sincerely,

# Professional Language Diagnostic

# Purpose and Use of Professional Language Diagnostics

There are two diagnostic instruments to accompany this set of modules. One is for written work and the second is for orally observing students in informal team/classroom interactions. These are strictly for diagnostic purposes not evaluation.

The written diagnostic looks at five categories: Content accuracy, Lexicogrammatical accuracy, Rhetorical and Argument, Audience and Concision. Student performance in these discrete areas is judged as Unacceptable, Acceptable or Strong.

An unacceptable performance means that the reader cannot extract meaning without multiple readings and even then must make assumptions about the intentions of the writer. The discrete items in each of the different categories identify contributing factors to the unacceptable performance.

An acceptable performance in one in which the reader may have to make a second pass at reading to extract meaning but there is little ambiguity in terms of the writer's intended meaning. It is possible to have issues with any of the five categories but they do not impede meaning. The discrete items in each are checked to indicate areas that may require additional support

A strong performance is one in which the reader can easily extract unambiguous meaning in one reading.

By using the diagnostic rubric, it is possible to identify instructional foci for different students. For example, a student may be acceptable or even strong in Content and Lexicogrammatical accuracy but unacceptable in Rhetorical and Argument. This student would benefit from instruction in paragraph and document organization, argument structure, use of evidence and justification. Another student may show up as weak in Audience indicating a lack of awareness or possibly knowledge of different vocabulary registers (the differences between formal/informal, academic/everyday, technical/non-technical language, etc) so instruction that focuses on vocabulary used in different registers and audience analysis would be useful. Some students will show up as unacceptable/acceptable in all areas. These students require an approach with more or less equal emphasis on each of the categories. The use of the diagnostic rubric helps an instructor focus the instruction for groups of students.

The Oral Diagnostic observation sheet is used somewhat differently in that it requires more interpretation and discussion with the student in order to accurately identify areas for instruction/practice. For example, the observation form may show that the student rarely initiates a point or asks a question but follows the discussion, actively listening. A discussion with this student may reveal that the student does not feel confident in speaking without making "grammar mistakes" or does not feel he or she can respond quickly enough. An intervention would be two-part in this case. Suggesting that the individual student make jot notes, use sketches, diagrams in conjunction with verbal explanations may give the student some strategies to help bolster confidence. It may also be useful to get the student to focus on how monolingual speakers often have incomplete sentences, grammar errors, and vocabulary form/choice errors in oral interactions. The second part of this is to have a discussion with the team about how the responsibility is shared between all team members for making the necessary space for everyone to contribute. Do they need to slow down? Do they need to monitor how they make sure everyone has a space or time to contribute, for example, deliberately asking individuals for comment. Could they incorporate an individual thinking time followed by team discussion time that would give everyone a chance to assemble and organize their own thoughts?

The Oral diagnostic observation sheet can provide a starting point for analyzing team dynamics in a conversation with the entire team. This helps to promote the concept that ALL team members bear responsibility for team communication. The interactions that are tracked make the communication patterns visible and as such, provides the opportunity to ask why.

# Written Professional Language Diagnostic Materials

# INSTRUCTIONS FOR FACILITATING THE WRITTEN PROFESSIONAL LANGUAGE DIAGNOSTIC

Students are given 30 minutes to complete three questions distributed as a multiple page copy with space allocated for students to write their answers. The answers are hand-written to allow students to use sketches, drawings or charts with their written text, if they wish. The first question requires a simple statement of the information found in the provided graph without explanation or interpretation. The second question requires a simple argument to support a recommendation to a peer. The third question requires an interpretation and application of the information from the graph to a different context as well as a recommendation to someone without the technical background and in a position of authority.

The Diagnostic Rubric includes a Content Accuracy category for each of the three questions to include a judgment on the accuracy of the answer to the prompt (e.g. did the student accurately comprehend the task they were asked to do and accurately comprehend the content of the prompt?). A Lexicogrammatical category is included for each of the prompts to identify the lexicogrammatical items that may or may not interfere with the meaning a student is attempting to communicate. Questions two and three include a Rhetorical/Argument category to assess a student's ability to organize ideas in a basic claim-evidence structure in paragraphs. The Audience category assesses student ability to recognize and use vocabulary appropriate to the designated audience. The Concision category assesses student ability to write with clarity and directness, valued characteristics of engineering writing.

At the beginning of each category, a row is included to provide a global assessment of Unacceptable, Acceptable, or Strong. Once the global judgment is made, the assessor checks all boxes that contribute to that judgment. There may be boxes checked in multiple columns, especially if there are issues with one or more lexicogrammatical items even if those do not impede meaning.

An **unacceptable** performance means that the reader cannot extract meaning without multiple readings, and even then, must make assumptions about the intentions of the writer. The discrete items in each of the different categories identify factors that contribute to the unacceptable performance.

An **acceptable** performance is one in which the reader may have to make a second pass at reading to extract meaning but there is little ambiguity in terms of the writer's intended meaning. It is possible to have issues with any of the five categories, but they do not impede meaning. The discrete items in each are checked to indicate areas that may require additional support.

A **strong** performance is one in which the reader can easily extract unambiguous meaning in one reading.

It is highly recommended that if the diagnostics are being assessed by more than one person, that a benchmarking session be held. In the benchmarking session, assessors will be given a minimum of three different samples reflecting a range of performance. Assessors mark the rubrics independently followed by a discussion to bring interpretations of the rubric and how the samples are judged into agreement. This will develop a shared understanding of the terms of the rubric and how they can be applied.

# WRITTEN PROFESSIONAL LANGUAGE DIAGNOSTIC PROMPT 1

## Instructions:

Please complete the three questions below in order. Your responses should be written clearly, concisely, and use standard English. Below each question in italics are the key elements we would like you to demonstrate in your response (e.g. concision, vocabulary).

Ensure that you record your final response in the provided sheets and record the time at which you complete each question.

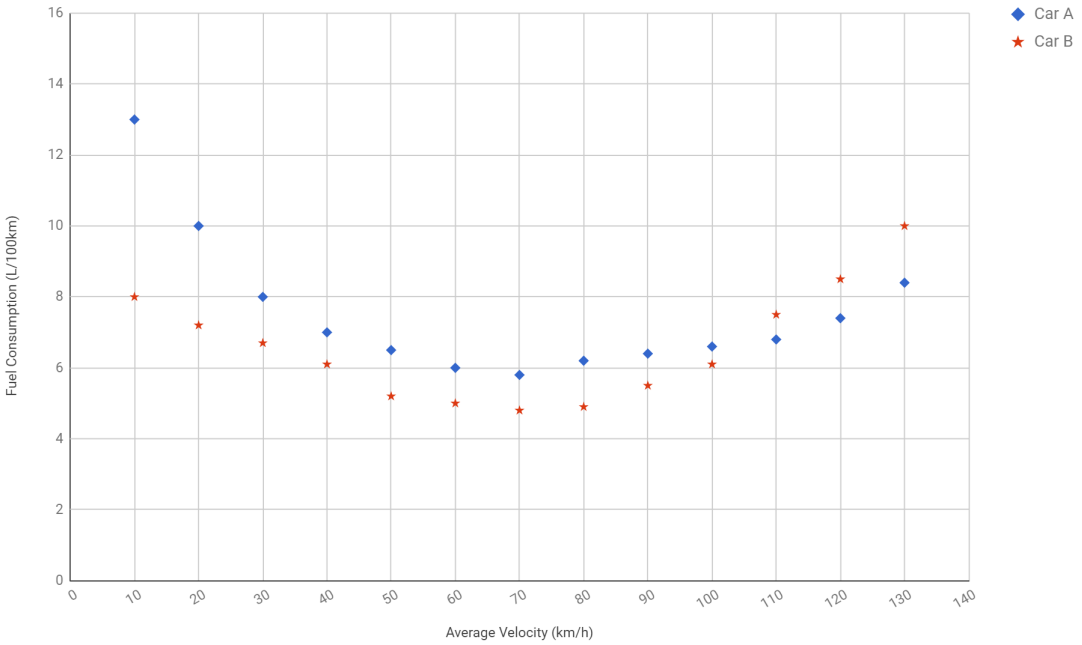
This will help us identify the time required to complete each question.

We have provided other paper for rough work.

Use the following plot to help answer Questions 1 and 2 of this task. The plot below displays measured fuel consumption (L/100km) at various average velocities (km/h) for 2 vehicles.

The relationship between volume of fuel consumed (V), fuel consumption (F), and distance travelled (d) is given by

$V = \frac{Fd}{100}$, where V is measured in L, F is measured in L/100km, and d is measured in km.




## Question 1

Write one or two clear, direct sentences that state the information represented by the graph above. Focus on the differences between the curves, and comment on the shape of the data (i.e. linear, parabolic, cubic, etc.). You do not need to do any new analysis or calculations. Simply describe data as shown on the plot.

*Criteria: accuracy in describing the content of the plot and proper English usage*

Time Completed:

## Question 2

A friend of yours is preparing to drive across the country, and it happens that the data above represents the fuel consumption of the two vehicles she may choose to drive on this trip. She's asked you to write her an email recommending which vehicle she should drive. She has shown you a map of her route across the country, so you know that the average velocity for her drive will be approximately 100 km/h. However, you also know she typically drives 15 km/h over the speed limit. Given these factors, explain what fuel economy she should expect and the reasons for your vehicle recommendation.

*Criteria: Proper English usage, ability to interpret and compare options, appropriate vocabulary, concision*

Respond in the space on the next page.

Response to question 2:

Time Completed:

## Question 3

A growing delivery company, QuickShip, is looking into purchasing a fleet of vehicles to transport their customers' packages to and from anywhere in North America. Their new fleet of vehicles will need to serve two purposes. They will need to transport goods on major highways at high speeds over large distances, as well as make deliveries within cities where the average speed is much lower. There are many factors the company is considering for this purchase, however, they have stated that minimizing fuel costs is the top priority given the increasing cost of fuel, both monetarily and environmentally.

The company has narrowed their search to 4 vehicles.

Vehicle 1: Diesel, City fuel consumption 12.7 L/100km, Highway fuel consumption 7.5 L/100km

Vehicle 2: Gas, City fuel consumption 10.1 L/100km, Highway fuel consumption 9.4 L/100km

Vehicle 3: Hybrid Electric/Gas, City fuel consumption 9.0 L/100km, Highway fuel consumption 8.7 L/100km

Vehicle 4: Gas, City fuel consumption 16.0 L/100km, Highway fuel consumption 8.5 L/100km

The company estimates that the cost of diesel fuel is approximately $2.50/L and the cost of gasoline is approximately $2.30/L. They predict that each vehicle in their new fleet will drive approximately 25000 km on highways, and 9000 km on city roads each year. Since this fleet will serve multiple purposes, they are considering purchasing either one or two types of vehicles.

You have been asked to write a letter to the CEO of QuickShip, Mr. Alex Garcia, on vehicle options. He is looking for your engineering judgement on this problem. He will use the information you provide him with to make clear explanations when presenting the option to his business and purchasing managers. He will also use the information you provide him with to answer any questions they may have.

Based on the information given, write a letter to the company with the following information:

- A short discussion of which groups of people might have an interest in this project and want to have a say
- An assessment of each proposed vehicle
- A supported recommendation for the best proposed vehicle

Address the letter to Mr. Alex Garcia, who is the CEO of QuickShip. Use language appropriate for an educated person to use with other with non-technical backgrounds.

*Criteria: Proper English usage, ability to interpret and compare options, ability to make an effective argument, appropriate vocabulary, concision*

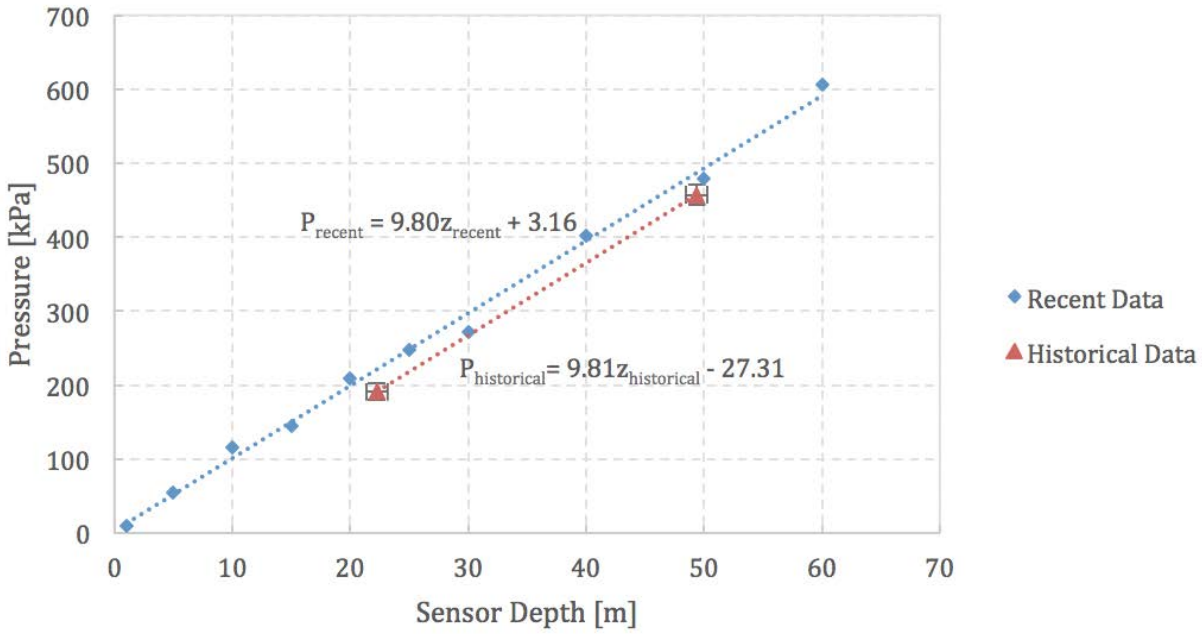
Response to question 3:

Time Completed:

# WRITTEN PROFESSIONAL LANGUAGE DIAGNOSTIC PROMPT 2

*Instructions*: Please complete the three questions below in order. Your responses below should be written clearly, concisely, and using standard English. Below each question in *italics* are the key elements we would like you to demonstrate in your response (e.g. concision, vocabulary). **Ensure that you record your final response in the provided sheets and record the time at which you complete each question.** This will help us identify the time required to complete each question. We have provided other paper for rough work.

The following plot will be used for all three questions in this task. This plot displays two sets of data measuring pressure (P) at varying depths (z) in a lake. Pressure is taken relative to atmospheric pressure, thus air pressure at the surface of the earth is considered to be zero, and all other pressures below the lake surface are above zero. The recent pressure data ($P_{recent}$) and depth data ($z_{recent}$) were taken in the past year using a digital pressure gauge and the historical data ($P_{historical}$, $z_{historical}$) were found in the City of Kingston archives, with no specific date or measuring method indicated. The original data points are shown as diamond or triangle markers. The trend lines (which are lines of best fit) are shown in dashed lines.



# Question 1

Using only words, describe the relationship between depth and pressure for the recent data and the historical data, and the difference between the two sets of data. You do not need to do any new analysis or calculations; simply describe data as shown on the plot in a couple of sentences.

# Question 2

A high school class is planning to use this data for a school project. You have been asked to write a paragraph to the class comparing the reliability of the data, and arguing which data set (the recent or historic) should be used for their project. The class has also asked you to extrapolate from the data to 70m in depth; include a sentence or two at the end indicating what the pressure would be at 70m depth based on the dataset you think should be used. You do not need to do detailed calculations; rather estimate this value from the graph.

# Question 3

A small oil company is looking into building a submarine pipeline from Kingston to Wolfe Island to transport gasoline to the island. A submarine pipeline is a pipeline that runs along the floor of an ocean or lake. The oil company is trying to select a path for the pipeline to follow along the lakebed that minimizes both the cost of building the pipeline as well as the risk of damage. The company has stated that minimizing risk is of utmost importance given the high cost of a spill, both monetarily and environmentally. The company has proposed three routes.

**Route 1**: This route requires a total pipe length of 3km, has a maximum depth of 47 m and passes under the ferry route between Kingston and Wolfe Island.
**Route 2**: This route requires a total pipe length of 4.5km, has a maximum depth of 29m and passes through an area with some small boat traffic.
**Route 3**: This route requires a total pipe length of 6km, has a maximum depth of 15m and does not pass through an area with significant boat traffic.

Shorter routes mean lower overall cost to the company. The pipe that the company plans on building can withstand a maximum external pressure of 400kPa relative to the water surface level. A significant risk to the pipeline in winter is seabed gouging due to ice flows. Seabed gouging occurs when large floes of ice scrape across the lakebed, leaving large gouges and damaging any structures on the lakebed. Ice flows in the Kingston area have been known to reach depths of 20m.

Based on the information given, write a letter to the City of Kingston with the following information:

- A short discussion of which groups of people might have an interest in this project and want to have a say
- An assessment of every proposed route
- A supported recommendation for the best proposed route
- Address the letter to Ms. Andrea Kwon, who is a member of Kingston City Council. Use language appropriate for a councillor with a non-technical background.

# Answer sheet

Last Name (Surname): _____ Given Name: _____ Student #: _____

**Question 1 response**

Please record the time you finished question 1 here: _____

**Question 2 response**

Please record the time you finished question 2 here: _____

**Question 3 response**

Please record the time you finished question 3 here: _____

# WRITTEN PROFESSIONAL LANGUAGE DIAGNOSTIC PROMPT ASSESSMENT

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Q1** | | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| | **Content Accuracy** | Misunderstands/ misinterprets meaning | | Incomplete description of data | | Complete description of data without misunderstanding/ misinterpretation | |
| | | Includes irrelevant information | | Includes some irrelevant information | | Information is relevant | |
| | | Primarily uses prompt vocabulary (words & phrases) | | Substantial use of prompt vocabulary chunks | | Uses prompt vocabulary in appropriate new constructions | |
| | | Not attempted | | | | | |
| | | | | | | | |
| | **Lexicogrammatical Accuracy** | Error rate and type make writing incomprehensible | | Error rate and type force reader to guess at intended meaning | | Error rate and type do not interfere with meaning | |
| | | Spelling, capitalization, punctuation | | Spelling, capitalization, punctuation | | Spelling, capitalization, punctuation | |
| | | Word choice | | Word choice | | Word choice | |
| | | Word form choice | | Word form choice | | Word form choice | |
| | | Verb tense choices | | Verb tense choices | | Verb tense choices | |
| | | Subject-verb agreement | | Subject-verb agreement | | Subject-verb agreement | |
| | | Singular/plural | | Singular/plural | | Singular/plural | |
| | | Pronoun usage | | Pronoun usage | | Pronoun usage | |
| | | Preposition usage | | Preposition usage | | Preposition usage | |
| | | Article usage | | Article usage | | Article usage | |
| | | Syntax | | Syntax | | Syntax | |
| | | Clause ordering | | Clause ordering | | Clause ordering | |
| | | Relative pronoun/conjunction choices | | Relative pronoun/conjunction choices | | Relative pronoun/conjunction choices | |
| | | | | | | | |
| **Q2** | | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| | **Content Accuracy** | Misunderstands/ misinterprets meaning | | Incomplete description of data | | Complete description of data without misunderstanding/ misinterpretation | |
| | | Includes irrelevant information | | Includes some irrelevant information | | Information is relevant | |
| | | Primarily uses prompt vocabulary (words & phrases) | | Substantial use of prompt vocabulary chunks | | Uses prompt vocabulary in appropriate new constructions | |
| | | Not attempted | | | | | |
| | | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| | **Lexicogrammatical Accuracy** | Error rate and type make writing incomprehensible | | Error rate and type force reader to guess at intended meaning | | Error rate and type do not interfere with meaning | |
| | | Spelling, capitalization, punctuation | | Spelling, capitalization, punctuation | | Spelling, capitalization, punctuation | |
| | | Word choice | | Word choice | | Word choice | |
| | | Word form choice | | Word form choice | | Word form choice | |
| | | Verb tense choices | | Verb tense choices | | Verb tense choices | |
| | | Subject-verb agreement | | Subject-verb agreement | | Subject-verb agreement | |
| | | Singular/plural | | Singular/plural | | Singular/plural | |
| | | Pronoun usage | | Pronoun usage | | Pronoun usage | |
| | | Preposition usage | | Preposition usage | | Preposition usage | |
| | | Article usage | | Article usage | | Article usage | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Syntax | | Syntax | | Syntax | |
| | Clause ordering | | Clause ordering | | Clause ordering | |
| | Relative pronoun/conjunction choices | | Relative pronoun/conjunction choices | | Relative pronoun/conjunction choices | |
| | | | | | | |
| | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| **Rhetorical Argument** | | | | | | |
| | Establishes no interpretive relationships with prompt question | | Attempts to establish interpretive relationships | | Clearly states interpretive relationships | |
| | Lacks justification | | Lacks or misuses conjunctions or connectors to establish justification | | Clearly states justification with appropriate conjunctions or connectors | |
| | No apparent organization | | In consistent or illogical organization at the paragraph level | | Uses known to new, part to whole, sequential or relationsl order | |
| | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| **Audience** | Mixed register | | Commits to register but misjudges audience (overuse of technical, formal vocab) | | Selects appropriate register as seen with selection of vocabulary | |
| | Mixed levels of technical/non-technical vocabulary | | Commits to level of technical language but the wrong one | | Uses appropriate technical terms with accurate everyday terms | |
| | Includes no relevant context | | Incomplete or inappropriate context | | Provides relevant context for audience | |
| | Primarily uses prompt vocabulary (words & phrases) | | Substantial use of prompt vocabulary chunks | | Uses prompt vocabulary in appropriate new constructions | |
| | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| **Concision** | Circumlocution | | Occasional circumlocution | | Precise use of vocabulary | |
| | Text dominated by complex or run-on sentences | | Indiscriminate use of complex sentence structures | | Simple, compound or complex sentences diversity that serves a meaning | |
| | Text dominated by passive voice | | Indiscriminate use of passive voice | | Passive voice used purposefully | |
| | Qualifiers used indiscriminately | | | | Qualifiers used to add precision to meaning | |
| | | | | | | |
| | | | | | | |
| **Q3** | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| **Content Accuracy** | Misunderstands/ misinterprets meaning | | Incomplete description of data | | Complete description of data without misunderstanding/ misinterpretation | |
| | Includes irrelevant information | | Includes some irrelevant information | | Information is relevant | |
| | Primarily uses prompt vocabulary (words & phrases) | | Substantial use of prompt vocabulary chunks | | Uses prompt vocabulary in appropriate new constructions | |
| | Not attempted | | | | | |
| | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| **Lexicogrammatical Accuracy** | Error rate and type make writing incomprehensible | | Error rate and type force reader to guess at intended meaning | | Error rate and type do not interfere with meaning | |
| | Spelling, capitalization, punctuation | | Spelling, capitalization, punctuation | | Spelling, capitalization, punctuation | |
| | Word choice | | Word choice | | Word choice | |
| | Word form choice | | Word form choice | | Word form choice | |
| | Verb tense choices | | Verb tense choices | | Verb tense choices | |
| | Subject-verb agreement | | Subject-verb agreement | | Subject-verb agreement | |
| | Singular/plural | | Singular/plural | | Singular/plural | |
| | Pronoun usage | | Pronoun usage | | Pronoun usage | |
| | Preposition usage | | Preposition usage | | Preposition usage | |
| | Article usage | | Article usage | | Article usage | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Syntax | | Syntax | | Syntax | |
| | Clause ordering | | Clause ordering | | Clause ordering | |
| | Relative pronoun/conjunction choices | | Relative pronoun/conjunction choices | | Relative pronoun/conjunction choices | |
| | | | | | | |
| | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| **Rhetorical Argument** | States a claim w/out evidence or justification | | States a claim,w/one piece of evidence but does not explicitly or implcitly link to claim | | States a claim(s) w/evidence and justification | |
| | Lacks justification | | Lacks or misuses conjunctions or connectors to establish links of evidence | | Appropriate use of conjunctions or connectors to establish links | |
| | Lacks paragraph structure | | Inconcistent use of topic sentence and either inductive or deductive structure | | Paragraphs organized around central idea and follow clear logical path | |
| | Document lacks logical structure or logical flow | | Inconsistent linking (explicitly or implcitly) of paragraphs | | Paragraphs linked either explicitly or implicitly to create cohesion and coherence | |
| | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| **Audience** | Mixed register | | Commits to register but misjudges audience (overuse of technical, formal vocab) | | Selects appropriate register as seen with selection of vocabulary | |
| | Mixed levels of technical/non-technical vocabulary | | Commits to level of technical language but the wrong one | | Uses appropriate technical terms with accurate everyday terms | |
| | Includes no relevant context | | Incomplete or inappropriate context | | Provides relevant context for audience | |
| | **Unacceptable Performance** | | **Acceptable Performance** | | **Strong Performance** | |
| **Concision** | Circumlocution | | Occasional circumlocution | | Precise use of vocabulary | |
| | Text dominated by complex or run-on sentences | | Indiscriminate use of complex sentence structures | | Simple, compound or complex sentences diversity that serves a meaning | |
| | Text dominated by passive voice | | Indiscriminate use of passive voice | | Passive voice used purposefully | |
| | Qualifiers used indiscriminately | | | | Qualifiers used to add precision to meaning | |

# Oral Professional Language Diagnostic Materials

# ORAL DIAGNOSTIC PROMPT USE AND ASSESSMENT

The Oral Diagnostic observation sheet is used somewhat differently. For use with teams, the observer watches a team interacting for 10-15 minutes. During that time, the observer records actions by the team members by a tally count in the boxes provided. A gaze, indicating where a student's attention is directed, is represented with arrows. A gaze which includes everyone in the team can be represented by arcs.

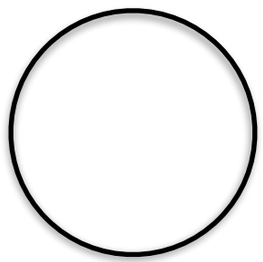
The Oral Diagnostic observation requires more interpretation and discussion with students in order to accurately identify areas for instruction/practice. If a student is observed rarely speaking but actively following the discussion, it is important to ask the student if this is normal behavior for the student in a group setting in their first language. If not, then additional questions should be asked, such as, if the student feels the need for additional "thinking" time before speaking, if the student feels uncomfortable or unable to insert themselves into the discussion, if the student is worried about making vocabulary, grammar or syntax errors, if the student feels insecure in their comprehension of the content of the discussion or the cultural references. Depending on the student's answers, the instructor can suggest different strategies to use to ask for clarification, for getting a turn, for overcoming the need for perfect sentences (listening carefully to the discussion will show that oral language contains multiple examples of incomplete sentences, errors in pronouns, subject-verb agreement, tense usage, word choice errors that are usually ignored or sometimes clarified as the speaker reformulates and restates ideas).

Because the Oral Diagnostic is done with the team, it affords the possibility to set up discussions with the team about how responsibility is shared between all team members for making the necessary space for everyone to contribute. The Oral diagnostic observation sheet can provide a starting point for analyzing team dynamics in a conversation with the entire team. This helps to promote the concept that ALL team members bear responsibility for team communication. The interactions that are tracked make the communication patterns visible and as such, provides the opportunity to ask why. For example, if it is obvious that one student rarely speaks, but is seen to be actively listening, it is equally important to ask other team members what they have noticed about their own behaviors including how they recognize others' attempts at turn-taking, the speed at which they speak, how often they speak over someone or interrupt, their use of cultural references and assumptions that "everyone knows that." Students can then suggest their own ideas for how to make the discussions more inclusive and able to take advantage of everyone's potential contributions.

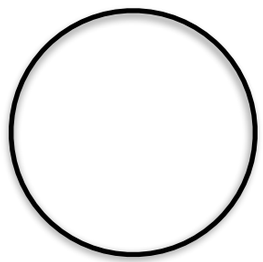
# Team Behaviour Observer Recording Sheet

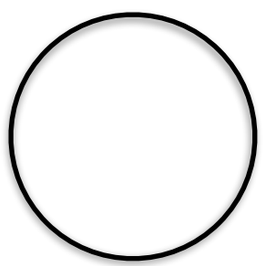
When you observe a particular behaviour by a particular individual, add a mark in the corresponding box

| IN | | IR | | C | | Q | | L | |
|---|---|---|---|---|---|---|---|---|---|

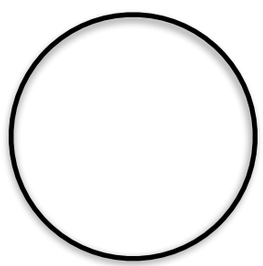


| IN | | IR | | C | | Q | | L | |
|---|---|---|---|---|---|---|---|---|---|





| IN | | IR | | C | | Q | | L | |
|---|---|---|---|---|---|---|---|---|---|



| IN | | IR | | C | | Q | | L | |
|---|---|---|---|---|---|---|---|---|---|

| | |
|---|---|
| **IN** | **Initiates**: individual initiates an interaction, verbally or non-verbally |
| **IR** | **Interrupts**: individual cuts off another's utterance without verbal or non-verbal acknowledgement or permission |
| **C** | **Completes** (expands or explains, builds): individual completes another's utterance with explicit verbal or non-verbal acknowledgement |
| **Q** | **Questions**: individual asks a question to confirm, clarify, seek information |
| **L** | **Listens**: individual follows interactions with gaze, non-verbal responses (facial expression, private language, note-taking) |
| **G** | **Gaze**: where does the individual's gaze predominantly rest: on an individual, on a device or notebook in front of them, on one other person, on the person who is currently speaking, in the distance<br>**Indicate the direction of gaze with arrows between the circles** |

# Module 1:

# Understanding Professional Language

## Table of Contents

| Module | 1 – Understanding Professional Language |
|---|---|
| Module Learning Outcomes | |
| By the end of this module students will be able to: | |
| 1. Interpret professional language [CLO 1, 2]<br>2. Comprehend the use of syntax and vocabulary [CLO 1, 2]<br>3. Comprehend modal verbs in an engineering context. [CLO 1, 2]<br>4. Comprehend language chunks (ie: no more than, exclusive of, inclusive of, etc.) [CLO 1, 2]<br>5. Interpret expectations from the professional language used. [CLO 1, 2]<br>6. Interpret context from the professional language used. [CLO 1, 2] | |

| Resources (Bank) | |
|---|---|
| **Item** | **Description of how to be used** |
| Example Assignment 1 | Used in workshop |
| Example Assignment 2 | Used in workshop |
| Example Assignment 3 | Use in workshop |
| Modal verbs exercise & key | Used by students on their own who show uncertainty with modal verb choices |
| Preposition exercise & key | Used by students on their own who show uncertainty with preposition use choices |

| Face to Face Workshop Plan | |
|---|---|
| **Description of Workshop** | This workshop/session provides students with an opportunity to read and extract important information from assignment instructions while attending to the language patterns and the uses specific to professional engineering language. |
| **Time for Completion** | 1-2 hours depending on total pages in assignment instructions |
| **Materials** | Hard copy of assignment instructions (one for each student)<br>Multicolored pens or highlighters<br>Projection device (if available)<br>Chart paper and tape |

| | |
|---|---|
| Workshop Preparation Instructions | You must select an assignment that all students will have in common and facilitators may do this in one of two ways. An instructor may choose to use assignment instructions that students have been given in one of their courses that they all have in common. If this is not possible, instructors may use one of the sets of instructions from the provided bank of materials.<br><br>Once 'content' (the assignment instructions) has been chosen, the facilitator needs to read through and mark in the assignment engineering specific vocabulary (e.g. stakeholder, constraints, objectives, procedure, protocol, etc.) The instructor should note not only the individual vocabulary words but the phrases in which they are used, (the collocations). Most of the words will occur in the same or similar phrases whenever they are used. The same should be done with document specific terminology (e.g. executive summary, recommendation, requirements, etc.), qualifiers such as exclusive of, including, excluding, no later than, by 22:00, not before, no more than, no less/fewer than, etc. The instructor should also identify uses of the modal verbs shall, must, should/should not, must not as these words are used with specific meanings in engineering. (See RFC 2119, https://www.ietf.org/rfc/rfc2119.txt)<br><br>The session will require students to skim the assignment multiple times to identify specific collocations and professional vocabulary, so it is important that the instructor will have identified the occurrences of the material in order to help students who do not find these words/phrases salient. |

| | |
|---|---|
| Procedure | *Facilitator Notes:*<br>Steps 1-4 should be given no more than 10 minutes in total to complete. Assure the students that they may miss something, but that only by forcing themselves to read under time pressure will they break the habit of reading word-by-word and begin to read as they do in their dominant language, in chunks. No one expects them to extract or understand everything from a single pass through.<br><br>Step 1: (Suggested time for reading: 1 minute per page)<br>Distribute the hardcopies of the instructions and different colour pens or highlighters if students do not have any. Instruct the students to skim through the instructions and mark anything they understand to be an absolute requirement for the assignment. This means they must mark instructions, that if not followed, will result in failing the assignment. They must read this quickly (suggest one minute per page).<br><br>*Facilitator Notes:*<br>The focus on reading quickly is important here. Many students, especially those students who are reading in their additional language, often read single words rather than phrases or chunks. One of the skills engineering students need is to be able to read something quickly and take advantage of several quick reads to extract relevant information. An enforced time limit helps them to break the reading word-by-word habit.<br><br>Step 2: (Suggested time for reading: 1 minute per page)<br>Repeat the reading process with a different colour pen to highlight/underline anything that would be beneficial to include in the assignment but is not required.<br><br>Step 3: (Suggested time for reading: 1 minute per page)<br>Repeat the reading process with a different colour pen to highlight/underline anything that students must not do as per the assignment instructions.<br><br>Step 4: (Suggested time for reading: 1 minute per page)<br>Repeat the reading process with a different colour pen to highlight/underline anything that is explanatory or provides information about the expected content.<br><br>Step 5: **(Approximately 20 minutes)**<br>Put students in groups of 2-4 (proximal is usually best so time is not wasted in moving around). Ask students to produce three lists on a large sheet of paper using their underlined/highlighted instructions as the |

| | |
|---|---|
| | source. Provide 1 piece of chart paper for each group, and have students make 3 lists on this page as shown below:<br>List 1 - Assignment requirements (what MUST be done)<br>List 2 - What must NOT be done<br>List 3 - What would be nice but is not required<br><br>Step 6: (~10-15 minutes)<br>Bring student attention back to the whole group. Using the lists from the groups, construct a shared Checklist. Instruct students to write a copy of this checklist down in order to use for future reference.<br><br>*Facilitator Notes:*<br>This is where the instructor can model the expected outcome/deliverable for the activity, which is a checklist that the student can use to plan and check that they have completed the assignments according to the requirements. This is also the time as the instructor moves through the list to ask students why they interpret something as a requirement, as beneficial to have, or as explanatory information. It is also when the instructor can draw attention to engineering specific use of certain words — changing them from everyday words to engineering words and the subsequent changes/shifts in meaning. This also facilitates discussion of the characteristics of engineering language (precision, directness, a level of formality or maybe even the equivalent of business casual).<br><br>Analysis of the language used facilitates noticing of specific vocabulary, collocations and how they are used. Students should be encouraged to look for these same patterns in other sets of instructions as they will help them predict what the expectations are. Noticing language patterns in order to predict expectations is a generalizable skill that evolves as students move into junior positions and part time jobs. |

| | |
|---|---|
| Supplemental Materials | If throughout this module it becomes evident that students are having difficulty with vocabulary and grammar, then you will need to provide them with some supplemental material to help them overcome those issues. There is a great chance that there will be students who will struggle with prepositions and the use of modal verbs.<br><br>If you identify difficulty with prepositions, please use the Prepositions Resource that explains the use of each preposition, gives examples for each preposition. Instruct the students to study that document thoroughly. Then have them complete the Exercises on Prepositions. Students will need to check their answers against the provided answer sheet, and if they have more than 40% wrong, they will need to practice more until they reach the point that there are no more than 1-2 errors per exercise.<br><br>If you identify difficulties with modal auxiliary verbs such as can, could, may, might, shall, should, will, would, must and ought to, please assign the Exercises on Modal Verbs. Follow the same steps as the ones described above for prepositions. |


# Resources

**Assignment: Project Requirements (PR)**

**Due date: must be submitted electronically by 6 p.m. the day of your tutorial in Week 6 (Oct. 10-14). Google Docs and Turnitin submissions are due at the same time.**

This team assignment will serve as a contract between you and your client. The document must give a complete solution-independent engineering definition of the project for which you will be designing a solution. The document must include value- added information beyond that in the client statement, including information gathered from sources other than your client and your own critical thinking on the project.

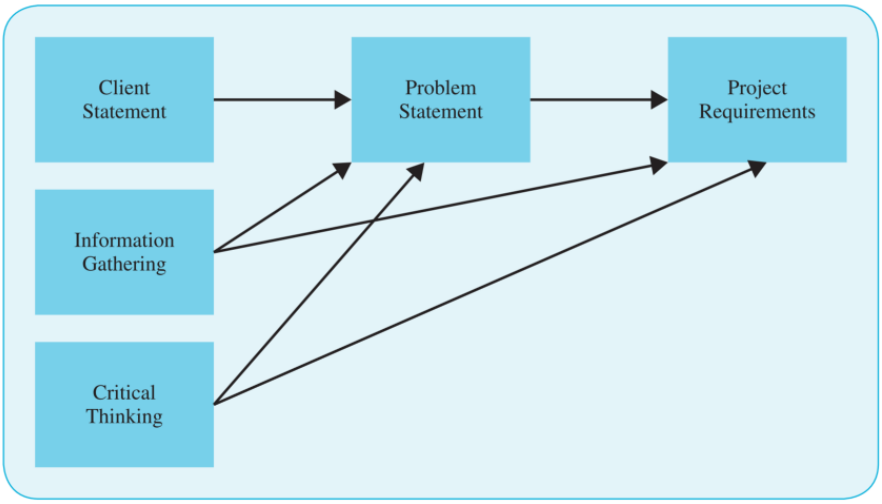



*Figure 1: Moving from a client statement to requirements requires gathering more information about the problem and critical thinking.*

**Required Content for PR**

***Only one assignment is required per team. Each assignment must include:***

- Cover Page (posted template)
- Executive Summary (start on new page after cover page)

1. Project Requirements (start on new page after Executive Summary)
   1.1. Problem Statement
   1.2. Stakeholders
   1.3. Functions
   1.4. Objectives
   1.5. Constraints
   1.6. Service Environment
2. Conclusion
3. Reference List (IEEE format)

- Appendices

- Attribution Table: In addition to the required content for the PR, a hard copy of the attribution table must be completed and signed by ALL team members. This attribution table must be submitted to the Teaching Assistant (TA) in the tutorial of the assignment deadline. This does not need to be submitted digitally.

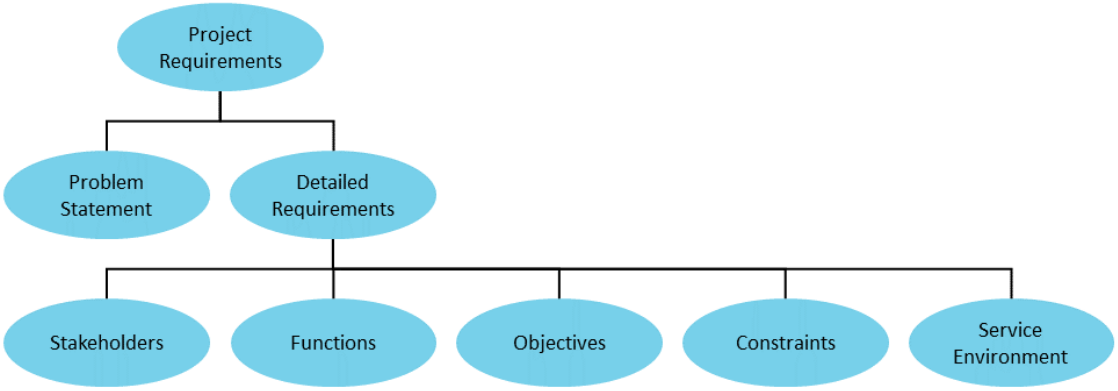



*Figure 2: There are many components of the Project Requirements*

### Format:

- **No less than 1200 words** and **no more** than **1500 words** excluding the Cover Page, Executive Summary, Reference List, and Appendices. Any words beyond the limit will be crossed out and will not be considered as part of the document.
- Formatting **must** follow "Document Style Requirements" in *Communication in ESP* in Course Information posted on Blackboard.
- Figures and tables, with descriptive labels, should be included within the text, where appropriate.

### Optional Draft Submission

If a team wishes to receive ungraded feedback from the TA on their team assignment prior to the assignment deadline so that they can correct important errors before grading, the team can submit one draft to the TA four days before the assignment deadline. The TA will only be checking the draft for major errors – the TA will not read or comment on everything. The TA may instruct teams to submit a draft by a certain time. Submitting a draft is optional.

### Requirements for submitting Final Draft for grading

Write and submit your assignment in a single Google Doc file shared with your TA, Communications Instructor (CI).

I. Create this file by opening the link to the cover page posted in Blackboard. You will not be able to edit this file.

II. Under File select Make a Copy to make a copy in your home Google Drive folder for which you are the owner and can edit.

III. Rename this file using this **strict** naming scheme:
Tut## - Team number – Team leader name - PR – Draft
I.E. Tut10 – Team 02 - Lee Logan – PR – Draft

IV. Share this file with your TA and CI and give them permission to edit.

V. **To officially submit,** rename the assignment file in Google Docs by changing the word "Draft" to "Final," but keeping all the other identifying parts of the file name. By the same deadline a PDF version exported from your Google Docs document ***must be*** submitted to Turnitin. Instructions for enrolling in Turnitin will be posted in Blackboard in advance of the assignment deadline. If your Google Docs or Turnitin submission is late, then standard late penalties apply (see below – Late Penalty).

There is no hard copy submission of the PR. The required content must be submitted to your TA as a single shared Google Docs document before the deadline**.** Other forms of submissions, hardcopy or digital, will not be accepted.

Only this single file will be graded. Students are NOT allowed to work offline or save the document to their desktop and work on it. Everything has to be online so that the TA can review the revisions and changes you make.

Any variance from this process will result in an incomplete submission; so be sure to get the syntax of the name right. Be sure to get the correct Google Account address from your TA and CI (their Google Account address might be different from their contact email address).

**Late Penalty**

For each portion of 24 hour period past the deadline there is a 10-mark (out of 100) penalty on that assignment. Late assignments will not be accepted beyond 72 hours past the deadline. After that point, a grade of "zero" will be assigned.

The assignment will not be considered submitted, and will accrue standard course late penalties, until the document:

- is shared with both the TA and CI in Google Docs,
- is named in the required syntax,
- is in a single file,
- is submitted to Turnitin,
- contains all required components.

# Personal Design Decision

## Overview

This document defines the scope and structure of the Personal Design Decision (PDD) assignment. The PDD requires that you develop a detail-level, selection-style[1] design decision that pertains to your own life experience. The primary goal of the assignment is to practice bringing engineering rigour and an engineering mentality to your everyday activities.

## Stakeholders

- You, a student engineer who needs to practice applying an engineering mentality and bringing engineering rigour to different types of design activities.
- Your Phase II – and future – engineering design teams who will benefit from having members with greater skill at making engineering design decisions.
- The Teaching Team, who are responsible for providing you with support and who expect their students to demonstrate both engineering rigour and an engineering mentality.
- Other Engineering students, who may also need to make a similar decision and who could benefit from your investigation and recommendation.
- Your PDD assessor, who has between 20 and 30 minutes to both assess and evaluate your submission.

## Requirements

### Objectives

The high-level objective of the PDD is to have you practice each element of an engineering design activity (framing, diverging, and converging) by making a detail-level, selection-style design decision. To enact this high-level objective, and to provide you with some additional guidance[2], the assignment has the following detailed objectives:

1. Select an opportunity with personal relevance that can be framed as a selection-style design decision.
2. Frame an opportunity as a design decision that has a set of requirements, including appropriate objectives, metrics, criteria, constraints.
3. Diverge in order to generate a viable set of candidate alternatives.
4. Converge to a single alternative by assessing the candidate alternatives against the requirements to determine the "best" one.
5. Recommend a single alternative that resolves the opportunity.
6. Support your recommendation with research that is both credibly-used and credible.
7. Communicate clearly in all aspects of your PDD, but with specific focus on the framing and recommendation.

[1] These descriptions will be introduced in Lecture 13.

[2] As discussed in Lecture 01, completing an engineering design activity usually involves practicing each of the different elements of design (framing, diverging, converging) multiple times and in no specific order. The list of detailed objectives in this assignment presents a highly idealized, unrealistic model of engineering design because of the linear limitations of textual lists. You should expect to (re)frame, (re)diverge, and (re)converge multiple times before reaching a single recommended alternative – with appropriate supporting documentation.

## Constraints

The PDD must meet the following constraints[3]:

1. It **should not** exceed (≤) five (5) pages, including figures but excluding references.
2. Relevant extracts from any used references **must** be included in an Appendix titled "Source Extracts".
3. It **must** be structured as a Design Report
4. It **should not** be more than (≤) 1200 words of text, excluding references.
5. It **should** be formatted with 11-point font, 1.25 spacing, and one-inch margins on standard letter-sized paper.
6. It **must** be submitted as a single PDF file.
7. The submission **must** have a file name that describes the decision opportunity but **must not** include the final decision (such that (e.g.) a classmate could quickly scan a list of titles and identify interesting or relevant PDDs).
8. The author's name **must** be included; other identifying information about the author **must not** be included.
9. It **must** include quantitative metrics and **should** include qualitative ("rubric style") metrics
10. It **should** include both continuous (e.g. "{ more, less } is preferred") and discrete (e.g. "rubric style" or "past this point there is no difference") criteria

## Criteria

Criteria are used to determine "better". Unless otherwise stated, "more" of a given criterion is considered better. The metrics associated with the criteria can be found on the Independent Assessment Tool (IAT) available on the course downloads site.

1. Legitimacy of the opportunity (that is being resolved through a selection-style design activity).
2. Quality of the requirements that frame the opportunity.
3. Quality, legitimacy, and credibility of candidate alternatives

   The number of candidate alternatives considered will be interpreted as one aspect of "quality". When selecting from a set of alternatives, a common approach is to designate one alternative as the "reference" against which the other alternatives are compared. As such students should expect to identify at least four (≥4) alternatives – one (1) to use as a reference and at least three (≥3) that are viable alternatives. This requirement is a criterion, not a constraint, so that students can limit the time they spend searching for (potentially non-existent) alternatives.
4. Quality of the decision-making process.
5. Quality of the justification for the recommendation.
6. The quality, credibility, and structure of your engineering arguments, including their basis in appropriate used and credible engineering evidence.
7. The quality of the design of your report, including appropriate use of structure and introduction.
8. The coherence and clarity of your English written and visual communication.

[3] Unlike in industry, or in other academic contexts, violating a constraint on this assignment will **not** result in the assignment being excluded from future considerations (e.g. not being assessed or evaluated and instead considered not to have been submitted). Instead an appropriate penalty will be applied to the final evaluation.

## Guidance and Guidelines

### About Metrics

As this represents a beginning (individual) attempt to develop a set of requirements, we want to acknowledge that metrics are particularly challenging. We accept that in this assignment you are going to exercise a degree of common sense in establishing metrics, particularly because the design decision in this case is "personal".

Where possible look for metrics that allow you to measure or quantify an assessment – this could be size, time, etc. Qualitative metrics, in rubric form, are also appropriate where quantification is not feasible or tractable.

Above all try to develop metrics that are practically useful (e.g. that you actually use to evaluate the candidate alternatives) as opposed to metrics that are theoretically applicable (e.g. that you cannot use given the time and equipment available to you).

### About Constraints

Developing constraints can be an extremely time consuming process. The PDD assignment is intended to provide you with practice on all aspects of selection-style engineering design. Therefore assuming quality metrics, it is more important that your constraints be useful and within an approximate order of magnitude of the "true" value (e.g. accurate) than that they be correct down to the decimal place (e.g. precise).

Above all avoid "overreaching" by stating requirements as constraints when there is insufficient justification for a hard limit.

## Format

A formal design report should include an engineering introduction, structured headings indicating sections, and a brief conclusion. The introduction should provide the framing, purpose, and overview of the report. The internal structure of the report, as indicated by headings (and subheadings, where necessary) should be governed by the content of the report. Any headings should be informative in nature (rather than generic). The conclusion can provide a summary **or** simply present the report's conclusion. Aside from these requirements, the format, structure and writing of the report are design decisions you need to consider, with the objective of the coherent and clear communication to your primary stakeholders, the teaching team.

# Prepositions

Prepositions are short words (on, in, to) that usually stand in front of nouns (sometimes also in front of gerund verbs).

Even advanced learners of English find prepositions difficult, as a 1:1 translation is usually not possible. One preposition in your native language might have several translations depending on the situation.

There are hardly any rules as to when to use which preposition. The only way to learn prepositions is looking them up in a dictionary, reading a lot in English (literature) and learning useful phrases off by heart (study tips).

The following table contains rules for some of the most frequently used prepositions in English:

## Prepositions – Time

| English | Usage | Example |
|---|---|---|
| • on | • days of the week | • on Monday |
| • in | • months / seasons<br>• time of day<br>• year<br>• after a certain period of time (when?) | • in August / in winter<br>• in the morning<br>• in 2006<br>• in an hour |
| • at | • for night<br>• for weekend<br>• a certain point of time (when?) | • at night<br>• at the weekend<br>• at half past nine |
| • since | • from a certain point of time (past till now) | • since 1980 |
| • for | • over a certain period of time (past till now) | • for 2 years |
| • ago | • a certain time in the past | • 2 years ago |
| • before | • earlier than a certain point of time | • before 2004 |
| • to | • telling the time | • ten to six (5:50) |

| | | |
|---|---|---|
| • past | • telling the time | • ten past six (6:10) |
| • to / till / until | • marking the beginning and end of a period of time | • from Monday to/till Friday |
| • till / until | • in the sense of how long something is going to last | • He is on holiday until Friday. |
| • by | • in the sense of at the latest<br>• up to a certain time | • I will be back by 6 o'clock.<br>• By 11 o'clock, I had read five pages. |

## Prepositions – Place (Position and Direction)

| English | Usage | Example |
|---|---|---|
| • in | • room, building, street, town, country<br>• book, paper etc.<br>• car, taxi<br>• picture, world | • in the kitchen, in London<br>• in the book<br>• in the car, in a taxi<br>• in the picture, in the world |
| • at | • meaning next to, by an object<br>• for table<br>• for events<br>• place where you are to do something typical (watch a film, study, work) | • at the door, at the station<br>• at the table<br>• at a concert, at the party<br>• at the cinema, at school, at work |
| • on | • attached<br>• for a place with a river<br>• being on a surface<br>• for a certain side (left, right)<br>• for a floor in a house<br>• for public transport<br>• for television, radio | • the picture on the wall<br>• London lies on the Thames.<br>• on the table<br>• on the left<br>• on the first floor<br>• on the bus, on a plane<br>• on TV, on the radio |
| • by, next to, beside | • left or right of somebody or something | • Jane is standing by / next to / beside the car. |

| English | Usage | Example |
|---|---|---|
| • under | • on the ground, lower than (or covered by) something else | • the bag is under the table |
| • below | • lower than something else but above ground | • the fish are below the surface |
| • over | • covered by something else<br>• meaning more than<br>• getting to the other side (also across)<br>• overcoming an obstacle | • put a jacket over your shirt<br>• over 16 years of age<br>• walk over the bridge<br>• climb over the wall |
| • above | • higher than something else, but not directly over it | • a path above the lake |
| • across | • getting to the other side (also over)<br>• getting to the other side | • walk across the bridge<br>• swim across the lake |
| • through | • something with limits on top, bottom and the sides | • drive through the tunnel |
| • to | • movement to person or building<br>• movement to a place or country<br>• for bed | • go to the cinema<br>• go to London / Ireland<br>• go to bed |
| • into | • enter a room / a building | • go into the kitchen / the house |
| • towards | • movement in the direction of something (but not directly to it) | • go 5 steps towards the house |
| • onto | • movement to the top of something | • jump onto the table |
| • from | • in the sense of where from | • a flower from the garden |

# Other important Prepositions

| English | Usage | Example |
|---|---|---|
| • from | • who gave it | • a present from Jane |
| • of | • who/what does it belong to<br>• what does it show | • a page of the book<br>• the picture of a palace |
| • by | • who made it | • a book by Mark Twain |
| • on | • walking or riding on horseback<br>• entering a public transport vehicle | • on foot, on horseback<br>• get on the bus |
| • in | • entering a car / Taxi | • get in the car |
| • off | • leaving a public transport vehicle | • get off the train |
| • out of | • leaving a car / Taxi | • get out of the taxi |
| • by | • rise or fall of something<br>• travelling (other than walking or horse-riding) | • prices have risen by 10 percent<br>• by car, by bus |
| • at | • for age | • she learned Russian at 45 |
| • about | • for topics, meaning what about | • we were talking about you |

# PREPOSITIONS

This worksheet is designed to build your skills in using correct prepositions.

## EXERCISE 1

Fill in the missing word buy using the correct preposition to finish the sentence.

1. Uluru is located ___ central Australia.
2. The large sandstone rock formation is also known ___ Ayers Rock ___ honour ___ Sir Henry Ayers, who was a Premier ___ South Australia ___ 1873.
3. Uluru is listed ___ a World Heritage Area ___ both its natural and cultural values.
4. It is sacred ___ the Aboriginal people ___ the area.
5. ___ different times ___ the day, Uluru seems to change colour.
6. The sandstone is infused ___ minerals that reflect the red light ___ sunrise and sunset.

## EXERCISE 2

Fill in the missing word buy using the correct preposition to finish the sentence.

1. The first McDonald's restaurant was opened ___ Dick and Mac McDonald ___ the 15th ___ May 1940.
2. The best-selling products ___ their restaurants were hamburgers.
3. So, the McDonald brothers thought ___ a way to produce hamburgers more quickly.
4. This was introduced ___ 1948 and became known ___ the Speedee Service System.
5. The first franchised McDonald's restaurant was opened ___ 1953, and today you can find McDonald's restaurants ___ more than 100 countries.
6. The meats ___ the burgers vary ___ the culture ___ the country.
7. Franchisees and the future managers ___ McDonald's restaurants are trained ___ Hamburger University, which is located ___ Oak Brook, a suburb ___ Chicago.
8. McDonald's is also known ___ its sponsorship ___ various international sport events.

## EXERCISE 3

Fill in the missing word by using the correct preposition to finish the sentence.

1. Henry Ford was born ___ the 30th ___ July 1863.
2. He made his first car, the Quadricycle, ___ June 1896.
3. ___ 1903, he founded the Ford Motor Company.

4. Modern mass production ___ cars were developed ___ him ___ 1913.
5. Ford's Model T could then be assembled ___ just 93 minutes.
6. ___ 1927, 15 million Model T cars had been manufactured ___ the Ford Motor Company.
7. Henry Ford became one ___ the richest and best-known people ___ the world.

## EXERCISE 4

Fill in the missing word by using the correct preposition to finish the sentence.

1. George Washington was born ___ Virginia ___ 1732.
2. ___ the American Revolutionary War (___ 1775 and 1783) he was the Commander-in-Chief ___ the American Forces.
3. Washington played an important role ___ the founding ___ the United States.
4. He became the first President ___ the United States.
5. He was President ___ 1789 ___ 1797.
6. George Washington died ___ the age ___ 67, ___ the 14th ___ December 1799.
7. The capital ___ the United States and one federal state are named ___ George Washington.

# PREPOSITIONS

## EXERCISE 1 – ANSWERS

1. Uluru is located in central Australia.
2. The large sandstone rock formation is also known as Ayers Rock in honour of Sir Henry Ayers, who was a Premier of South Australia in 1873.
3. Uluru is listed as a World Heritage Area for both its natural and cultural values.
4. It is sacred to the Aboriginal people of the area.
5. At different times of the day, Uluru seems to change colour.
6. The sandstone is infused with minerals that reflect the red light of sunrise and sunset.

## EXERCISE 2 - ANSWERS

1. The first McDonald's restaurant was opened by Dick and Mac McDonald on the 15th of May 1940.
2. The best-selling products at their restaurants were hamburgers.
3. So, the McDonald brothers thought of a way to produce hamburgers more quickly.
4. This was introduced in 1948 and became known as the Speedee Service System.
5. The first franchised McDonald's restaurant was opened in 1953, and today you can find McDonald's restaurants in more than 100 countries.
6. The meats for the burgers vary with the culture of the country.
7. Franchisees and the future managers of McDonald's restaurants are trained at Hamburger University, which is located in Oak Brook, a suburb of Chicago.
8. McDonald's is also known for its sponsorship in various international sport events.

## EXERCISE 3 - ANSWERS

1. Henry Ford was born on the 30th of July 1863.
2. He made his first car, the Quadricycle, in June 1896.
3. In 1903, he founded the Ford Motor Company.
4. Modern mass production of cars were developed by him in 1913.
5. Ford's Model T could then be assembled in just 93 minutes.
6. By 1927, 15 million Model T cars had been manufactured in the Ford Motor Company.
7. Henry Ford became one of the richest and best-known people in the world.

## EXERCISE 4 - ANSWERS

1. George Washington was born **in** Virginia in 1732.
2. **In** the American Revolutionary War (**between** 1775 and 1783) he was the Commander-in-Chief **of** the American Forces.
3. Washington played an important role **in** the founding **of** the United States.
4. He became the first President **of** the United States.
5. He was President **from** 1789 **to** 1797.
6. George Washington died **at** the age **of** 67, **on** the 14th **of** December 1799.
7. The capital **of** the United States and one federal state are named **after** George Washington.

# MODAL VERBS

This worksheet is designed to improve your skill in the use of auxiliary verbs. The modal auxiliary verbs are ***can, could may, might, shall, should, will, would, must*** and ***ought to***. They are used before other verbs, in tags and in short answers.

*For example: "I must cook dinner for everyone tonight."*

## EXERCISE 1

In each sentence, identify and correct the mistakes by rewriting the sentence.

1. I don't can ride a bicycle.
2. I would like to can travel more.
3. He should to work harder.
4. I must work last Saturday and Sunday.
5. Could you telling me how to get to the bank?

## EXERCISE 2

Identify and select the correct modal auxiliary verb to compete the sentence.

1. They ___ be on holiday, but I'm not sure.
    - can
    - may
2. You ___ be right, but I'd still like to check.
    - can
    - could
3. ___ you turn it down a bit please?
    - Can
    - May
4. It's OK, you ___ go when you've finished.
    - may
    - might
5. Ask any questions now as you ___ not talk during the test.
    - may
    - could
6. You ___ smoke in the cinema
    - can't

- might not

7. From the way he speaks, he ___ be from London.
   - can
   - could
8. It's impossible, they ___ have finished it already!
   - can't
   - mustn't
9. The weather ___ be better tomorrow.
   - can
   - may
10. ___ you speak Japanese?
    - Can
    - May

# MODAL VERBS

## EXERCISE 1 - ANSWERS

1. I can't ride a bicycle.
2. I would like to travel more.
3. He should work harder.
4. I had to work last Saturday and Sunday.
5. Could you tell me how to get to the bank?

## EXERCISE 2 - ANSWERS

1. They may be on holiday.
2. You could be right, but I'd still like to check.
3. Can you turn it down a bit please?
4. It's OK, you may go when you've finished.
5. Ask any questions now as you may not talk during the test.
6. You can't smoke in the cinema.
7. From the way he speaks, he could be from London.
8. It's impossible, they can't have finished it already!
9. The weather may be better tomorrow.
10. Can you speak Japanese?

# Module 2:

# Alternative Strategies to Scripting Presentations

## Table of Contents

Module 2: Alternative Strategies to Scripting Presentations

| Module | 2 – Alternative Strategies to Scripting Presentations |
|---|---|
| Module Learning Outcomes | |
| By the end of this module students will be able to: | |
| 1. Recognize content needs of the audience. [CLO 2]<br>2. Organize content in a manner that is appropriate to the context and purpose. [CLO 2, 3]<br>3. Develop fluency in delivery. [CLO 4, 5]<br>4. Develop a sense of timing. [CLO 4]<br>5. Develop a familiarity and comfort with content that leads to the ability to improvise, rephrase, or restructure an explanation to meet audience response and needs. [CLO 2, 5]<br>6. Develop strategies for comprehending, clarifying, and responding to audience questions. [CLO 2, 3] | |

| Resources (Bank) | |
|---|---|
| Item | Description of how to be used |
| Structure Handout for Students | Distribute Structure Handout in Workshop A as students are working on Step 2, Storyboarding |
| Listener Checklist | Distribute to students for Activity 5 in Workshop B |
| Handling Questions Handout | Distribute to students at end of Workshop B |
| Sample Presentation Assignments | The sample presentation assignments may be used only if the facilitator has not been able to get a current assignment from local instructors. Content, purpose and expectations for presentations are highly variable so it is important to emphasize understanding the presentation purpose and audience rather than a general template. |

| Face to Face Workshop Plan | |
|---|---|
| Description of Workshop | Workshop A—Developing Presentation Content<br>Workshop B—Developing Presentation Skills<br><br>Workshops A and B may be used together or separately depending on the time available for students. They are meant to be complementary as it is possible but not probable to give a brilliant |

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| | performance without content just as it is possible but not probable to have brilliant content without performance skills.<br>These workshops are meant to help students develop the skill of preparing for presentations not to fully prepare a specific presentation. |
| Time for Completion | 1 hour for each section. Total: 2 hours |
| Materials | Post-Its<br>Markers or Pens<br>Index cards<br>Video cameras if possible (or use students' phones) |
| Workshop Preparation Instructions | Identify student presentation assignments. Are they formal or informal, team or individual, marked or unmarked, cumulative activity, public facing or class only. |
| Procedure | Workshop A: Developing Presentation Content |
| | *Facilitator Notes:*<br>Although students may worry more about the act of standing in front of a group of people and speaking, it is equally important to have something of value to say to that group of people. Developing confidence in the content that they will present also develops confidence in their ability to present. Remind students that if they are not using more than half of their conscious effort to remember the content, then they will have more attention to focus on how they are presenting that content. Start the workshop with three questions. Answering the why and the who questions helps students to answer questions about the level of technical language they can use, confident that their listeners will understand. The answer will also help students make decisions about the level of detail they need to include about context or background information. Answering the third question will help students articulate what response or action they expect from their audience. These questions should be written and displayed where everyone can see them.<br><br>1. Why are you presenting what you are presenting?<br>2. Who are you presenting to?<br>3. What do you hope to achieve with your presentation? |

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| | Step 1: (~3-5 minutes)<br>Everyone writes on an index card why they are presenting, to whom and what they hope to achieve.<br><br>*Facilitator Notes:*<br>Once students have individually written down the answers to those questions, ask a few students to share their audience and purpose. Follow that up by asking about the implications for language and content. Try to get students to articulate if the audience is familiar with the project or the lab, if so, then they will not need to include detailed background information. They will most likely only need a brief sentence or two to make sure their listeners know which project or lab they are going to speak about. Also, ask students to make the connection between their assumptions about the depth of the listeners' understanding—can they use the acronyms or technical terms and be confident that most of the listeners will be familiar with them? If they cannot, what does that imply about language choices they will need to make.<br><br>Step 2: Storyboarding (~20-25 minutes)<br>Following the initial discussion with a few students' examples, distribute the Structure Handout.<br>Explain the idea of storyboarding as a way of prototyping a presentation.<br>Instruct students to use their notes from Activity One. Students can use the Post-Its to record key words or phrases from their particular topic and organize them on their large chart paper.<br>Each time they organize their ideas, encourage students to clearly state what the links are between the Post-Its.<br><br>*Facilitator Notes:* Storyboarding and explaining links helps students articulate their reasons for organizing and linking ideas, allows them to rehearse possible transitions between ideas, pick out where the links are missing and to build an understanding that there are multiple ways to organize ideas. They should be able to see a coherent flow in the organization of their Post-Its.<br><br>Step 3: (~20-25 minutes) |

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| | Filling in the outline—what will you need to complete your thoughts/ideas? Make "Notes to self" about what you want to look for and/or create to complete your presentation outline.<br>*Facilitator Notes:*<br>This part of the process allows students to make notes about what specific information, details, visuals, they might need to use to make their point. They can start to use more Post-Its as "Notes to self" to remind them to find the information, create the visual, etc. At the end of this step, students should be able to give a "quick and dirty" version of their presentation to a partner who can help them evaluate if there is a logical flow of information that supports the purpose. |
| Procedure | Workshop B—Developing Presentation Skills |
| | *Facilitator Notes:*<br>It is important for students to understand the difference between written and oral styles. Oral presentations are dependent on listeners' short-term memories. As a result, oral presentations use shorter sentence structures, repetition and "sign posting" to help listeners remember and connect the information or points they are hearing. Because of this fundamental difference in style, it is best NOT to write out a presentation in complete sentences. Rather, students are usually better served if they develop their presentations from "talking it through". IF students want to write something out first to organize their thoughts that is not necessarily a problem. Writing it out can often help clarify thoughts. However, if students then use that as their "script" it often becomes a problem. Confidence in the content students have prepared will contribute to their ability to deliver that content. Standing in front of an audience demands that students pay attention to much more than the words they are reciting. Students must attend to where they are standing, how they are standing and moving, where they are looking, how fast they are speaking, how loudly or softly they are speaking, how their listeners are responding, how much time they have used—that's a lot to think about which is why they need to feel confident in their content. Then they can concentrate on delivery.<br><br>Activity 1: (~15 minutes) |

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| | Seated, ask students to “talk through” the outline they have prepared in Workshop A with a partner. Partners should check one another’s outlines for what was included or missed. Partners need only provide the total time from start to finish. Instruct students not to cut anyone off.<br><br>Activity 2: (~15 minutes)<br>Repeat Activity 1 but this time use a cut-off using the students’ presentation time limits.<br><br>Activity 3: (~20 minutes)<br>Instruct students to work individually and use the information learned from the two previous activities to revise their presentation plan. Encourage students to use the Post-its to avoid anchoring.<br><br>*Facilitator Notes:*<br>Encourage students to make notes that use their key words/phrases but not full sentences. Talk about “owning their difficult words” which means they need to recognize the words or phrases that are difficult and plan to slow down and take the time to say them with confidence.<br><br>Activity 4: (~10 minutes)<br>Stand and Deliver - This activity will get students on their feet and using their voices without having to think about content. Introduce the terms: Speed, intonation, volume and articulation<br><br>*Facilitator Notes:*<br>Speed refers to the how quickly or slowly students speak (how many words per minute). Related to speed is breathing. Many students will speed through their presentations and finish breathless because they have not taken a breath. The audience will not be listening but only waiting for the presenter to take a breath. Intonation refers to the rise and fall of pitch and volume in speaking. Volume refers to how loudly or softly someone speaks. Articulation refers to how clearly sounds are produced. Control of speed, intonation and volume all require support from the diaphragm to avoid straining the vocal cords. If there are any |

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| | students who have sung in choirs or have had voice training, they will know what this means.<br><br>Have students stand, place one hand on their upper chests and breathe ONLY moving the upper chest. Ask them to repeat a phrase slowly, quickly, loudly, softly, with exaggerated rises and falls in pitch. Students do NOT need to do this in unison.<br><br>Sample phrase: T'was brillig and the slithy toves did gyre and gimble in the grabe. (From The Jabberwock by Lewis Carroll)<br><br>Next have students place their hands on their belly and breathe from the belly and repeat the same sequence of speaking.<br><br>Ask students to compare the two experiences.<br><br>*Facilitator Notes:*<br>Students should notice a difference in their ability to control speed, volume, and intonation between the two breathing methods. Belly breaths or breathing from the diaphragm and supporting the breath should give students both more breath and more ability to control their voices.<br><br>Finally have students practice some tongue-twisters after "warming up" their facial muscles with exaggerated yawns and stretches. Emphasize the need to slow their speech down in order to take the time to clearly enunciate each sound.<br><br>*Facilitator Notes:*<br>Speed often compromises clear articulation. This is a good time to remind students to "own" the words they may find challenging to clearly pronounce. Everyone has them—not just multilingual speakers!<br><br>Activity 5: (~20 minutes)<br>Ask students to work with a partner and deliver their presentation, standing and imagining they have slides or any other aid (a model or prototype). Partners pay attention to pace, volume, intonation and posture, using the provided Listener Checklist to guide feedback. |

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| | *Facilitator Notes:*<br>Students will likely not be ready to think about answering questions at this point in the preparation of their presentations. Distribute the Handling Questions Student Handout for information only at the end of the workshop. |
| Supplemental Materials | There are two supplemental materials for this Module. Use the documents labelled as follows to get these exercises and information.<br>1. Unscripted Presentation Exercise – The purpose of this exercise is to build skills in delivering a successful speech or an oral presentation.<br>2. Checklist for Preparing and Delivering Presentations – The purpose of this handout is to provide students with some suggestions for developing their own personal checklists when they are preparing a presentation.<br>3. TED Talk links can be used as models of good presentations. Please note that a good presentation requires many hours of practice. Ted Talk presenters get 40 to 60 hours of one-to-one coaching before they are recorded.<br>https://www.ted.com/talks/danit_peleg_forget_shopping_soon_you_ll_download_your_new_clothes |

# Resources

# Possible Ways to Organize Content Related to Why You Are Presenting

In order to establish a clear and coherent line of thought, you need to consider what links your points together. Part of the answer to this question will come from the first question you were asked to answer—Why are you presenting what you are presenting. The following are only two of many possible reasons why you would be making a presentation and **possible** organizational structures. You need to make **decisions** about the order in which you wish to present your ideas, what the possible links are between the ideas, and what are possible transitions you can use to move from between each portion of your presentation.

- Inform—overview and organize the information in connected chunks
    - Big picture—so the audience has a frame and and outline
    - Specific details—to fill in the outline
    - Conclusion that returns to a better informed/complete big picture

- Recommend—an argument that justifies a recommendation with evidence
        - Recommendation (usually not trying to keep audience in suspense as the emphasis is on why this is the best decision
    - Background/context
    - Criteria for the decision
    - A series of arguments and rebuttals (anticipating any objections or counter arguments) that usually begins with strongest arguments/claims and works down to ones of lesser importance. Time considerations often determine how many arguments a presenter uses
    - Conclusion restates recommendation now linked with criteria, arguments and how it best meets or answers the question

# Listener Checklist

Content “makes sense”:

- Purpose is clear from the beginning
- Presentation follows a logical path evident to a listener
- Repetition and “sign posting” is used to reinforce key points and the structure of the presentation

Delivery makes the content accessible:

- Volume is sufficient to follow
- Articulation is clear and intelligible (not the same as “no accent”—we all have accents)
- Speed is neither too fast nor too slow
- Intonation is appropriately varied (not too “flat”, not too “sing-songy”)
- Posture and gestures do not distract a listener
- Speaker includes audience in his/her gaze (eyes not glued to any one place e.g.notecards, screen, ceiling or the back wall)

# Tips for Handling Questions

- Be prepared to answer the questions asked by the audience at the end of your presentation (Anticipate questions as you prepare your presentation. What might someone want to know?)
- Be calm, wear a smile on your face and breathe before you answer a question
- Show confidence and reply slowly and clearly
- Keep eye contact
- Project your voice so that everyone can hear you
- Say “I don’t know” or “I am not sure” or “That’s a really interesting question that I need to consider, thank you” if you really don’t know
- Ask the person to repeat the question slower and clearer in case you didn’t understand the question (This also gives you time to think.)
- Repeat the question in your own words if needed to make sure that this is what you were asked (This is always a good idea as you are then more certain that you are answering the question the person has asked.)
- Try to be short and to the point so that there is enough time for everyone to ask their questions
- Thank the people for their questions at the end

# Unscripted Presentation Exercise

*Exercise for students to do on their own.*

Overview:

This exercise is designed to build skills in delivering a successful speech or an oral presentation.

Instructions:

1. Pick a topic that you know a lot about it and you are confident to talk about
2. Choose a group of people you want to share your knowledge with
3. Without spending a lot of time thinking about what to say, get ready to talk about the main things that are important for the audience to understand your topic
4. Taking into consideration the main elements in delivering a successful oral presentation (please see the attached list) set your video camera/phone and record yourself while you talk about your topic
5. Having in mind that you only have 5 minutes, try to start and finish your mini presentation within that time
6. When you are done, watch the video of yourself and make notes of how you projected your voice, eye contact with your audience, hand gestures and facial expressions, tone of your voice, confidence in your speech, etc.
7. Make a list of the good things and the bad things of your presentation and write an assessment report of one page
8. Redo the presentation by recording yourself again and see if you made any improvements

# Sample Presentation Assignments

Assignment: Final Presentation

This oral presentation will provide an overview of your completed project. The audience will be faculty members, colleagues and clients. Generally, oral presentations cannot cover the same amount of detail as written documents; therefore, your presentation must be a distillation of your report, organized around its most significant information (key messages). It is recommended that, early in your presentation, you identify the problem you were addressing and the solution you chose; it is also recommended that you follow the presentation sequence indicated in these instructions. Each team, however, will need to decide itself the best way to organize its presentation.

> Industry Analogy: This is similar to a Final Client Meeting which is common in industry. At the conclusion of a design contract you will meet one final time with your client. You are attempting to persuade your client that your final design meets their needs and is ready for implementation. Rarely directly stated, but important, is communicating what value you have added to your client's situation. I.E. Have you been worth the cost to hire you?

Final Presentation Required content:

- Presentation should include:
  - Opening strategy
  - Main statement
  - Keyword Summary of Sub-statements
  - Sub-statements with individual explanations and evidence
  - Conclusion
  - Take-away statement
  - Question and answer period
- Visual support. Presentation slides are commonly used. You may also bring handouts, prototypes, or anything that is reasonable and will help to persuade your client to accept your final design.

Final Presentation Format:

- Presentations shall be a maximum of 21 minutes long. Teams that are significantly under 21 minutes will have the lack of content reflected in their grade. Teams will receive a one-minute warning at 20 minutes. At 21 minutes, they will be stopped; if they are not finished, the lack of conclusion will be reflected in their grade.
- The total final presentation time, the presentation plus the mandatory question answer period, will not exceed 25 minutes.
- EVERY team member shall present for at least three (consecutive) minutes, but teams may have members speak twice, providing these members speak the second time for approximately three additional (consecutive) minutes.
- After the title slide, a slide should be presented with the main idea of the presentation and its components. Each team member's full name shall be listed next to the section of the presentation for which that team member is responsible.

- At the end of the presentation there is a mandatory question and answer period. The ability of the team to respond to questions will be reflected in their grade.
- Dress code: business casual. Failure to dress business casual will be reflected in their grade.
- The presentation shall be carefully thought-out, organized and practiced beforehand, but neither read nor memorized, though you may glance briefly at notes or the podium monitor. Your presentation should have the feeling of a conversation with the audience, rather than a lecture or a speech. You are not permitted to read slides from the screen. If you must point briefly to the screen, your body must remain turned ¾ toward the audience and you must return to the audience as quickly as possible.

# Module 3:

# Reading Through Concepts

## Table of Contents

Module 3: Reading Through Concepts

| Module | 3 – Reading Through Concepts |
|---|---|
| Module Learning Outcomes | |
| By the end of this module students will be able to: | |
| 1. Recognize the need to read a text multiple times to maximize comprehension. [CLO 1, 5, 6]<br>2. Read in chunks rather than word by word. [CLO 1, 5]<br>3. Connect content with engineering concepts. [CLO 1, 2]<br>4. Articulate their understanding of read information in their own words. [CLO 5, 6]<br>5. Paraphrase intermediate level text. [CLO 5, 6] | |

| Resources (Bank) | |
|---|---|
| Item | Description of how to be used |
| Inspection Request<br>(Green Consultants Report) | Distributed to students as source reading material |
| What It Means to Know a Word | May be used to develop facilitator understanding of vocabulary learning, may be distributed to students.<br><br>(Table adapted from Nations, Paul. 2013. *Learning Vocabulary in Another Language,* Cambridge, UK: Cambridge University Press. p. 44-86.) |
| Case Study 1 | See supplemental instructions |
| Case Study 2 | See supplemental instructions |
| Professional Vocabulary Exercises | See workshop plan |
| Professional Vocabulary Answers | See workshop plan |

| Face to Face Workshop Plan | |
|---|---|
| Description of Workshop | This workshop targets student understanding and use of discipline-specific vocabulary and phrases. Students work individually first and then in pairs. Emphasis is placed on reading quickly and multiple times for specific information relevant to lexicogrammatical chunks. While this activity targets reading practices, it serves well as a strategy to review and prepare for exams. |
| Time for Completion | 60-90 minutes |
| Materials | Index cards<br>Flip chart paper<br>Markers<br>Copies of a blank grid/table to be filled in<br>Copies of the text, one for each student |
| Workshop Preparation Instructions | This activity uses as an example a "case study," (Green Consultants Inspection Report), however, a similar activity could be built around any engineering text such as a Request for Proposals (RFP), Client statement, an introductory chapter in a design text, or an engineering handbook. We encourage instructors to work with the curriculum to identify the texts or documentation being used in student coursework in order to create the most relevant materials for an activity such as this. |
| Procedure | *Facilitator Background Information on Reading and Vocabulary:* Multilingual students often read challenging or unfamiliar texts one word at a time, determined to understand each and every word. However, we don't read word by word, but rather, in chunks or phrases; we take in phrases and build meanings from those. For example, idioms such as "read between the lines" or collocations such as "in the meantime," will not make any meaningful sense if read word-by-word. The meaning is in the single chunk or phrase.<br><br>This exercise is designed to draw attention to this reading practice and to force students to practice reading in chunks through the use of two strategies. The first is to draw attention to reading practices. By asking students to think about and describe how they read in their first or dominant language, they |

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| | can start to notice that their eyes do not pick out each individual word or character, but instead focus on phrases or chunks of meaning. The second strategy is to challenge students to skim through text, looking for meaningful chunks. It is easier to do this when students have identified a small number of significant words or ideas and purposefully read/skim with those in mind. It is also useful to enforce a time limit, putting pressure on students to search for those chunks in order to meet the time limit. The purpose is to break old reading habits and create new ones.<br>In determining which words and their associated concepts are important, it is best to consult with the engineering course instructors. It is important to confirm with an engineering faculty member the vocabulary being used as engineering disciplines use the same words with slightly different meanings. This technique is useful for reading textbooks, going through notes and slides or as an exam or term test preparation strategy.<br><br>How students approach new or unfamiliar vocabulary is related to their ability to read for meaning. Many students equate knowing the definitions of words with understanding. Nation, a vocabulary scholar, developed a framework for what it means to know a word. Introducing students to this framework can help them understand where their efforts may have the best return.<br><br>It could be useful to introduce students to Paul Nation's concept of what it means to "know" a word. For many students, memorizing the definition of a word and its part of speech was sufficient for taking a vocabulary test. However, it is necessary but not sufficient for using the words to learn a content area or a discipline. This is also an opportunity to call students' attention to the difference between everyday words and discipline-specific vocabulary. Students often assume that they know the meaning of words when they actually only know the everyday meaning and are unaware of the discipline-specific meaning. Students can begin to understand this by reminding them of the meaning of "function" in their math classes and the everyday meaning of function contrasted with the way that a mechanical engineer probably uses "function." Students would also understand this with words like "load," "stress," "moment," etc. |

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| | This is an easy way to introduce students to the idea of "associated concepts." Many engineering design courses also use function, but in a variety of ways. This is another reason to check with faculty on just exactly how the terminology is defined and used.<br><br>Workshop Procedure<br><br>**Step 1:** (~10 minutes)<br>Together, with students, brainstorm concept vocabulary from their courses. Have students write 6 concepts on individual index cards on their own. Ask students to share those concepts with two other people to produce a list of up to 18 concepts.<br><br>**Step 2:** (~10 minutes)<br>Distribute the Concept Vocabulary Grid and have each student fill in the second column (Forms) and the third column (Phrases) of the provided table.<br><br>Students take the word and produce other forms e.g. design, designer; require, requirement; function (noun and verb), functional, etc. and phrases or chunks associated with the word. For example, "engineering design," "develop requirements," "conceptual design," "detailed design," "agile design," algorithmic design," "risk management," "identify risk," "manage risk," "mitigate risk," "risk mitigation," etc.<br><br>*Facilitator Notes:*<br>Before starting Step 3, get students to think about and describe how they read in their dominant language. Draw attention to the habit of reading chunks or phrases rather than single words. Ask them to consider why they might do this.<br><br>**Step 3:** (~20 minutes)<br>Assign each pair of students a different concept. Give students 5 minutes to skim through the reading (Green Consultants Inspection Report) and identify everything connected with that concept, note it on the table. Repeat this with an additional 3-4 concepts. |

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| | **Step 4:** (~5 minutes)<br>Have students identify the collocation or phrase in which the concept word appears, note any difference in form and position in the sentence, use of articles, prepositions, etc.<br><br>*Facilitator Notes:* This is a good time to address lexicogrammatical issues, pointing out to students the different forms of the words and the repeating patterns they are used in.<br><br>**Step 5:** (~20 minutes)<br>Individually, students create a summary of the relationship of the concept or concepts to the case. (e.g. Safety is an engineering concern in this case because …)<br><br>*Facilitator Notes*: Depending on the concepts, students may connect two or more concepts in their summaries of relationships. This part of the exercise forces students to use the chunks of language in sentences that are their own expressions of the meaning rather than those memorized or copied from books.<br><br>If time permits, use Step 6.<br><br>**Step 6:** (~10 minutes)<br>Students exchange summaries and generate two questions to ask about the concept in the context of the case/scenario. |
| **Supplemental Materials** | Case Study 1 and 2 are available for you to use to repeat this workshop's module plan multiple times. |
| **Assessment** | The completed Concept Vocabulary Grid exercise can be used to assess student knowledge of the definitions, forms and associated conceptual phrases of language. |


# Resources

# Green Consultants Inspection Report

Green Consultants is an Engineering firm that inspects buildings and decides whether they are structurally sound. The company has been contracted to inspect Rosewood Mall and produce a detailed report that highlights the conditions of the mall building and any major problems resulting from those conditions. The report will recommend if a more in-depth inspection is needed or not.

Rosewood Mall has provided the building plans and related building documents. The mall has three levels and contains a food court, hotel, gym, theatre, offices, a public library, and many retail stores. The roof of the building is used for parking, and holds a two level parking garage. The mall was built June 10, 1977 and has had several renovations over the years. Most of the building's architecture is distinctive of the period it was built in. A review of real estate records reveals that the mall has changed ownership several times over the last ten years. A list of several records of maintenance projects is included with the documentation, but many appear not to have been finished due to budget problems.

A preliminary inspection on August 23rd revealed a serious water leakage problem. There were buckets scattered around all levels of the mall to catch water leaking. Many of the businesses were closed and the ones that were open had put tarps out to protect their goods. Near the water damaged areas, mold and rust on the walls had been noted. This could contribute to air borne pollutants and cause breathing issues for staff and customers.

The owner of a restaurant called Blue's Bistro, Jennifer Blue, has reported that the building generally had many problems that had not been attended to by the Management. She mentioned the leaking roof, frequently backed up drains in the bathrooms, and window leaks that rotted the window sills and created moisture problems. Her restaurant had tried to work with management on getting these items repaired, however, none of the complaints have been

addressed. She said she was not warned about the conditions before she signed the lease, and that at times customers had to use umbrellas to stand at the take-out counter. She also said she plans to close the location as soon as the lease ends.

The cashier of Donkey Burger, John Yellow, has worked at Donkey Burger for 5 years. He reported that about a month ago, a chunk of concrete about the size of a plate fell through the restaurant ceiling and landed in the garbage bins. The mall promised that an inspector would come in two weeks after the incident, but the inspector never came. The mall management did not respond any further to the incident. John said that residents of the town had been complaining about the mall for some time, but that the management was always unresponsive.

In the public library in the mall many shelves had been covered completely with tarps. The librarian reported that the library was worried about the condition of the books.

Additional notes had been made that several fire alarms were not functional, along with the sprinkler system not being up to building code. There were missing fire extinguishers, and an emergency exit was blocked by some piled construction material.

A maintenance room on the top floor was locked blocking inspection of the roof support beams. Calls to the mall management company refused a request to unlock the maintenance room claiming it was unnecessary. They stated that the mall had passed an inspection conducted in May by another engineering firm.

Visual inspection of the rooftop parking lot showed an expansion joint in the concrete floor that appeared to be loose. There was water damage, indicating that water often ran through this crack and into the mall. There was also residue buildup that appeared to be from dissolved de-icing salt during the winter.

# What It Means to Know a Word

Facilitators can use this sheet as a guide to develop their understanding of vocabulary learning but may also be distributed to students.

| | | | |
|---|---|---|---|
| Form | Spoken | Recognition | What sounds are heard in the word? What does the whole word sound like? |
| | | Production | How is the word pronounced? |
| | Written | Recognition | What shape does the word have? |
| | | Production | How is the word spelled or formed? |
| | Word parts | Recognition | What suffixes, markers, prefixes, roots etc. are recognizable |
| | | Production | What word parts can be used to express different meanings of the word? |
| Meaning | Form and Meaning | Recognition | What meaning does this word form signal, e.g. d/ed signals past tense, s/es signals plural |
| | | Production | What word form can be used to express a meaning? |
| | Concept and References | Recognition | What is included in the concept? |
| | | Production | What items does the word make users think of? |
| | Associations | Recognition | What other words does the word make users think of? |
| | | Production | What other words could be used instead of this one? |
| Use | Grammatical Functions | Recognition | In what patterns does the word occur? |
| | | Production | In what patterns must the word be used? |
| | Collocations | Recognition | What words or types of words occur with this word? |
| | | Production | What words or types of words must be used with this one |
| | Constraints on use (register, frequency | Recognition | Where, when, and how often would we expect to meet this word? |
| | | Production | Where, when, and how often can we use this word? Where and when can we NOT use this word? |
| Adapted from Nation, I.S.P. (2013) | | | |

# CASE STUDY 1

## Appendix A: Case Study – Quantifying Drift Invertebrates in River and Estuary Systems

This case study is based on an Innocentive Design Challenge -- Challenge ID: 9933647

Habitat restoration, improvement, and creation in rivers, streams, and estuaries are key elements for the recovery of salmon, trout, and other critical fish species in the North America. Millions of dollars are spent annually on activities such as manipulating flow regimes, adding structural elements such as wood or rock, reconnecting rivers with their floodplains, and restoring wetlands. A critical aspect in evaluating the effectiveness of these habitat manipulations is understanding how they influence the food resources available to critical fish species targeted for recovery and protection. Yet despite its importance, quantification of food resources has proven difficult.

The Bureau of Reclamation, in collaboration with other federal agencies (NOAA-National Marine Fisheries Service, U.S. Geological Survey, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers) is seeking a way to economically detect, count, and identify zooplankton and drift invertebrates in river and estuary systems. Problems identified that prevent the simple transfer of oceanographic techniques to rivers and streams are higher water velocities, turbidity, higher surface/depth ratio, and costs (time and money).

### Background

Habitat restoration is considered a key element of fish recovery, and the quality of habitat and food resources available to fish often needs to be evaluated before and after restoration actions. Habitats are often designed to provide increased foraging and rearing habitats at appropriate spatial and temporal scales. Accurate food counts, such as zooplankton and drift invertebrates, are instrumental in fish habitat evaluation and restoration in our rivers and streams. Although technology has been developed for automated detection and identification of zooplankton and drift invertebrates in oceanographic settings, they have not been developed for the unique environmental conditions in rivers and estuaries. High flow rates and turbidity cause problems with automated visual systems used today. The main obstacle in estuaries is turbidity while the main obstacle in river systems is flow velocity. In addition, the horizontal nature of rivers invokes problems not encountered in deep ocean waters (e.g., sunlight effects at the surface of water and the mixing of food sources throughout the water column in rivers due to turbulence as opposed to more stratified food webs in ocean waters). We would like to identify devices/methods that can detect, count, and identify zooplankton and drift invertebrates in an economical way in rivers and estuary systems. Measurements of this type are currently time-intensive and expensive, especially for juvenile salmon in a highly dynamic and complex system such as the Sacramento-San Joaquin Delta (California).

Traditional sampling methods involve the use of towed nets (for slow-moving water) or stationary nets (for fast-moving water) that collect organisms from the water column. Both the field collection of samples and the subsequent sorting and identification of collected invertebrates are time-intensive and expensive, and agencies lacking technical expertise must often rely on outside experts to process samples. Because of the high costs associated with these traditional methods, the spatial and temporal extent of sampling is often inadequate to characterize food availability at scales that are biologically relevant.

In the marine science community, significant advances have been made in plankton monitoring through the use of devices that capture high-resolution images of particles (>100 µm) and invertebrates. These devices produce a catalog of time-stamped images that can be processed to various taxonomic levels with image analysis software, allowing the abundance of organisms in a known volume of water to be quantified.

Analogous technologies for freshwater environments do not exist, but could be developed to continuously monitor the prey abundances and dynamics in key locations for migrating and rearing fishes. Pilot systems have been tested in the freshwater environment, but there have been problems with image capture, leading to poor image quality (blurred) and poor identification (low probability of differentiating target organisms from drift algae, detritus and other materials).

The difficulties during the pilot were likely caused by

- High water velocity
- Low water clarity (turbidity)
- Small target size (1-20 mm)

Another big difference between the marine ocean environment and the freshwater and estuarine environment is that ocean monitoring tends to be vertical (in the water column) and items on the surface are not a large percentage of the whole so they can be ignored. In a stream, items on the surface are a high percentage of the overall water column, and sunlight at the surface affects the imaging equipment considerably. It is difficult to get accurate measurements if targeted items on the surface are ignored.

### The Challenge

A device/method is sought that could be deployed to collect data continuously (over hours, preferably days) to capture tidal and day/night variation in prey abundance in rivers and streams. By simultaneously deploying multiple units, scientists could measure important spatial and temporal variation such as depth stratification and source/sink food web dynamics.

The device/method must detect, count, and identify drift invertebrates automatically in a size range of 1 to 20 mm in a cost effective method.

Things to Avoid

1. Equipment made today for oceanographic study – although a good place to start, we are familiar with what exists and our Challenge is to go beyond what exists for our particular problems in freshwater systems.
2. A simple list of equipment without explanation of how they work in concert will not suffice as a description of the system.

Any proposed solution should meet the following specifications:

1. The device/method should be able to:
    a. Detect representative samples of drift invertebrates (1-20 mm). This should include those targeted items floating on the surface to a high degree as well as those in the water column. Representative samples of drift invertebrates in California and other localities are available at the California Department of Fish and Wildlife's Aquatic Bioassessment Laboratory digital reference collections. (http://www.dfg.ca.gov/abl/Lab/referencecollection.asp).
    b. Count the targeted items in samples (sort out debris from targeted zooplankton and invertebrates to minimize false positives)
    c. Identify the number and taxonomic family (or groups of morphologically similar families) of specimens detected (NOTE: exact identification of each species is not as critical as identification of the total amount of food available to fish).
2. This must be accomplished under the following conditions:
    a. Velocities between 0 and 1.5 meters per second.
    b. Turbidity between 0 and 100 NTUs.
    c. Function in shallow water (less than 1 m) and deep water (up to 20 meters).
    d. Function over a long period of continuous deployment (greater than24 hours but preferably many days).
    e. Operate without natural light (at night or dark spaces, provides own light source as needed).
    f. Operate under bright light conditions near the surface in the daytime.
3. If the device is submersible in water, it should be durable enough to be deployable when towed off a boat.
4. If optical, it should be able to capture images without a blur.
5. The device/method should be able to accurately count and identify available drift invertebrates (food) with 95% accuracy.
6. The device/method should be able to measure the size of each target item within 0.5 mm or 10% of item size.

7. The total cost of the equipment should be targeted to not exceed $100K when produced in larger quantities.
8. The proposed system should offer the Seeker client “freedom to practice”. There should be no third party patent art preventing the use of specific equipment and materials for their commercial application.

Nice to have

Include ability to measure flow entering device, such that number of food particles per volume of water is estimable.

Some examples of drift invertebrates are shown below:

These photos show some food sources available to fish in streams: a) mayfly, Ephemeroptera, family Baetidae, b) stonefly, Plecoptera, family Perlidae, and c) caddisfly, Trichoptera family Hydropsychidae.

*Photos taken from http://www.dfg.ca.gov/abl/Lab/california_referencecollection.asp*

# CASE STUDY 2

## Autonomous Vehicles

Autonomous vehicles, also known as driverless vehicles, are capable of travelling between destinations without human operators. Various predictions forecast that by 2030 up to 15 percent of new cars in North America could be fully autonomous. [1]


*Figure 1: Google self-driving car [2]*

Autonomous vehicles are equipped with various sensors that work in conjunction with each other to control a driverless car by detecting its surroundings:

- Radar sensors monitor the position of vehicles nearby.
- Video cameras interpret traffic lights and road signs, and detect pedestrians and other obstacles.
- LIDAR, which stands for Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure distances and is used to detect the edges of roads and lane markings.

Estimates of the costs for the various components required to retrofit a vehicle to become autonomous could add up to $10,000 to the base cost of the vehicle. However, in early 2016, Honda announced that its new Civic LX Sedan could be purchased with full autonomous driving capability for only $20,440 (U.S. dollars) [3]. This is only $1,423 (U.S. dollars) more than the average price for a new Civic LX Sedan without autonomous driving capability. [4]

A 2016 research report by Rand Corporation found autonomous vehicles offer the possibility of significant benefits: fewer vehicle crashes; more efficient traffic flow; less traffic congestion; lower fuel consumption; less pollution; and, increased mobility for the young, the elderly, and the disabled. [5] The same research report described drawbacks, including the potential loss of occupations and economies based on public transit, vehicle repair, and insurance.

On January 1, 2016, the Ontario provincial government began allowing the testing of autonomous vehicles on Ontario's roads. The testing period will last 10 years. Ontario is the first jurisdiction in Canada to allow autonomous vehicles on its roads. [6] In the United States, California, Michigan and Nevada have

passed detailed legislation that allows the operation of autonomous vehicles, but currently allow them on public roads for testing purposes only. [7]

## References


[1] City of Toronto (2016, May). "Preparing the City of Toronto for Autonomous Vehicles". Decision of the Public Works and Infrastructure Committee. [Online] Available: http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2016.PW13.14

[2] A. Robinson, *Google is my co-pilot – what can go wrong.* 2012 [Online]. Available: http://media.caranddriver.com/images/media/51/google-is-my-co-pilot-what-can-go-wrong-inline-1-photo-469797-s-original.jpg

[3] Zillman, Claire (March, 2016). "You Can Buy This Self-Driving Car for $20,000" *Fortune.* [Online] Available: http://fortune.com/2016/03/14/self-driving-car-honda/

[4] "2016 Honda Civic Sedan Pricing". [Online] Available: http://www.edmunds.com/honda/civic/2016/sedan/

[5] Anderson, James M., et al. (2016). Autonomous Vehicles – A Guide for Policy Makers. *RAND Corporation*. [Online] Available: http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR443-2/RAND_RR443-2.pdf

[6] Ontario Ministry of Transportation (2016). "Automated Vehicles - Frequently Asked Questions". [Online] Available: http://www.mto.gov.on.ca/english/vehicles/automated-vehicles-faq.shtml#what-levels-of-automation

[7] Reynolds, Michael W., and Jason Orr (2016, July). "A State-By-State Guide To Driverless Car Regulations". *Law360.* [Online] Available: http://www.law360.com/articles/819698/a-state-by-state-guide-to-driverless-car-regulations

# PROFESSIONAL VOCABULARY

The worksheet is designed to build your skills in exploring your knowledge on professional vocabulary.

## EXERCISE

Look at the word on the left. When you read your textbook, engineering reference material or engineering reports look for as many instances of the words on the left as you can find. Note different ***forms*** of the word. At the same time, note the ***phrases*** that the word appears in. A phrase may include 1-3 words before the word and 1-3 words after the word. Paying attention to both the form and the phrases will help you learn how the word and its different forms are used in engineering writing. The first word, inspect, is provided as an example. Try to find as many forms of the word given to you on the left column and as many chunks of that word used in professional writing.

Word: A word is a single unit of language that can be represented in writing or speech.

Form: The structure of a word, phrase, sentence, or discourse.

Phrase: A group of two or more words functioning as a meaningful unit within a sentence or clause.

| WORDS | FORMS | PHRASES |
|---|---|---|
| inspect | inspecting, inspected, inspection, inspections, inspector, inspectors | safety inspector, building inspection, inspection report, perform an inspection |
| maintain | | |
| function | | |
| require | | |
| constrain | | |
| extinguish | | |
| manage | | |
| own | | |
| response | | |

# PROFESSIONAL VOCABULARY

## ANSWERS

Use the provided sheet to compare against your answers. Are there similarities or differences? Discuss any differences with a peer or instructor.

| WORDS | FORMS | PHRASES |
|---|---|---|
| inspect | inspecting, inspected, inspection, inspections, inspector, inspectors | safety inspector, building inspection, inspection report, perform an inspection |
| maintain | maintaining, maintenance, maintained | maintenance manual, design for maintenance, perform regular maintenance, easily maintained, poorly maintained |
| function | functions, functional, functioning, functionalities, | functional basis, primary function, secondary function, unintended function, determine the primary function of the design, mathematical functions |
| require | requires, required, requiring, requirement, requirements | a requirements model, design requirements, project requirements, determine the project requirements, stakeholder impact on project requirements |
| constrain | constrains, constrained, constraining, constraint | determine the budget constraints, client-imposed constraints, regulatory constraints, |
| extinguish | extinguishes, extinguished, extinguisher, extinguishing | fire extinguisher, ensure all flames are fully extinguished before, |
| manage | manager, management, managed, managing, manages | management requires regular updates, a well-managed team, manager input is critical, risk-management, risk-management analysis |

| | | |
|---|---|---|
| own | owner, owned, owning, owns | owner-operator, community-owned resources, publicly-owned utilities |
| respond | responder, response, responds, responded, responding, | client response, respond to the request for proposals, respond to client requests, request a response from the stakeholders, meet stakeholder requests |

# Module 4:

# Making Arguments

# Table of Contents

Module 4: Making Arguments

| Module | 4 – Making Arguments |
|---|---|
| Module Learning Outcomes | |
| By the end of this module students will be able to: | |
| 1. Create claims in an engineering context. [CLO 3, 5]<br>2. Structure an argumentative paragraph using precise language. [CLO 2, 3, 5]<br>3. Justify a claim with the most relevant evidence. [CLO 5]<br>4. Make judgements about the quality of evidence and justification. [CLO 3, 4, 5]<br>5. Evaluate a source using the CRAAP test. [CLO 6] | |

| Resources (Bank) | |
|---|---|
| Item | Description of how to be used |
| Exercise 1 – Correct Order of Sentences | Used to draw attention to logical order of sentences at the beginning of the workshop |
| Exercise 2 – Ordering Sentences into Paragraphs | Used to review logical organization of sentences into a meaningful paragraph |
| Research Article (Rohrer, Dedrick, Burgess, 2014) | Used to help students identify claim(s) and evidence and how they can be placed in a piece of writing |
| Supplemental Exercise – Putting Words in the Correct Order | The purpose of this exercise is to draw student attention to sentence structure. This is particularly useful if students are having difficulty constructing a syntactically correct sentence. |

| Face to Face Workshop Plan | |
|---|---|
| Description of Workshop | This workshop provides students an opportunity to practice recognizing the elements of an argument, which is one of the most common genres used in engineering communication. It also provides them with supervised practice in organizing sentences within a paragraph in order to produce a logical argument, inductively or deductively. |

| | |
|---|---|
| Time for Completion | 90 minutes |
| Materials | Exercise Sheet 1 - Correct Order of Sentences – one per student<br>Exercise Sheet 2 - Ordering Sentences into Paragraphs - one per student<br>Exercise 1 & 2 answer sheets<br>Copies of research article - one per student<br>Coloured pens or highlighters |
| Workshop Preparation Instructions | The facilitator should read the article carefully, identifying the various claims, qualifiers, evidence, and justifications used throughout. The facilitator should also identify specific paragraphs to be used by pairs of students where the argument structure is particularly salient. |
| Procedure | **Step 1: Constructing a simple argument** (~5 minutes)<br><br>*Facilitator Notes:* The following exercise focuses on sentence order to help students identify a simple argument structure—background, claim, evidence, justification or linking the evidence with the claim. The exercise also acts as a self-diagnostic in that it will show students where they may experience difficulty or have control over paragraph structure.<br><br>• Give students the Exercise Sheet 1: Correct Order of Sentences and allow them five minutes to complete the exercise.<br>• Give or display answer key and answer questions about alternative constructions, if there are any.<br><br>**Step 2: Recognizing a claim** (~15 minutes)<br><br>*Facilitator Notes:* Students are now primed to notice how sentences work together to construct a concise argument. Concise sentences are used in abstracts to state the article's claim(s) and the most important evidence.<br><br>• Give students a copy of the Rohrer, Dedrick, Burgess (2014) article and instruct them to read the abstract (and only the abstract). |

- Students should underline what they believe to be the main claim of the article as expressed in the abstract in one colour.
- Students should underline main pieces of evidence found in the abstract in a different colour.

The following is the abstract with the claims and evidence highlighted.

> Most mathematics assignments consist of a group of problems requiring the same strategy. For example, a lesson on the quadratic formula is typically followed by a block of problems requiring students to use that formula, which means that students know the appropriate strategy before they read each problem. In an alternative approach, different kinds of problems appear in an interleaved order, which requires students to choose the strategy on the basis of the problem itself. In the classroom-based experiment reported here, grade 7 students (n = 140) received blocked or interleaved practice over a nine-week period, followed two weeks later by an unannounced test. The mean test scores were greater for material learned by interleaved practice rather than by blocked practice (72 % vs. 38 %, d = 1.05). This interleaving effect was observed even though the different kinds of problems were superficially dissimilar from each other, whereas previous interleaved mathematics studies had required students to learn nearly identical kinds of problems. We conclude that interleaving improves mathematics learning not only by improving discrimination between different kinds of problems, but also by strengthening the association between each kind of problem and its corresponding strategy.

(Rohrer, D., Dedrick, D. F. & Burgess, K., 2014. "The benefit of interleaved mathematics practice is not limited to superficially similar kinds of problems". Psychon Bull Rev 21:1323–1330 DOI 10.3758/s13423-014-0588-3)

**Step 3: Exercise 2 Constructing a Paragraph** (~10-15 minutes)

| | |
|---|---|
| | *Facilitator Notes:* The following is an exercise meant to get the students thinking about how a paragraph is organized to make an argument. It uses something easy to understand but still demands that there needs to be logical connections. The facilitator can point out to the students that the same principles of organization apply to the paragraphs they are about to read in the article in the next step.<br><br>Distribute Exercise Sheet 2 - Ordering Sentences into Paragraphs. Instruct students to read the sentences and then re-organize them into logical, linked paragraphs. They can just number the sentences rather than re-write them, although students may find it easier to see the logical connections if they write them out.<br><br>**Step 4: Reading to Identify Parts of an Argument** ~15 minutes)<br><br>*Facilitator Notes:* This exercise is meant to be short. The facilitator should have already identified the paragraphs he or she has chosen to assign to students. Paragraphs in the first two sections or in the discussion section of the article may be most useful. The students are only to identify the parts of the paragraphs they are assigned. Most of the paragraphs in this article are relatively short, so should not take that long to read. Students need not understand every word in the paragraph to identify the claim, evidence, etc. The instructor can point out to the students that authors often use words like "The evidence suggests that…. Or "We claim that…."<br><br>Divide the group into pairs. Assign each pair one paragraph in the article to identify the claims, the evidence, any qualifiers, and the justification. Do not use more than 5 minutes for reading. After the pairs have finished, ask them to share their claims, evidence, justifications, etc. Call attention, in particular, to the use of words such as "because, as a result, even though, etc." as well as order of sentences to show relationships between the ideas.<br><br>**Step 5: CRAAP Test** (~15 minutes)<br><br>*Facilitator Notes:* This step is meant to introduce students to one commonly accepted method of evaluating sources used in an argument. Students are asked to choose one of the references |

| | |
|---|---|
| | from the article and do the CRAAP test on it. They are expected to Google authors, publishers, etc. in order to make their best judgments about the quality and appropriateness of the source they choose.<br><br>• Currency—is the article current? Currency is usually thought of as in the past five years, however, some seminal pieces of research or books written 15 or more years ago may still be current. Standards and regulations change more slowly, so these topics can have a longer period of currency. Something in fields like biomed or artificial intelligence etc., is probably measured in much shorter time periods.<br>• Relevance—is the content of the source relevant to the question or subject being considered?<br>• Authority—does the author (or authors) have authority in the subject? Although Steve Jobs may have been an amazing designer, he probably had little authority when it came to the best way to raise puppies.<br>• Accuracy—how accurate do you judge the information to be? Information supplied by most government sites is usually more accurate than information supplied by a marketing site. Information provided by a standards organization such as Underwriters Laboratory is usually more accurate than information provided by a blogger.<br>• Purpose—For what purpose was the information produced? If the article or information was produced to persuade readers or to convey information, the content may be different. If the purpose is aligned with the person using the information, it is probably more reliable or useful.<br><br>**Step 6: Writing an Argumentative Paragraph** (~20 minutes)<br><br>*Facilitator Notes:* Students should have some idea of what interleaving vs blocked practice with mathematical problems is all about. (Note: Interleaving refers to switching from one subject or type of problem to another in a set time. Blocked practice refers to focusing on only one subject or type of problem for an extended period of time.) They are all familiar with "problem sets" and learning new strategies and formulae to use in solving problems. |

| | |
|---|---|
| | Writing a paragraph that makes a claim about one way of learning new formulae, using evidence from the article or their own experience, should not be too challenging for the students. Students need only make one major claim.<br><br>Based on the work the students have done, ask each student to write one paragraph making an argument about the efficacy of interleaving or blocked study practices. At the end of 20 minutes (or earlier if most students have finished) each student gives his or her paragraph to a partner. The partners mark what they see as the claim, evidence, and justification. |
| Supplemental Materials | Supplemental Word Order Exercise—The purpose of this exercise is to draw student attention to sentence structure. This is particularly useful if students are having difficulty constructing a syntactically correct sentence. |
| Assessment | Student-produced paragraphs with identifiable claim, evidence, and justification. |


# Resources

# CORRECT ORDER OF SENTENCES

This worksheet is designed to build your skills in putting sentences in the correct order.

## EXERCISE

You will be constructing an email out of the information in the chart below. Each line on the right will be filled in with information from the left.

| Items to Move | Move items into this column |
|---|---|
| I attached the doctor's note. | |
| Message: | |
| Thank you. | |
| Please confirm that the cost of the medicine is covered by the company healthcare plan. | |
| I was sick yesterday, and therefore I couldn't come to work. | |
| To: Jennifer Brown, Human Resources | |
| Date: October 26, 2011 | |
| Subject: Sick leave certificate | |
| In order to receive sick pay, I need to send in my doctor's note. | |
| From: Mark Green, Sales | |

# CORRECT ORDER OF SENTENCES

This worksheet is designed to build your skills in putting sentences in the correct order.

## ANSWERS

| Items to Move | Move items into this column |
|---|---|
| I attached the doctor's note. | From: Mark Green, Sales |
| Message: | To: Jennifer Brown, Human Resources |
| Thank you. | Date: October 26, 2011 |
| Please confirm that the cost of the medicine is covered by the company healthcare plan. | Subject: Sick leave certificate |
| I was sick yesterday, and therefore I couldn't come to work. | Message: |
| To: Jennifer Brown, Human Resources | I was sick yesterday, and therefore I couldn't come to work. |
| Date: October 26, 2011 | In order to receive sick pay, I need to send in my doctor's note. |
| Subject: Sick leave certificate | I attached the doctor's note. |
| In order to receive sick pay, I need to send in my doctor's note. | Please confirm that the cost of the medicine is covered by the company healthcare plan. |
| From: Mark Green, Sales | Thank you. |

# ORDERING SENTENCES INTO PARAGRAPHS

This worksheet is designed to build your skills in putting sentences in the correct order to form paragraphs.

## EXERCISE

Read the following sentences. Arrange and group them in order and into paragraphs. Write the completed paragraphs in the space provided.

- In those days, lunch was served at noon, but dinner was not eaten until late at night.
- In fact, they are two entirely different things.
- Afternoon tea began in the mid-1800s.
- A noblewoman, the Duchess of Bedford, found herself hungry during those long afternoon hours and so she started having a tray of tea with bread and butter served to her in the mid-afternoon.
- Most people think that afternoon tea is synonymous with high tea.
- And although high tea sounds classy, it actually consisted of a full dinner for the common people.
- Soon, she began to invite other ladies to join her.
- High tea, on the other hand, was served around six in the evening.
- Tea was still served, but there would also be meats, fish or eggs, cheese, bread and butter, and cake.
- Without realizing it, the Duchess of Bedford was setting the trend of having afternoon tea for the upper-class women.

| Completed Paragraph |
| --- |
| |

# ORDERING SENTENCES INTO PARAGRAPHS

## ANSWER

Most people think that afternoon tea is synonymous with high tea. In fact, they are two entirely different things.

Afternoon tea began in the mid-1800s. In those days, lunch was served at noon but dinner was not eaten until late at night. A noblewoman, the Duchess of Bedford, found herself hungry during those long afternoon hours and so she started having a tray of tea with bread and butter served to her in the mid-afternoon.

Soon, she began to invite other ladies to join her. Without realizing it, the Duchess of Bedford was setting the trend of having afternoon tea for the upper- class women.

High tea, on the other hand, was served around six in the evening. And although high tea sounds classy, it actually consisted of a full dinner for the common people. Tea was still served, but there would also be meats, fish or eggs, cheese, bread and butter, and cake.

Psychon Bull Rev (2014) 21:1323–1330
DOI 10.3758/s13423-014-0588-3

BRIEF REPORT

# The benefit of interleaved mathematics practice is not limited to superficially similar kinds of problems

**Doug Rohrer · Robert F. Dedrick · Kaleena Burgess**

Published online: 28 February 2014


**Abstract** Most mathematics assignments consist of a group of problems requiring the same strategy. For example, a lesson on the quadratic formula is typically followed by a block of problems requiring students to use that formula, which means that students know the appropriate strategy before they read each problem. In an alternative approach, different kinds of problems appear in an interleaved order, which requires students to choose the strategy on the basis of the problem itself. In the classroom-based experiment reported here, grade 7 students ($n$ = 140) received blocked or interleaved practice over a nine-week period, followed two weeks later by an unannounced test. The mean test scores were greater for material learned by interleaved practice rather than by blocked practice (72 % vs. 38 %, $d$ = 1.05). This interleaving effect was observed even though the different kinds of problems were superficially dissimilar from each other, whereas previous interleaved mathematics studies had required students to learn nearly identical kinds of problems. We conclude that interleaving improves mathematics learning not only by improving discrimination between different kinds of problems, but also by strengthening the association between each kind of problem and its corresponding strategy.

**Keywords** Learning · Mathematics · Interleaved · Spacing · Practice

Learning techniques inspired by research in the laboratory can improve learning in the classroom (for recent reviews, see Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Roediger & Pyc, 2012). In the study reported here, a simple intervention designed to improve mathematics learning was assessed in a classroom-based experiment. We first describe the intervention and the relevant research.

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## Interleaved practice

The solution of a mathematics problem requires two steps, as is illustrated by the following example:

> A bug flies 48 m east and then flies 14 m north. How far is the bug from where it started?

This problem is solved by using the Pythagorean theorem to find the length of a hypotenuse ($\sqrt{48+14}=50$). In other words, students first choose a strategy (Pythagorean theorem) and then execute the strategy. The term *strategy* is used loosely here to refer to a theorem, formula, concept, or procedure. Learning to choose an appropriate strategy is difficult, partly because the superficial features of a problem do not always point to an obvious strategy (e.g., Chi, Feltovich, & Glaser, 1981; Siegler, 2003). For example, the word problem about the bug does not explicitly refer to the Pythagorean theorem, or even to a triangle or hypotenuse. Additional examples are given in Fig. 1.

Although students must learn to choose an appropriate strategy, they are denied the opportunity to do so if every problem in an assignment requires the same strategy. For example, if a lesson on the Pythagorean theorem is followed by a group of problems requiring the Pythagorean theorem, students know the appropriate strategy *before* they read each problem. The grouping of problems by strategies is termed *blocked practice*, and the large majority of practice problems in most mathematics textbooks are blocked. Blocked practice served as the control in the study reported here.

In an alternative approach that is evaluated in the present study, a majority of the problems within each assignment are drawn from previous lessons, so that no two consecutive problems require the same strategy—a technique known as *interleaved practice*. With this approach, students must choose an appropriate strategy and not *only* execute it, just as they must choose an appropriate strategy when they encounter a problem during a cumulative exam or high-stakes test. Put another way, blocked practice provides a crutch that might be optimal when students first encounter a new skill, but only interleaved practice allows students to practice what they are expected to know. To create assignments with interleaved practice, the problems within a set of blocked assignments can be rearranged (Fig. 2).

In addition to providing opportunities to practice choosing a strategy, interleaved mathematics assignments guarantee that problems of the same kind are distributed, or *spaced*, across different assignments (Fig. 2). Spacing typically improves performance on delayed tests of learning (e.g., for recent reviews, see Dunlosky et al., 2013; Roediger & Pyc, 2012), and several studies have shown that spacing can improve the learning of mathematics, in particular (Rohrer & Taylor, 2006, 2007; Yazdani & Zebrowski, 2006). To summarize thus far, interleaved practice has two critical features: Problems of different kinds are interleaved (which requires students to choose a strategy), and problems of the same kind are spaced (which usually improves retention).

## Previous studies of interleaved practice

Four previously published studies compared the effects of interleaved and blocked mathematics practice (Le Blanc & Simon, 2008; Mayfield & Chase, 2002; Rohrer & Taylor, 2007; Taylor & Rohrer, 2010). In each of the studies, participants received interleaved or blocked practice of different kinds of problems, and interleaving produced better scores on a delayed test. However, in each of these studies, the different kinds of problems (and the corresponding strategies) were nearly identical in appearance (Fig. 3). In one study, for example, every problem included a variable raised to an exponent, and, in another, every problem referred to a prism. We refer to problems with shared features as *superficially similar* problems, and this similarity might hinder students' ability to distinguish or *discriminate* between different kinds of problems. Indeed, the benefit of interleaved practice is often attributed to improved discrimination, as we will detail in the Discussion section. Therefore, the superficial similarity of the problems used in previous studies leaves open the possibility that the test benefit of interleaving is limited to scenarios in which students learn to solve kinds of problems that look alike, and such a boundary condition would curtail the utility of interleaved practice in the classroom, where students encounter problems that are often easily distinguished from other kinds of problems.

## Present study

We compared interleaved and blocked mathematics practice in a classroom-based experiment with a counterbalanced, crossover design. Students learned to solve different kinds of problems drawn from their mathematics course, and they received the lessons and assignments from their regular teacher over a period of nine weeks. Two weeks after the last assignment, students sat for an unannounced test. Unlike previous studies of interleaved mathematics practice, the different kinds of problems were superficially dissimilar.

| | Problem | 1. Choose Strategy | 2. Execute Strategy |
|---|---|---|---|
| A | A bug flies 48 m east and then 14 m north. How far is the bug from where it started? | Pythagorean Theorem | $\sqrt{48^2+14^2}=50$ |
| B | A bug flies 48 m east and then 14 m west. How far is the bug from where it started? | Number line arithmetic | $48-14=34$ |
| C | Find the length of the line segment with endpoints (1, 1) and (5, 4). | Pythagorean Theorem | $\sqrt{3^2+4^2}=5$ |
| D | Find the slope of the line that passes through the points (1, 1) and (5, 4). | $\text{slope}=\frac{\text{rise}}{\text{run}}$ | $\frac{4-1}{5-1}=\frac{3}{4}$ |

**Fig. 1** The two steps in the solution of a problem. To solve a problem, students must choose a strategy and then execute it. Superficially similar problems may require different strategies (A and B, or C and D), and superficially dissimilar problems may require the same strategy (A and C). Regardless of similarity, students know the strategy in advance when working a block of problems requiring the same strategy

| | | Lesson | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 50 | 51 | 52 | 53 | 54 | 55 | 60 | 70 | 90 |
| 4 problems on the current lesson | 1 | **50** | 51 | 52 | 53 | 54 | 55 | 60 | 70 | 90 |
| | 2 | **50** | 51 | 52 | 53 | 54 | 55 | 60 | 70 | 90 |
| | 3 | **50** | 51 | 52 | 53 | 54 | 55 | 60 | 70 | 90 |
| | 4 | **50** | 51 | 52 | 53 | 54 | 55 | 60 | 70 | 90 |
| 1 problem on each of 8 previous lessons | 5 | 49 | **50** | 51 | 52 | 53 | 54 | 59 | 69 | 89 |
| | 6 | 48 | 49 | **50** | 51 | 52 | 53 | 58 | 68 | 88 |
| | 7 | 47 | 48 | 49 | **50** | 51 | 52 | 57 | 67 | 87 |
| | 8 | 46 | 47 | 48 | 49 | **50** | 51 | 56 | 66 | 86 |
| | 9 | 45 | 46 | 47 | 48 | 49 | **50** | 55 | 65 | 85 |
| | 10 | 40 | 41 | 46 | 47 | 48 | 49 | **50** | 60 | 84 |
| | 11 | 30 | 31 | 32 | 33 | 34 | 35 | 40 | **50** | 70 |
| | 12 | 10 | 11 | 12 | 13 | 14 | 15 | 20 | 30 | **50** |

**Fig. 2** A hypothetical set of assignments providing interleaved practice. Each column represents an assignment, and each table entry indicates the lesson number on which the problem is based. For example, if Lesson 50 is on ratios, the corresponding assignment includes four ratio problems and one problem on each of eight lessons seen earlier in the school year (or during the previous school year). Another eight ratio problems (Lesson 50) are distributed across future assignments, with decreasing frequency. In other words, problems of different kinds are interleaved (which requires students to choose a strategy), and problems of the same kind are spaced (which improves retention). Note that the arrangement shown here is not the one that was used in the present study

## Method

### Participants

The study took place at a public middle school in Tampa, Florida. Three teachers and eight of their seventh-grade mathematics classes participated. Each teacher taught two or three of the classes. Of the 175 students in the classes, 157 students participated in the study. Of these, 140 students attended class on the day of the unannounced test, and only these students' data were analyzed. Nearly all of the students were 12 years of age at the beginning of the school year.

### Material

Students learned to solve four kinds of problems drawn from their course (Fig. 4). To confirm that students could not solve these kinds of problems before the experiment, we administered a pretest with one of each kind of problem. Averaged across problems, just 0.7 % of the students supplied both the correct answer (e.g., $x = 7$) and the correct solution (the steps leading to the answer). When scored solely on the basis of answers (which presumably included guesses), the mean score was 3.2 %.

The four kinds of problems were not only superficially different from each other, but also quite unlike other kinds of problems that the students had seen prior to the completion of the experiment. For example, although students ultimately learn how to solve many kinds of equations, a linear equation was the only kind of equation that these students had encountered previously in school (Fig. 4A). Likewise, a linear equation was the only kind of equation that the students had previously graphed (Fig. 4C). The slope problem (Fig. 4D) was also moderately unique, because the term "slope" is used only in limited contexts. However, the proportion word problem (Fig. 4B) does resemble other kinds of word problems.

### Design

For the study, we used a counterbalanced crossover design. We randomly divided the eight classes into two groups of four, with the constraint that each group included at least one of the classes taught by each teacher. One group interleaved their practice of problems kinds A and B and blocked their practice of kinds C and D, and the other group did the reverse.

### Procedure

During the nine-week practice phase, students received ten assignments with 12 problems each. Across all assignments, the students saw 12 problems of each of the four kinds (Fig. 4). The remaining problems were based on entirely different topics. Students received the ten assignments on Days 1, 15, 24, 30/31, 36, 37, 57, 58, 60, and 64. Every student received the same problems, but we rearranged the problems to create two versions of each assignment—one for each group. The first four problems of kinds A, B, C, and D were the first four problems of Assignments 1, 2, 4, and 5, respectively. If a problem kind was learned by blocked practice, the remaining eight problems appeared in the same assignment as the first four, meaning that the assignment included one block of 12 problems. If a problem

| | Problem | 1. Choose Strategy | 2. Execute Strategy |
|---|---|---|---|
| A | Simplify. $8x^5 \cdot 4x^2$ | Add exponents | $32x^{5+2} = 32x^7$ |
| | Simplify. $\frac{8x^5}{4x^2}$ | Subtract exponents | $2x^{5-2} = 2x^3$ |
| | Simplify. $(2x^5)^2$ | Multiply exponents | $2^2x^{5\cdot2} = 4x^{10}$ |
| B | Find the volume of a wedge with radius 2 and height 3. | $\frac{1}{2}\pi r^2h$ | $\frac{1}{2}\pi 2^2 3 = 6\pi$ |
| | Find the volume of a spheroid with radius 2 and height 3. | $\frac{4}{3}\pi r^2h$ | $\frac{4}{3}\pi 2^2 3 = 16\pi$ |
| | Find the volume of a spherical cone with radius 2 and height 3. | $\frac{2}{3}\pi r^2h$ | $\frac{2}{3}\pi 2^2 3 = 8\pi$ |
| C | The base of a prism has 5 sides. How many faces does the prism have? | base sides + 2 | 5 + 2 = 7 |
| | The base of a prism has 5 sides. How many corners does the prism have? | base sides x 2 | 5 x 2 = 10 |
| | The base of a prism has 5 sides. How many edges does the prism have? | base sides x 3 | 5 x 3 = 15 |

**Fig. 3** Problems learned in previous studies of interleaved mathematics: Students learned to solve several kinds of problems relating to (A) exponent rules (Mayfield & Chase, 2002), (B) the volume of obscure solids (Le Blanc & Simon, 2008; Rohrer & Taylor, 2007) or (C) prisms (Taylor & Rohrer, 2010) [EE2] In each study, the different kinds of problems (as well as the corresponding strategies) were nearly identical. Note that each of the studies included four or five kinds of problems, but only three are shown here

kind was learned by interleaved practice, the remaining eight problems of the same kind were distributed across the remaining assignments. This meant that students saw the last problem of each kind on a *later* date in the interleaved condition than in the blocked condition, which is an intrinsic feature of assignments with interleaved practice (Fig. 2). The effect of this difference in "true test delay" is detailed in the Results.

Shortly before the scheduled date of each assignment, teachers received paper copies for their students and a slide presentation with solved examples and solutions to each problem. We asked teachers to present the examples before distributing the assignment. On the following school day, teachers presented the solution to each problem while encouraging students to make any necessary corrections to their own solutions. Teachers then collected the assignments. Within two days, one or more of the authors visited the school, scored each assignment (without marking it), and returned the assignments to the teachers. Although these scores do not measure students' mastery, because students could correct their errors while the teacher presented the correct solutions, this scoring of the assignments provided us with evidence of teacher compliance with the experimental procedures.

Students were tested two weeks after the last assignment. We asked teachers not to inform students of the test in advance, because we did not want the final test to be affected by cramming just prior to the test. Teachers did not see the test before it was administered. The students were tested during their regular class, and the teacher and one author proctored each test.

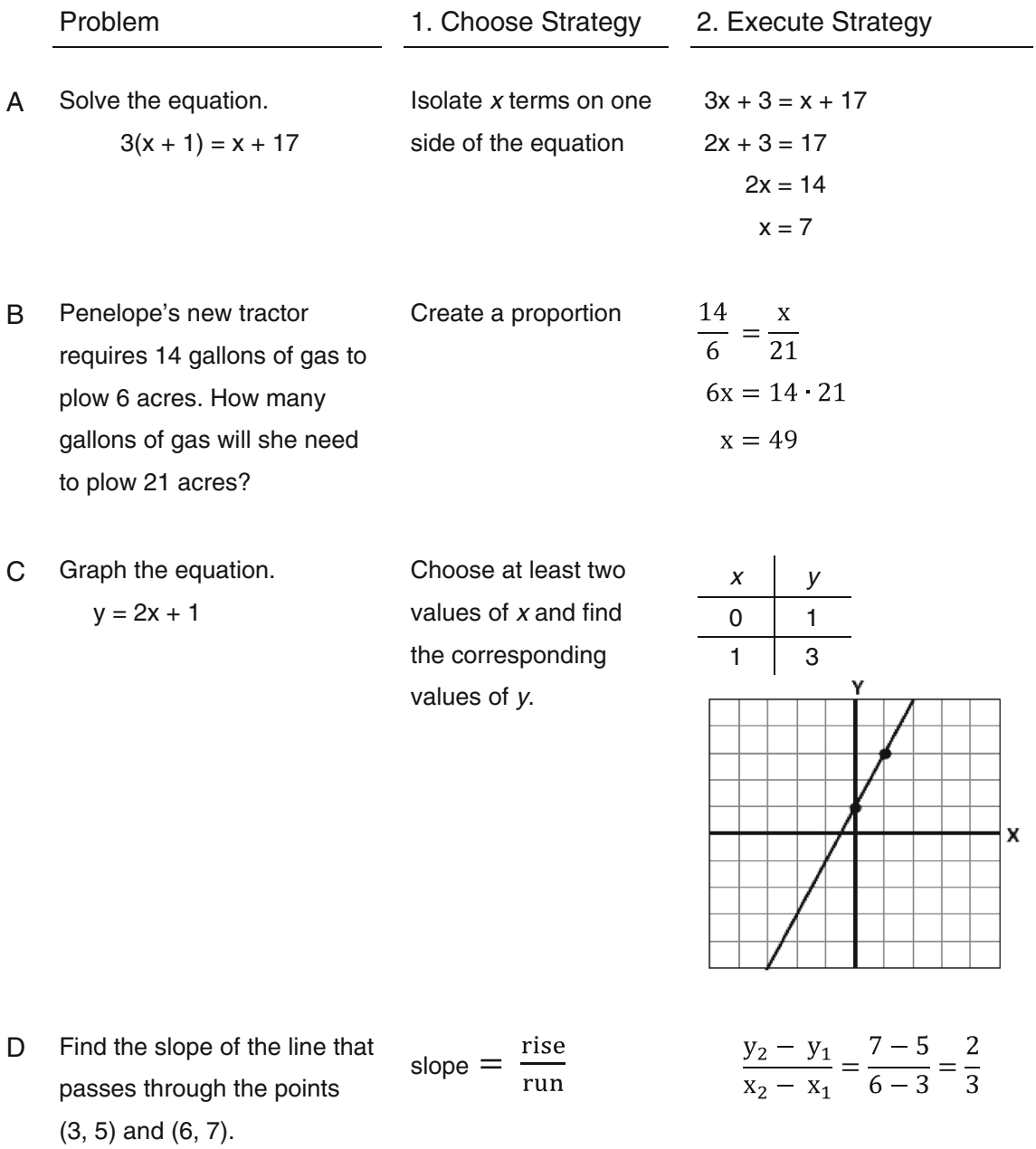



**Fig. 4** Examples of the four kinds of problems used in the present studies. (A) Solve a linear equation requiring four steps. (B) Solve a word problem using a proportion. (C) Graph an equation of the form, $y = mx + b$, where $m$ and $b$ are integers. (D) Determine the slope of the line defined by two given points with integer coordinates

All of the test problems were novel. The test included three problems of each of the four kinds, and each of the four pages included a block of three problems of the same kind. We created three versions by reordering problems within each block, and students in adjacent chairs received different versions. Students were allotted 36 min and allowed to use their school-supplied basic calculator. Each test was scored on site that day by two raters who were blind to each student's group assignment. The two raters scored each answer as correct or not correct and later resolved the few discrepancies (17 of 1,680). Test score reliability was moderately good (Cronbach's alpha = .78).

## Results

A repeated measures comparison of the two halves of the test showed that interleaved practice was nearly twice as effective as blocked practice, $t(139) = 10.49$, $p < .001$ (Table 1). The effect size was large, $d = 1.05$, 95 % CI = [0.80, 1.30]. This benefit of interleaving was observed for each of the four kinds of problems, $ps < .01$. The effect sizes for the four kinds (A, B, C, and D) exhibited a positive trend (0.72, 0.45, 1.00, and 1.27, respectively). This means that the interleaving benefit was *larger* for problem kinds introduced *later* in the practice phase. In other

**Table 1** Proportions correct on test

| | Mean | *SD* |
|---|---|---|
| Interleaved practice | .72 | .30 |
| Blocked practice | .38 | .35 |

words, although the true test delay (the interval between the last practice problem and the test) was larger in the blocked condition than in the interleaved condition (see the Procedure section), the problem kinds with larger test delay differences (i.e., that were seen earlier in the practice phase) were associated with *smaller* effect sizes. Although this negative association might reflect order effects—that is, all participants saw the four problem kinds in the same order—we cannot think of a reason why order would matter. In brief, the effect sizes for problem kinds introduced later in the practice phase were larger than the effects for the earlier ones, and this trend was in the opposite direction from what would be expected if the difference in test delays contributed to the observed effect. Furthermore, if this difference did play a role, it might be seen not as a confound, but as an intrinsic feature of interleaved assignments (Fig. 2).

## Discussion

Whereas previous studies of interleaved mathematics practice had required students to learn kinds of problems that were nearly identical in appearance (Fig. 3), the results reported here demonstrate that this benefit also holds for problems that do not look alike (Fig. 4). That is, the benefit of interleaved mathematics practice is not limited to the ecologically invalid scenario in which students encounter only superficially similar kinds of problems. Although it might seem surprising that a mere reordering of problems can nearly double test scores, it must be remembered that interleaving alters the pedagogical demand of a mathematics problem. As was detailed in the introduction, interleaved practice requires that students choose an appropriate strategy for each problem and not only execute the strategy, whereas blocked practice allows students to safely assume that each problem will require the same strategy as the previous problem.

However, the interleaved practice effect observed here might reflect the benefit of spaced practice rather than the benefit of interleaving per se. As we explained in the introduction, the creation of interleaved mathematics assignments guarantees not only that problems of different kinds will be interleaved, but also that problems of the same kind will be spaced across assignments, and spacing ordinarily has large, robust effects on delayed tests of retention. We therefore believe that spacing contributed to the large effect observed here ($d = 1.05$). Still, we have reason to suspect that interleaving, per se, contributed as well. In one previous interleaved mathematics study, students in both the interleaved and blocked conditions relied on spaced practice to the same degree, and interleaving nevertheless produced a large positive effect ($d = 1.23$; Taylor & Rohrer, 2010). In the present study, though, we chose to compare interleaved practice to the kinds of assignment used in most textbooks, which is a massed block of problems.

### Theoretical accounts of the interleaved mathematics effect

How does interleaving improve mathematics learning? The standard account holds that the interleaving of different kinds of mathematics problems improves students' ability to distinguish or *discriminate* between different kinds of problems (e.g., Rohrer, 2012). Put another way, each kind of problem is a category, and students are better able to identify the category to which a problem belongs if consecutive problems belong to different categories. This ability to discriminate is a critical skill, because students cannot learn to pair a particular kind of problem with an appropriate strategy unless they can first distinguish that kind of problem from other kinds, just as Spanish-language learners cannot learn the pairs PERRO–DOG and PERO–BUT unless they can discriminate between PERRO and PERO.

This discriminability account parsimoniously explains the interleaving effects observed in previous mathematics interleaving studies, because participants in these studies were required to discriminate between nearly identical kinds of problems (Fig. 3). For instance, one of these previous studies included an error analysis, and it showed that the majority of test errors in the blocked condition, but not in the interleaved condition, occurred because students chose a strategy corresponding to one of the *other* kinds of problems that they had learned—for example, using the formula for prism *edges* rather than the formula for prism *faces* (Taylor & Rohrer, 2010). Furthermore, the students in this study were given a second final test in which they were given the appropriate strategy for each test problem and asked only to execute the strategy, and the scores on this test were near ceiling in both conditions. In sum, the data from this earlier experiment are consistent with the possibility that interleaving improves students' ability to discriminate one kind of problem from another (or discriminate one kind of strategy from another).

However, in the present study, discrimination errors appeared to be rare. In a post-hoc error analysis, three raters (two of the authors and a research assistant, all blind to conditions) examined the written solution accompanying each incorrect answer and could not find any solutions in which students "used the wrong strategy but one that solves another kind of problem." The raters then expanded the definition of discrimination error to include solutions with at least one step of a strategy that *might* be used to solve any kind of problem other than the kind of problem that the student should have solved. With this lowered threshold, discrimination errors still accounted for only 33 of the 756 incorrect answers (4.4 %), with no reliable difference between conditions (5.1 % for

interleaved, 4.0 % for blocked). For the other incorrect answers, students chose the correct strategy but incorrectly executed it (45.9 %), or they relied on a strategy we could not decipher, often because they did not show their work (49.7 %). The virtual absence of discrimination errors is arguably not surprising, partly because the different kinds of problems did not look alike, and partly because some strategies were obviously an inappropriate choice for some kinds of problems (e.g., trying to graph a line by creating a proportion). The rarity of discrimination errors in the present study raises the possibility that improved discrimination cannot by itself explain the benefits of interleaved mathematics practice.

We suggest that, aside from improved discrimination, interleaving might strengthen the association between a particular kind of problem and its corresponding strategy. In other words, solving a mathematics problem requires students not only to *discriminate* between different kinds of problems, but also to *associate* each kind of problem with an appropriate strategy, and interleaving might improve both skills (Fig. 5). In the present study, for example, students were asked to learn to distinguish a slope problem from a graph problem (a seemingly trivial discrimination) and to associate each kind of problem with an appropriate strategy (e.g., for a slope problem, use the strategy "slope = rise/run"), and the latter skill might have benefited from interleaved practice. Yet why would interleaving, more so than blocking, strengthen the association between a problem and an appropriate strategy? One possibility is that blocked assignments often allow students to ignore the features of a problem that indicate which strategy is appropriate, which precludes the learning of the association between the problem and the strategy. In the present study, for example, students who worked 12 slope problems in immediate succession (i.e., used blocked practice) could solve the problems without noticing the feature of the problem (the word "slope") that indicated the appropriate strategy (slope = rise/run). In other words, these students could repeatedly execute the strategy $(y_2 - y_1)/(x_2 - x_1)$ without any awareness that they were solving problems related to slope. In brief, blocked practice allowed students to focus only on the execution of the strategy, without having to associate the problem with its strategy, much like a Spanish-language learner who misguidedly attempts to learn the association between PERRO and DOG by repeatedly writing DOG.

It might be possible to experimentally tease apart the effects of interleaving on discrimination and association. In one such experiment, participants would receive either blocked or interleaved mathematics practice during the learning phase, as they typically do, and then take two tests. The first test would assess only discrimination. For example, students might be shown a random mixture of five problems—four problems of one kind (e.g., word problems requiring a proportion) and one problem of a different kind (e.g., a word problem requiring the Pythagorean theorem)—and then be asked to identify the problem that does not fit with the others (the Pythagorean theorem problem). Students would repeat this task many times with different kinds of problems. On a second test measuring both discrimination and association, students would see problems one a time and, for each problem, choose the correct strategy, but not execute it. Scores on the first test (discrimination only) should be greater than scores on the more challenging second test (discrimination and association), with larger differences between the two test scores reflecting a poorer ability to associate a kind of problem and its strategy. Therefore, *if* interleaving improves association, the difference between the two test scores should be smaller for students who interleaved rather than blocked.

## Category learning

Finally, although we focused here on mathematics learning, several studies have examined the effect of interleaved practice on category learning. For example, participants might see

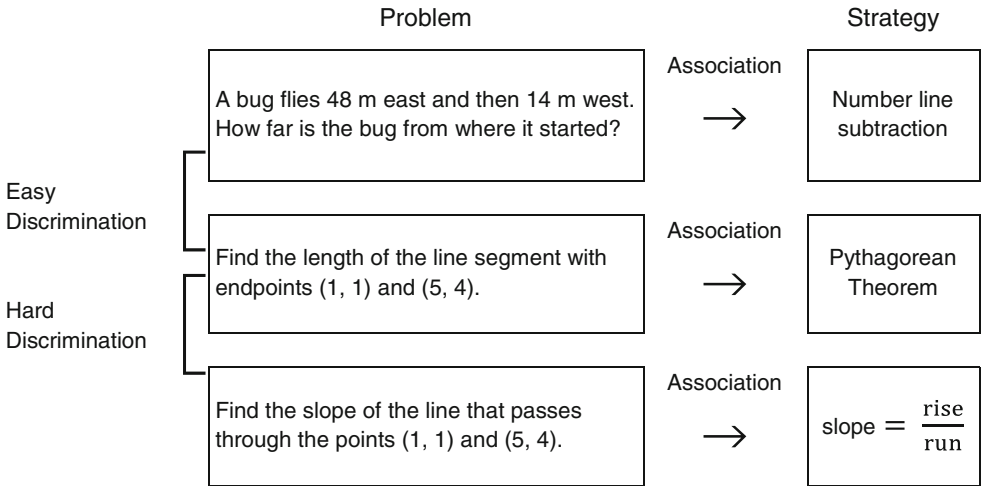



**Fig. 5** Discrimination and association. The solution of a mathematics problem requires that students discriminate one kind of problem from another and associate each kind of problem with an appropriate strategy. Interleaving might improve both skills

photographs of different kinds of birds (jays, finches, swallow, etc.) one at a time, in an order that was either blocked (each of the jays, then each of the finches, etc.) or interleaved (jay, finch, swallow, etc.), and interleaving would produce greater scores on a subsequent test requiring participants to identify previously unseen birds (e.g., Birnbaum, Kornell, Bjork, & Bjork, 2013; Kang & Pashler, 2012; Kornell & Bjork, 2008; Wahlheim, Dunlosky, & Jacoby, 2011; but see Carpenter & Mueller, 2013). As with the results of previous interleaved mathematics tasks, the positive effect of interleaving on category learning could also be attributed to an improved ability to discriminate between, say, a jay and a finch. To our knowledge, though, it remains an untested possibility that this effect might also reflect a strengthened association between each category (e.g., finches) and the category name ("finch"). The relative contributions of enhanced discrimination and stronger associations to interleaving effects could be disentangled by an experiment analogous to the mathematics experiment proposed in the previous section: Participants would receive two tests: a discrimination-only test requiring them to sort birds (or identify the one bird that is different from others), and the usual test requiring them to name novel birds, which would require both discrimination and association. In summary, although strong evidence exists showing that interleaved practice can improve both mathematics learning and category learning, it seems unclear why either of these effects occur.

**Author Note** This work was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant No. R305A110517 to the University of South Florida (PI: D.R.). The opinions expressed are those of the authors and do not necessarily represent the views of the U.S. Department of Education. We thank Sandra Stershic for her help with the data analysis, and we thank Jennifer DeMik, Brendan Paul, Nancy Self, Liberty Middle School, and Hillsborough County Public Schools for their participation.

## References

Birnbaum, M. S., Kornell, N., Bjork, E. L., & Bjork, R. A. (2013). Why interleaving enhances inductive learning: The roles of discrimination and retrieval. *Memory & Cognition, 41,* 392–402. doi:10.3758/s13421-012-0272-7

Carpenter, S. K., & Mueller, F. E. (2013). The effects of interleaving versus blocking on foreign language pronunciation learning. *Memory & Cognition, 41,* 671–682. doi:10.3758/s13421-012-0291-4

Chi, M. T. H., Feltovich, P. J., & Glaser, R. (1981). Categorization and representation of physics problems by experts and novices. *Cognitive Science, 5,* 121–152.

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest, 14,* 4–58.

Kang, S. H. K., & Pashler, H. (2012). Learning painting styles: Spacing is advantageous when it promotes discriminative contrast. *Applied Cognitive Psychology, 26,* 97–103.

Kornell, N., & Bjork, R. A. (2008). Learning concepts and categories: Is spacing the "enemy of induction"? *Psychological Science, 19,* 585–592. doi:10.1111/j.1467-9280.2008.02127.x

Le Blanc, K., & Simon, D. (2008). *Mixed practice enhances retention and JOL accuracy for mathematical skills*. Chicago: Paper presented at the 49th Annual Meeting of the Psychonomic Society.

Mayfield, K. H., & Chase, P. N. (2002). The effects of cumulative practice on mathematics problem solving. *Journal of Applied Behavior Analysis, 35,* 105–123.

Roediger, H. L., III, & Pyc, M. A. (2012). Inexpensive techniques to improve education: Applying cognitive psychology to enhance educational practice. *Journal of Applied Research in Memory and Cognition, 1,* 242–248.

Rohrer, D. (2012). Interleaving helps students distinguish among similar concepts. *Educational Psychology Review, 24,* 355–367.

Rohrer, D., & Taylor, K. (2006). The effects of overlearning and distributed practice on the retention of mathematics knowledge. *Applied Cognitive Psychology, 20,* 1209–1224.

Rohrer, D., & Taylor, K. (2007). The shuffling of mathematics practice problems boosts learning. *Instructional Science, 35,* 481–498.

Siegler, R. S. (2003). Implications of cognitive science research for mathematics education. In J. Kilpatrick, G. W. Martin, & D. E. Schifter (Eds.), *A research companion to principles and standards for school mathematics* (pp. 219–233). Reston: National Council of Teachers of Mathematics.

Taylor, K., & Rohrer, D. (2010). The effect of interleaving practice. *Applied Cognitive Psychology, 24,* 837–848.

Wahlheim, C. N., Dunlosky, J., & Jacoby, L. L. (2011). Spacing enhances the learning of natural concepts: An investigation of mechanisms, metacognition, and aging. *Memory & Cognition, 39,* 750–763. doi:10.3758/s13421-010-0063-y

Yazdani, M. A., & Zebrowski, E. (2006). Spaced reinforcement: An effective approach to enhance the achievement in plane geometry. *Journal of Mathematical Sciences and Mathematics Education, 37–43.*

# CRAAP TEST

When evaluating sources you must ensure that they meet the following criteria before using them in your scholarly work.

- Currency—is the article current? Currency is usually thought of as in the past five years, however, some seminal pieces of research or books written 15 or more years ago may still be current. Standards and regulations change more slowly, so these topics can have a longer period of currency. Something in fields like biomed or artificial intelligence etc., is probably measured in much shorter time periods.
- Relevance—is the content of the source relevant to the question or subject being considered?
- Authority—does the author (or authors) have authority in the subject? Although Steve Jobs may have been an amazing designer, he probably had little authority when it came to the best way to raise puppies.
- Accuracy—how accurate do you judge the information to be? Information supplied by most government sites is usually more accurate than information supplied by a marketing site. Information provided by a standards organization such as Underwriters Laboratory is usually more accurate than information provided by a blogger.
- Purpose—For what purpose was the information produced? If the article or information was produced to persuade readers or to convey information, the content may be different. If the purpose is aligned with the person using the information, it is probably more reliable or useful.

# PUTTING WORDS IN THE CORRECT ORDER

This worksheet is designed to build your skills in putting words in the correct order.

## EXERCISE

Put the following words into the correct order.

*For example: drink/the/performance/a/You/after/buy/can becomes:*

> *"You can buy a drink after the performance."*

1. The/is/music/thing/the/about/love/film/I/that/the
2. order/It/realize/is/word/the/important/to/correct
3. We/have/about/it/must/it/before/forgotten/seen/and
4. ordinary/accidents/year/items/by/Every/of/are/thousands/caused
5. building/woman/furry/A/from/a/was/dog/burning/her/by/rescued
6. animals/business/It/to/after/an/exotic/look/is/expensive
7. nervous/students/Taking/very/time/an/test/a/for/be/English/can

## STUDENT ANSWERS

1.
2.
3.
4.
5.
6.
7.

# PUTTING WORDS IN THE CORRECT ORDER

This worksheet is designed to build your skills in putting words in the correct order.

## ANSWERS

1. The thing that I love about the film is the music.
2. It is important to realize the correct word order.
3. We must have seen it before and forgotten about it.
4. Every year thousands of accidents are caused by ordinary items.
5. A woman was rescued from a burning building by her furry dog.
6. It is an expensive business to look after exotic animals.
7. Taking an English test can be a very nervous time for students.

# Module 5:

# Revising for Concision

## Table of Contents

Module 5: Revising for Concision

| Module | 5 – Revising for Concision |
|---|---|
| Module Learning Outcomes | |
| By the end of this module students will be able to: | |
| 1. Avoid unnecessary repetition. [CLO 4, 5]<br>2. Use revision to refine meaning, clarity, and purpose. [CLO 3, 4, 5]<br>3. Recognize the difference between revision and proofreading. [CLO 4, 5]<br>4. Reconstruct sentences accurately using varied syntax. [CLO 1, 4, 5]<br>5. Write with directness in an engineering context. [CLO 1, 5] | |

| Resources (Bank) | |
|---|---|
| Item | Description of how to be used |
| Sample Paragraph (Wordy) | Used for analysis and practice during session |
| Sample Paragraph (Concise) | Used for analysis and practice during session |
| Avoiding Wordiness Exercise | See instructions |
| Avoiding Wordiness Answers | See instructions |
| Concision Resource | To be used to assist students with concision |

| Face to Face Workshop Plan | |
|---|---|
| Description of Workshop | Students will analyze a paragraph to identify genre, lexicogrammatical choices, and the impact on clarity and directness before practicing revision for concision. Ideally, students will bring one of their own assignments to use for further practice. |
| Time for Completion | 60 – 90 minutes |
| Materials | Separate copies of sample wordy paragraph and concise paragraph - one for each student<br>Multi-coloured highlighters or pens |

| | |
|---|---|
| Workshop Preparation Instructions | Students should be instructed to bring an introduction, executive summary or abstract from one of their own assignments to the workshop as a practice sample.<br><br>Instructors may also wish to prepare a list of resources for further practice including the Purdue Owl Concision Information. |
| Procedure | **Step 1: Instructors distribute the first sample paragraph** (~10 minutes)<br><br>Ask students to read the paragraph. Ask students to identify the main purpose of the two paragraphs, what kind of document would they expect to contain paragraphs such as these? Why? What word choices and sentence structure choices might indicate the purpose and intended readers of these paragraphs?<br><br>*Facilitator Notes:*<br>It is important that the students identify the exaggerations, repetitions and overly complex sentences in the sample rather than the instructor pointing them out.<br><br>**Step 2: Revising for concision and clarity** (~10 minutes)<br><br>Ask students to revise the paragraph for clarity and concision. Challenge the students to cut 100 words without losing meaning.<br><br>**Step 3: In pairs ask students to compare the changes they made** (~10 minutes)<br><br>Take up one or two examples from the students to explain why they made the change and ensure students have not lost the meaning.<br><br>*Facilitator Notes:*<br>Getting students to explain why they made their edits provides the opportunity to bring to conscious awareness the differences between lexical choices, simple versus complex sentences, active versus passive voice constructions, and the impact those choices can have on clarity and concision.<br><br>**Step 4: Introduce students to a step-by-step process for achieving more concision in their writing** (~15 minutes)<br><br>**FIRST:**<br>If using the sample paragraph:<br>• Identify main point(s) and their relationships |

- Underline or highlight the main idea(s) in each sentence (the subject and verb)
- Identify information essential to understanding the main point(s) and their relationships
  - Underline or highlight in a different colour the most important information a reader needs to know in order to understand the point
- Underline or highlight in a different colour essential specific details that are more pertinent or relevant

If using students' writing:

- Ask students to identify what they believe to be the main ideas, relevant information and specific details and then locate them in their draft

SECOND:

- What isn't underlined or highlighted?
- Does it contribute to the purpose or meaning in any way?
- Can you make an argument for what it contributes? If not—cut it! When in doubt, cut it out.

THIRD:

- Making the sentences/paragraph readable or "Wordsmithing"
- Making decisions about word choice and sentence structures
- Getting the right verb - lets you cut adjectives in many cases

*Facilitators Notes:*
It may be useful to introduce students to Princeton's WordNet search at this point. Based on a corpus of current usage, the dictionary provides examples of the many meaning's words may have and can help students develop more nuanced definitions of the words they are using.

*Facilitator Notes:*
Students are often dependent on bilingual dictionaries. These are not bad, but rather, they are incomplete. It is important to let students know that they are often getting incomplete information including outdated or only the most common meanings of words. They need to take the word their bilingual dictionary gives them and look that word up on a site like the Princeton's WordNet search to see the various meanings the word can have along with sample sentences. They need to do this before making a final choice. If they want to be very complete and check their knowledge in their first language, they can take the word they found and put that in their bilingual dictionary and see what they find. It may or

| | |
|---|---|
| | may not be the word they started with. If it isn't, it may be interesting to find out why.<br><br>**Step 5: Using all this information** (~10 minutes)<br><br>Students now take their sample and see which pair can get it to 90 words without losing essential meaning.<br><br>*Facilitators Notes:*<br>Students have been revising until this point. It is important to point this out to students. Proofreading, a very important step, is done last. It is done after a writer is satisfied that the meaning is clear, all essential information is included, and all irrelevant information has been cut.<br><br>**Step 6: Proofreading** (~5 minutes)<br><br>Now, students can do the easy part—proofreading. It is easier to proofread something you haven't written, so, have pairs exchange their final paragraphs for proofreading (spelling, capitalization, punctuation, subject-verb agreement, singular-plural forms, etc.)<br><br>**Step 7: Comparing the Sample** (~5 minutes)<br><br>Give students the sample concise paragraph (89 words) and have them compare their attempts. Did anyone edit down lower than 89 words? Were they able to maintain the meaning? |
| **Supplemental Material** | Purdue Owl Concision Exercises: Used as reference for concision strategies/techniques<br>Avoiding Wordiness Exercise: Used to provide additional practice |
| **Assessment** | Self-assessment: How close do students get to the goal of 89 words in the practice sample? |


# Resources

# SAMPLE PARAGRAPH (WORDY)

Rosewood Mall tucked behind a lush planting of regional foliage and forest is located only a precious few minutes from the airport or train station at 1873 Rosewood Blvd. It promises options for a luxurious and comfortable place to rest and relax in a well-appointed 150-room hotel along with a movie theatre containing three separate screening spaces showing the latest blockbuster films or, if preferred, live theatre featuring the latest hits from Broadway and London's West End capable of handling up to 500 theatre guests. Sustenance for the body is catered to through the rich variety of six superb gourmet restaurants and food stands that can in combination provide seats for 245 discerning diners scattered throughout the extremely well-managed and maintained avenue of edible delights that features exquisite regional specialties. Furthermore, facilities are available in a 2-story center to provide opportunities to attend to fitness and health needs. The mall provides discerning customers with a plethora of choices where they might browse and compare options for everyday needs or a special gift. With 720 places to shelter your car from the elements, guests can choose to arrive in the comfort of their own vehicles.

Rosewood Mall managements always puts efficiency, safety, environmentally-friendly practices and processes and ethical responsibility first by continually improving and updating the well-managed facilities anticipating before customers or vendors know themselves maintenance needs and opportunities for improving and bettering facilities. They respond within 48 hours to any maintenance or repair issue, of which there are only a minute number as the mall has passed two safety of its regularly scheduled safety inspections in the past five years with another one scheduled, exceeding provincial inspection requirements.

# SAMPLE PARAGRAPH (CONCISE)

Rosewood Mall located at 1873 Rosewood Blvd is separated from the highway by deciduous and evergreen foliage. It houses a 150-room hotel, a 3-screen movie theatre, a 500-seat capacity performance venue, a two-story fitness center, 6 restaurants with a combined capacity of 245 seats and parking capacity of 720 cars located on the mall rooftop. The mall has passed two safety inspections in the past five years. The management follows a protocol for reporting maintenance needs and responds within 48 hours to any reported problems.

# AVOIDING WORDINESS

Writing should be clear and concise. A sentence should contain no unnecessary words. This worksheet is designed to build your skills in writing by avoiding redundancy and using as little words as possible without changing the meaning.

*Examples: In my opinion, I think we should go ahead with the plan can be shortened to:*

> *In my opinion, we should go ahead with the plan.*
>
> *I think we should go ahead with the plan.*
>
> *We should go ahead with the plan.*

## EXERCISE

Rewrite the following sentences in a more concise way by removing the redundant words or expressions.

1. I couldn't sleep and woke up in the wee hour of the morning at 3:00 a.m.
2. You should not repeat he same mistake again.
3. They are in complete agreement with one another.
4. The troop was surrounded on all sides by the enemy.
5. In future to come, Jason wants to study medicine and be a doctor.
6. As I see it, I don't see any reason why a person who is honest should do it that way.
7. The reason why he kept telling me about it was because he was worried that I did not believe him.

# AVOIDING WORDINESS

## SUGGESTED ANSWERS

1. I couldn't sleep and woke up at 3:00 a.m.
2. You should not repeat the same mistake.
3. They agree with one another.
4. The troop was surrounded by the enemy.
5. Jason wants to study medicine and be a doctor in future.
6. I don't see any reason for an honest person to do it that way.
7. He kept telling me about it because he was worried that I did not believe him.

# CONCISION RESOURCE

Students use the provided checklist to achieve concision:

- Intensifiers (very, really), qualifiers (quite, sometimes), absolutes (definitely, absolutely, always)
- Choose qualifiers with purpose—important to your argument
- There is/there are —search for all instances of forms of "to be" such as is, are, was, were
- All writers use some form of "there is, there are, it is, it was, etc. in first and second drafts." They act as pauses while the writer thinks. When revising, these sentences need to be restructured. Simply replacing a word or cutting a word will not help in clarity or concision.
- Identify subject and action (the verb), revise the sentence
- Pronouns - Identify the pronoun and its referent. When pronouns are physically separated by a clause or two from their referents, ambiguity is usually created.
- Repetition has a place — when constructing an argument, introducing a new idea or concept repeating the word or the phrase helps the reader become familiar with it.
- Making choices between clarity and concision. Sometimes clarity demands more words rather than fewer words. It becomes a judgment call—given the audience and the purpose which is more important-the number of words or the clarity of the sentence?
- Making the right word choices for precision in meaning
- Now is the time to use a dictionary, but reading beyond the first, common definition. Meaning needs to be clear and precise.
- Checking dictionaries, usage and definition.

# Module 6:

# Summaries and Recommendations

## Table of Contents

Module 6: Summaries and Recommendations

| Module | 6 – Summaries and Recommendations |
|---|---|
| Module Learning Outcomes | |
| By the end of this module students will be able to: | |
| 1. Present arguments using evidence-based persuasion that recognizes the needs of the client or audience. [CLO 1, 3, 5]<br>2. Distinguish between relevant from irrelevant information using critical thinking. [CLO 3]<br>3. Organize the relevant information in the appropriate order at the document and paragraph level. [CLO 3, 5]<br>4. Present information using non-judgmental language. [CLO 1, 4] | |

| Resources (Bank) | |
|---|---|
| Item | Description of how to be used |
| Inspection Observations | Source for summary and recommendation |
| Peer Feedback Chart | For presentations |

| Face to Face Workshop Plan | |
|---|---|
| Description of Workshop | Students practice writing a summary and recommendation from a short report of observations of a field site. |
| Time for Completion | 60-90 minutes |
| Materials | Copies of observation report<br>Multi-coloured highlighters |
| Workshop Preparation Instructions | Read the observation report and identify relevant information to summarize for the purpose of making a recommendation for next steps. Identify the information that could be used as evidence to support a course of action. |
| Procedure | **Step 1: Distribute a copy of the Inspection Observations to each student** (~ 15-20 minutes)<br><br>Have students: |

| | |
|---|---|
| | • Read the observations to identify relevant information to summarize the inspection observations. Highlight this information in one colour.<br>• Read the report to identify relevant information to argue for or against a specific recommendation (action to be taken). Highlight this information in a different colour.<br><br>Note: There may be some information that will be highlighted twice. There may be information that is not highlighted, i.e. irrelevant information.<br><br>**Step 2:** (~ 5 minutes)<br>In pairs, students should compare what they have highlighted and gather all the relevant information together.<br><br>**Step 3:** (~ 10 minutes)<br>Ask students to organize this information in a logical order that will make sense to a reader who is looking for a summary of what was found during an inspection.<br><br>*Facilitator Notes:*<br>The instructor should explain that information can be organized in a number of different ways. Logical organization may change according to purpose. It could be organized chronologically (often used when reporting on accidents or a process). It could be organized spatially from east to west, top to bottom, bottom to top. It could also be organized categorically (i.e. immediate actions required, action required in the next six months, in the next year; structural, HVAC, plumbing, electrical, etc.). Depending on the purpose, different organizational patterns may be more useful. A certain amount of background or context is also necessary because the reader will likely not be familiar with the site.<br><br>**Step 4:** (~ 10 minutes)<br>Working as a pair, have students draft the summary according to the purpose and structure they have chosen.<br><br>**Step 5:** (~ 5 minutes)<br>Return to the information highlighted as relevant to arguing for a specific recommendation. State the recommendation in preferably one clear, actionable sentence.<br>**Step 6:** (~ 5 minutes)<br>Construct an argument to support the recommendation. Students will organize relevant information from the observations to make the argument (See Module 4) for their recommendation. |

| | |
|---|---|
| | *Facilitator Notes:*<br>A recommendation report may be organized with the recommendation coming first and then supported by the evidence or it may build a case from the evidence and conclude with the recommendation. In the latter case, the report will likely begin with the summary of the observations.<br><br>**Step 7:** (~ 15 minutes)<br>Compose a report that provides a well-supported recommendation and summary. |
| Supplemental Materials | No supplemental material is needed for this module. |
| Assessment | *Facilitator Notes:*<br>Remind students to read from an "unfamiliar reader's perspective" (e.g. if it is not written in the document, they have no way of knowing).<br><br>**Step 8:** (~ 10 minutes)<br>After students finish composing their report with their recommendation and summary, make them work in pairs and exchange their draft reports. Handout the Peer Feedback Chart. Each pair reads and underlines or highlights the summary, the recommendation, the evidence to support the recommendation, and note any missing or irrelevant information. Students then can put an "X" in the appropriate box on the Peer Feedback Chart. |


# Resources

# INSPECTION OBSERVATIONS

Green Consultants is an Engineering firm that inspects buildings and decides whether they are structurally sound. The company has been contracted to inspect Rosewood Mall and produce a detailed report that highlights the conditions of the mall building and any major problems resulting from those conditions. The report will recommend if a more in- depth inspection is needed or not.

Rosewood Mall has provided the building plans and related building documents. The mall has three levels and contains a food court, hotel, gym, theatre, offices, a public library, and many retail stores. The roof of the building is used for parking, and holds a two level parking garage. The mall was built June 10, 1977 and has had several renovations over the years. Most of the building's architecture is distinctive of the period it was built in. A review of real estate records reveals that the mall has changed ownership several times over the last ten years. A list of several records of maintenance projects is included with the documentation, but many appear not to have been finished due to budget problems.

A preliminary inspection on August 23rd revealed a serious water leakage problem. There were buckets scattered around all levels of the mall to catch water leaking. Many of the businesses were closed and the ones that were open had put tarps out to protect their goods. Near the water damaged areas, mold and rust on the walls had been noted. This could contribute to air borne pollutants and cause breathing issues for staff and customers.

The owner of a restaurant called Blue's Bistro, Jennifer Blue, has reported that the building generally had many problems that had not been attended to by the Management. She mentioned the leaking roof, frequently backed up drains in the bathrooms, and window leaks that rotted the window sills and created moisture problems. Her restaurant had tried to work with management on getting these items repaired, however, none of the complaints

have been addressed. She said she was not warned about the conditions before she signed the lease, and that at times customers had to use umbrellas to stand at the take-out counter. She also said she plans to close the location as soon as the lease ends.

The cashier of Donkey Burger, John Yellow, has worked at Donkey Burger for 5 years. He reported that about a month ago, a chunk of concrete about the size of a plate fell through the restaurant ceiling and landed in the garbage bins. The mall promised that an inspector would come in two weeks after the incident, but the inspector never came. The mall management did not respond any further to the incident. John said that residents of the town had been complaining about the mall for some time, but that the management was always unresponsive. In the public library in the mall many shelves had been covered completely with tarps. The librarian reported that the library was worried about the condition of the books. Additional notes had been made that several fire alarms were not functional, along with the sprinkler system not being up to building code. There were missing fire extinguishers, and an emergency exit was blocked by some piled construction material.

# PEER FEEDBACK CHART

Use this chart to assess your peers' report.

| Criteria | Complete<br>*All important information is there* | Needs some work<br>*Unnecessary information is there* | Incomplete<br>*Important information and/or a lot of irrelevant information is present* |
|---|---|---|---|
| Summary | | | |
| Recommendation | | | |
| Evidence | | | |

# Module 7:

# Writing for Specific Purposes

## Table of Contents

Module 7: Writing for Specific Purposes

| Module | 7 – Writing for Specific Purposes |
|---|---|
| Module Learning Outcomes | |
| By the end of this module students will be able to: | |
| 1. Identify the purpose of writing, such as: executive summary, client report, status update to supervisor, and process summary. [CLO 1, 2, 5]<br>2. Recognize the difference between formal, informal, technical, and professional writing. [CLO 2, 4]<br>3. Use an appropriate tone for audience and purpose. [CLO 1, 5]<br>4. Determine appropriate language choices. [CLO 1, 2, 4]<br>5. Organize and format a piece of writing to suit the purpose (tables, charts, diagrams, appendices). [CLO 1, 3, 5] | |

| Resources (Bank) | |
|---|---|
| Item | Description of how to be used |
| Green Consultants Report | Used as source material for Recommendation, Status Report |
| Request for Proposal (RFP) Quality of Life of Street Vendors | Used as source materials for Executive Summary, Status Report, Specifications |
| Executive Summary Rubric | Used by students to construct an individual assessment tool |
| Status Report Rubric | Used by students to construct an individual assessment tool |
| Specifications Rubric | Used by students to construct an individual assessment tool |
| Student Worksheet | Definitions of report terms |

| Face to Face Workshop Plan | |
|---|---|
| Description of Workshop | This module provides an opportunity for students to see how changes in language, organization and/or content are key to producing effective communication for specific audiences and purposes. |
| Time for Completion | 90-120 minutes |

| | |
|---|---|
| Materials | One copy per student of a short Green Consultants Report or RFP Worksheet that students can use to identify relevant information and organization decisions.<br>Ideally, this workshop would be held in a room that could project documents from students' laptops/tablets. |
| Workshop Preparation Instructions | The facilitator needs to clarify with engineering instructors their definitions and expectations of the different types of engineering communication (executive summary, status report or update, process summary, client report, recommendation, specification document, etc.) Although this module will use an executive summary, status update and recommendation as examples, the facilitator should feel free to use examples that are most relevant to the group of students they are working with. It is most important to confirm with the engineering instructors and the facilitator's institution the differentiating characteristics of acceptable examples for each of the different purposes. |
| Procedure | **Step 1:** (~5 minutes)<br>Distribute a copy of the inspection report or design brief. Explain that students will use the report/brief as their source material to produce drafts of three different documents for three different audiences and purposes.<br><br>**Step 2:** (~10-15 minutes)<br>As a large group, identify the purpose of each of the three events and the audience (reader/listener) and what structures and content would be most appropriate for each of the documents.<br><br>*Facilitator Notes:*<br>An executive summary will be read by someone who may only have a general idea of the project, but who needs enough information to make a go/no go type of decision. The reader may or may not have an engineering background but will be familiar with the language of engineering projects. There is an expectation of all necessary information in a concise form.<br><br>Status Report or Status Update: This may be oral or written. Generally given to a supervisor or project manager, lab supervisor in the workplace who will most likely be familiar with the project, |

| | |
|---|---|
| | technically knowledgeable and primarily interested in what has been accomplished, will be accomplished and if there are any problems or risks to successful completion or next steps. There is probably a greater degree of familiarity personally and so less formal in nature, but not less professional.<br><br>A specification document will be for specific readers to provide the requirements that a design must meet. The document acts as a requirements checklist. Because clarity and precision are essential, technical language is usually preferred over everyday language. There is no room for ambiguity in specification documentation.<br><br>**Step 3: Two Approaches** (~30-40 minutes)<br>Divide group into pairs. Each pair will produce one rough draft of one of the different documents (status report, executive summary, specifications document). Randomly assign one of the three different documents to different pairs of students. This way they could see the differences in practice. They spend 15-20 minutes to draft their assigned document.<br><br>When the students finish their draft, each pair joins two other pairs who worked on a different document, and they create a group of three pairs. Then they work all together for about 15-20 minutes to see the differences of language, format, structure, etc. that each document has.<br><br>**Step 4:** (~30 minutes)<br>Student pairs present their analysis of the purpose, the audience and the decisions that analysis prompted (e.g. what information to include/exclude, organization, language choices) and display/share their documents. |
| **Supplemental Materials** | No supplemental material is needed here. |
| **Assessment** | After students have watched the presentations of their peers, they can be asked to fill in the Executive Summary, Status Report, Specification Document rubrics to create individual assessment tools. Students will use the formatting, structure, content, and |

| | |
|---|---|
| | organization characteristics they identified to create a description for each category. |


# Resources

# Green Consultants Inspection Report

Green Consultants is an Engineering firm that inspects buildings and decides whether they are structurally sound. The company has been contracted to inspect Rosewood Mall and produce a detailed report that highlights the conditions of the mall building and any major problems resulting from those conditions. The report will recommend if a more in-depth inspection is needed or not.

Rosewood Mall has provided the building plans and related building documents. The mall has three levels and contains a food court, hotel, gym, theatre, offices, a public library, and many retail stores. The roof of the building is used for parking, and holds a two level parking garage. The mall was built June 10, 1977 and has had several renovations over the years. Most of the building's architecture is distinctive of the period it was built in. A review of real estate records reveals that the mall has changed ownership several times over the last ten years. A list of several records of maintenance projects is included with the documentation, but many appear not to have been finished due to budget problems.

A preliminary inspection on August 23rd revealed a serious water leakage problem. There were buckets scattered around all levels of the mall to catch water leaking. Many of the businesses were closed and the ones that were open had put tarps out to protect their goods. Near the water damaged areas, mold and rust on the walls had been noted. This could contribute to air borne pollutants and cause breathing issues for staff and customers.

The owner of a restaurant called Blue's Bistro, Jennifer Blue, has reported that the building generally had many problems that had not been attended to by the Management. She mentioned the leaking roof, frequently backed up drains in the bathrooms, and window leaks that rotted the window sills and created moisture problems. Her restaurant had tried to work with management on getting these items repaired, however, none of the complaints have been

addressed. She said she was not warned about the conditions before she signed the lease, and that at times customers had to use umbrellas to stand at the take-out counter. She also said she plans to close the location as soon as the lease ends.

The cashier of Donkey Burger, John Yellow, has worked at Donkey Burger for 5 years. He reported that about a month ago, a chunk of concrete about the size of a plate fell through the restaurant ceiling and landed in the garbage bins. The mall promised that an inspector would come in two weeks after the incident, but the inspector never came. The mall management did not respond any further to the incident. John said that residents of the town had been complaining about the mall for some time, but that the management was always unresponsive.

In the public library in the mall many shelves had been covered completely with tarps. The librarian reported that the library was worried about the condition of the books.

Additional notes had been made that several fire alarms were not functional, along with the sprinkler system not being up to building code. There were missing fire extinguishers, and an emergency exit was blocked by some piled construction material.

A maintenance room on the top floor was locked blocking inspection of the roof support beams. Calls to the mall management company refused a request to unlock the maintenance room claiming it was unnecessary. They stated that the mall had passed an inspection conducted in May by another engineering firm.

Visual inspection of the rooftop parking lot showed an expansion joint in the concrete floor that appeared to be loose. There was water damage, indicating that water often ran through this crack and into the mall. There was also residue buildup that appeared to be from dissolved de-icing salt during the winter.

Request for proposal

Helping pilots fly drones safely and legally

**Table of contents**

## 1. Introduction:

### 1.1 Background

The term “drone” refers to any vehicle that can operate on surfaces or in the air without a person on board to control it; and that can vary in size, shape, form, speed, and a whole host of other attributes [1]. It may sometimes be referred to as UAV (Unmanned Air Vehicle), UAS (Unmanned Air System), RPAS (Remotely Piloted Aircraft Systems) or Model Aircraft [1].

During the past few years, the popularity of drones has begun to soar. Besides domestic drones that are used as, for example, surveillance tools and commercial drones that are used for business research, more and more people own personal drones for recreational purposes or other personal uses [2]. According to staff at Best Buy, the number of drone sales keeps increasing [3]. However, these recreational drones raises new safety and privacy concerns.

### 1.1 Safety Concern

In October 2017, it was reported that a drone hit a commercial airplane approaching Quebec City [4]. In November 2016, 2 crew members on a plane were injured because a drone interfered with the plane’s flight [5]. Such incidents caused by drones have become more frequent in the past few years. In 2013, there was only 1 reported drone incident. The number of drone incidents in 2014 rose to 46. The number of drone incidents reported each year has kept going up since then and reached 87 in 2015, 215 in 2016 and 233 in 2017 [6]. As the number of drone sales keeps increasing [3], safety concerns may become even more serious in the future.

Moreover, according to current drone-flying law made by Transport Canada [8], drones cannot be flown within a certain distance from a aerodrome or from a area of accident or natural disaster. Unfortunately, many incidents happened because the pilot did not know these were restricted areas for flying drones [4][7]. Therefore, the police officers do not want to be too harsh on people who break drone-related laws or regulations [9].

### 1.2 Privacy Concern

Because a camera or a recorder can be mounted to a drone, drone pilots can use the drone to invade other people's privacy from miles away. It is hard to stop drones being used for peeping because it is hard to determine the ownership and purpose of the drone [2].

### 1.3 Various Possible Solutions but No Existing Solution

To solve problems caused by drones, possible solutions range from radar surveillance system to drone-flying assisting app. Unfortunately, no current design satisfactorily meets all requirements in this engineering opportunity. (See later requirements section and reference design section)

### 1.4 Request for Proposal (RFP)

Although there are current regulations and laws about drone-flying [8], an engineering design solution is requested to enforce the laws and regulations and to protect or prevent drone pilots from breaking the law. The risk of injury or damage would be lowered by helping drone pilots avoid restricted areas and avoid intrusion onto private property. Additionally, if law enforcement has a reliable way of identifying and potentially capturing drones that fly into restricted air space or onto private property, it can become easier to ensure citizen safety and privacy. Therefore, the proposed design should alleviate safety concerns and privacy concerns caused by drone-flying.

## 2. Stakeholders:

### 2.1 Primary stakeholders:

Primary stakeholders have high influence in the proposed design [14]. Among stakeholders who have high influence in the proposed design, stakeholders who also have high interest in the proposed design are prioritized. Below, stakeholders are arranged in order of prioritization.

2.1.1 **Drone pilots** who wish to know the laws surrounding drone use and would like to fly their drone while fully complying with the law.

2.1.2 **City police** who would like citizens to abide by the law when flying drones. They are responsible for making sure that drones are flying where they are supposed to. If a drone is flying in a restricted area, the police are responsible for finding out who is flying the drone and if needed they need to take down the drone. If a solution is found to help the police with these responsibilities, this would be very interesting for them.

2.2 Secondary stakeholders:

Secondary stakeholders have low influence in the proposed design [14]. Among secondary stakeholders, stakeholders who have high interest in the proposed design are prioritized. Secondary stakeholders are arranged in order of prioritization below.

2.2.1 **Homeowners** who would not like their privacy to be invaded by drones and who would not like to be injured or damaged by flying drones.

2.2.2 (equally prioritized as 2.2.1) **Airport or airfields staff** who will not authorize drones to be flown less than 5.5 km away from airport or airfield because it is dangerous and illegal [8].

2.2.3 (equally prioritized as 2.2.1) **People who deal with natural hazards and disasters**. They will not authorize drones to be flown less than 9 km away from natural hazard or disaster site because it is dangerous to people working and illegal.

2.2.4 (equally prioritized as 2.2.1) **Drone law regulators** who would like to see drone-flying related regulations and laws being enforced.

2.2.5 **Drone manufacturers** who would not like the proposed design adding additional cost to drone production.

## 3. Requirements

The table below is organized to show the relationship of stakeholders, high-level and detailed objectives to associated metrics and criteria. The associated metrics have been suggested, however, the list is not exhaustive. It is important to note that a number of approaches may be used to meet the high level objectives, therefore, not all objectives may be relevant to different solutions.

3.1 Requirements Table

| Stakeholders | High-Level Objectives | Detailed Objectives | Metrics | Criteria | Constraints |
|---|---|---|---|---|---|
| Drone Pilots | Provide an engineering design that helps the drone pilot to abide by the law (see [8] for law and regulation specified by Transport Canada) | Minimize the number of laws that the drone can break. | Number of laws listed in section 3.2 that the solution prevents pilots from breaking. | For each law listed in section 3.2, design scored “Yes” is better than “NO”. | |
| | | Help inform people about current drone related laws and regulations. | Different laws and regulations listed in section 3.3 about which the proposed design informs drone pilots. | For each law listed in section 3.3, design scored “Yes” is better than “No”. | |
| | | | Accuracy of representation of restricted areas. Measured by percentage of areas that are correctly marked as unrestricted or restricted relative to total area.<br>Units: % | Larger percentage is better. | |
| | | | Accuracy of representation of restricted areas measured by time taken for solution to inform user about dynamic restricted areas such as areas where an accident has taken place.<br>Units: minutes. | Less time is better. | |

| | | | | | |
|---|---|---|---|---|---|
| City Police<br><br>Home Owners<br><br>Airport and Airfield Staff<br><br>People who deal with natural hazards and disasters<br><br>Drone law regulators | Provide an engineering design that helps police enforce drone related laws and regulations. (All stakeholders listed here, besides police, have an interest in the enforcement of the law because they have an interest in lowering the risk of injury and/or damage.) | Help police officers to know who is flying the drone. | Maximum distance for the police to be able to recognize who is flying the drone (either visibly or using a solution that helps them recognize pilots)<br>Units: meters | Higher distance is better. | |
| | | Help police officers detect drones that are breaking the law. | Maximum distance between a drone and the police such that the police can identify whether the drone is in the restricted area.<br>Units: meters | Higher distance is better. | |
| | | Help police officers take down drones if needed. | Ease of taking down the drones. (see the rubric in section 3.4). | Higher on the rubric the better. | Must score satisfactory in the rubric. |
| Drone Pilots<br><br>City Police | Provide an engineering design that is usable for both drone pilots and police. [15] | Provide an engineering solution that is learnable. [15] | Learnability is measured by time taken for a user to learn to use the solution. [15]<br>Units: minutes | Less time is better. | |
| | | Provide an engineering solution that is reliable. [15] | Reliability is measured by rate of errors of the solution, which is number of error occurrence in certain amount time of using. [15] (the exact time of using in this metrics is left to be determined by metric-evaluation team)<br>Units: number | Less number is better. | |
| | | Provide an engineering solution that performs efficiently. [15] | Efficiency of performance is measured by time added if using the solution compare to not using the solution. [15]<br>Units: Minutes 15 | Less time is better. | |
| Drone pilots<br><br>Police | Provide an engineering design that is portable for both drone pilots and police. | Minimize the weight of the solution. | Weight of the solution.<br>Units: kilograms | Less weight is better. | |
| | | Minimize the volume of the solution. | Volume of the solution.<br>Units: meter cubes | Less volume is better. | |

| | | | | | |
|---|---|---|---|---|---|
| Drone pilots<br><br>Police | Minimize the cost to implement the proposed design for both drone pilots and police. | Minimize the cost required from drone pilots to implement the proposed design. | Cost required from drone pilots to implement the proposed design.<br>Units: Canadian dollars, $ | Less cost is better. | |
| | | Minimize the cost from police to implement the proposed design. | Cost required from police to implement the proposed design.<br>Units: Canadian dollars, $ | Less cost is better. | |
| Drone Manufacturer | Minimize the additional manufacturing difficulties to the drone itself. | Minimize additional drone-manufacturing cost. | Additional cost includes additional material cost, additional research cost and additional labour cost.<br>Units: Canadian dollars, $. | Less cost is better. | |
| | | Minimize additional weight that need to be added to the drone. | Additional weight that need to be added to the drone.<br>Units: kilograms. | Less weight is better. | The weight of the drone and the additional weight caused solution combined cannot exceed 35 kilograms (according to drone weight laws). [8] |
| Additional constraint that is not directly link to metrics | | | | | Must be usable with all types of recreational drones and control systems (remote control, apps that control the drones.) |

3.2 List of drone related laws [8]

The solution technically prevents pilots from violating any of the following laws. [8]:

1. flying drones less than 9 km away from natural hazard and disaster area. Yes/No

2. flying drones less than 5.5 km away from aerodromes. Yes/No

3. flying drones less than 1.8 km away from heliports or aerodromes used by helicopters only. Yes/No

4. flying drones 500 m away from themselves. Yes/No

5. flying drones 90 m above ground: Yes/No

6. flying drones inside controlled or restricted air space. Yes/No

7. flying drones less than 30 m away from vehicles if the drone is less than 1kg weight, else less than 75 m away. Yes/No

8. flying drones during nights or cloudy day. Yes/No

9. flying drones close to areas where its use could interfere with police or first responders. Yes/No

10. flying drones out of their eye-sight. Yes/No

11. flying more than one drone at the same time. Yes/No

12. fly drones without clearly labelling drone pilots' name, address and phone numbers on the drone

3.4 Metrics Rubric

Ease of taking down drones

| Unsatisfactory | Satisfactory | Good | Outstanding |
|---|---|---|---|
| Police officers have no way to take down the drone. | Police officers are able to take down the drone but inflict damage to it. | Police officers are able to take down the drone without inflicting damage to it. | As per good + Police officers can take down drones from their office. |

## 4. Reference designs

### 4. 1 Detecting illegal drones

#### 4.1.1 Human Surveillance

Surveillance by humans and optical systems, with or without a telescope, has some strengths in detecting drones entering restricted areas such as the capability to distinguish drones from other flying objects, but is also limited by range and visual conditions.[10]

#### 4. 1. 2 Robin Radar Systems

Radars can detect multiple targets simultaneously, also under low visibility conditions. However, it comes with the disadvantages of high cost and the inaccuracy in classifying flying objects.[10]

## 4. 2 Taking down illegal drones

### 4. 2. 1 DroneDefender Ray Gun

The DroneDefender disrupts the drone's control signal by bombarding it with even more signal. The problem with "fire so much signal that everything goes electronically deaf" is that it disrupts the communications. [11]

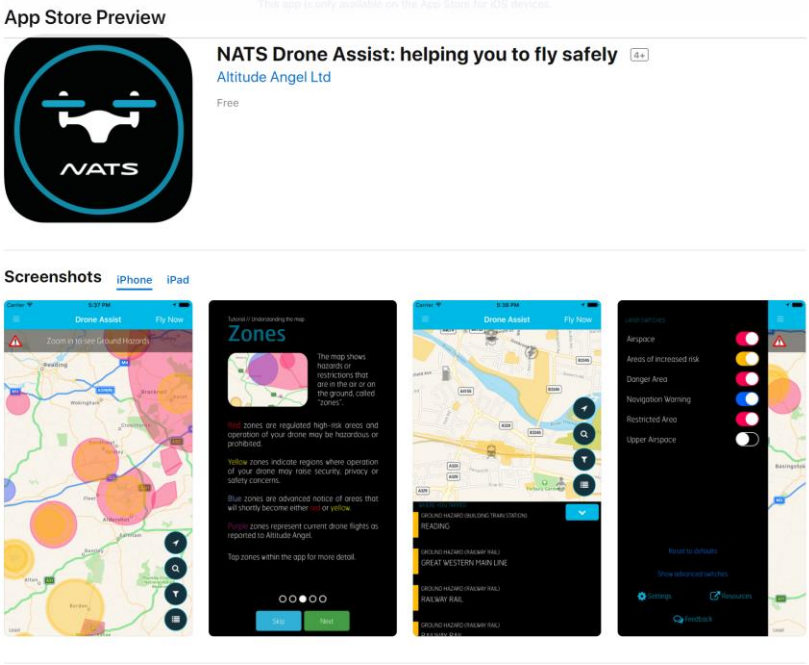
### 4. 2. 2 Skywall 100 Net Bazooka

It's a massive, shoulder-mounted, gas-powered, net-flinging bazooka, blasting a capsule which opens to reveal a net which wraps itself around the target, tangling it in weighted bolas, and then deploys a parachute. It’s a good design except for a few safety concerns (capturing other objects) and high requirement of accuracy.[11]

## 4. 3 Informing drones pilots

### 4. 3. 1 NATS Drone Assist

It is an app developed by the UK's main Air Traffic Control provider in partnership with Altitude Angel, which aims to help drones pilots fly safely and legally in the UK. It contains a map that shows hazards and or restrictions in the air or on the ground, called "zones", and reminds users not to go in the zones. It only shows the airspace information
in the UK, which is the main limitation [12].




### 4. 3. 2 B4UFLY

It is an easy-to-use smartphone app that helps unmanned aircraft operators determine whether there are any restrictions or requirements in effect at the location where they want to fly. Key features of the B4UFLY app include: (a) a clear "status" indicator that immediately informs the operator about the current plan or location, (b) information on the parameters that drive the status indicator, (c) "Planner Mode" for future flights in different locations, (d) informative, interactive maps with filtering options, (e) links to other FAA UAS resources and regulatory information [13].

To use the app you need to pin your location and it will inform you if you are in a restricted zone. It will not inform you if you are in a restricted zone in real time while your are flying the drone. A solution that is integrated into the drone itself or the remote control would fit our requirements better.

# B4UFLY Mobile App

B4UFLY is available for free download in the App Store for iOS and Google Play store for Android.

B4UFLY is an easy-to-use smartphone app that helps unmanned aircraft operators determine whether there are any restrictions or requirements in effect at the location where they want to fly.

Key features of the B4UFLY app include:

- A clear "status" indicator that immediately informs the operator about the current or planned location. For example, it shows flying in the Special Flight Rules Area around Washington, D.C. is prohibited.
- Information on the parameters that drive the status indicator
- A "Planner Mode" for future flights in different locations
- Informative, interactive maps with filtering options
- Links to other FAA UAS resources and regulatory information

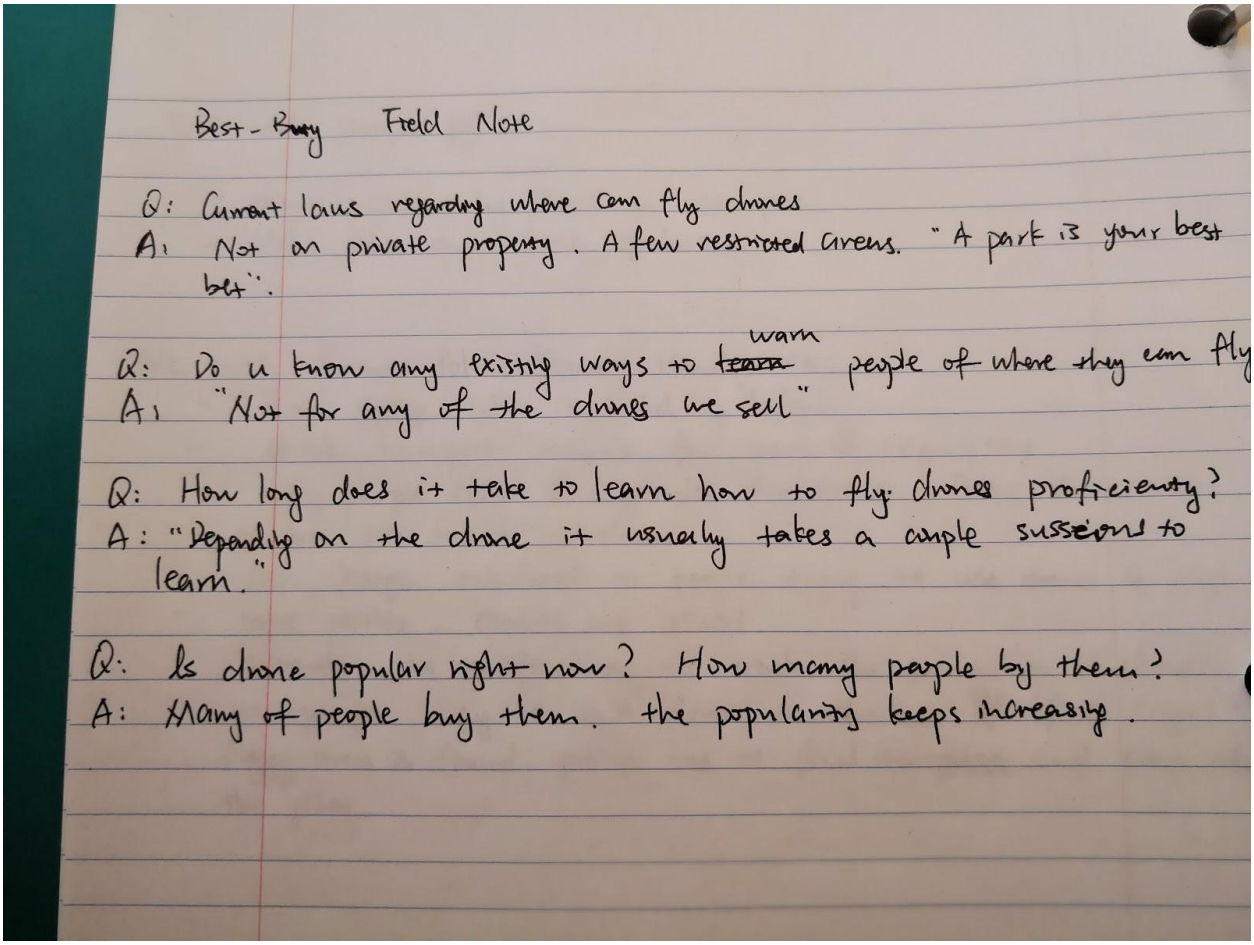
For more information, view the B4UFLY Q & A (PDF).

## Appendix

[1] Priv.gc.ca. (2018). *Drones in Canada*. [online] Available at: https://www.priv.gc.ca/media/1760/drones_201303_e.pdf [Accessed 28 May 2018].

[2] CBC. (2018). *Why it's hard to stop a peeping drone | CBC News*. [online] Available at: http://www.cbc.ca/news/technology/why-it-s-hard-to-stop-a-peeping-drone-1.2743927 [Accessed 28 May 2018].

[3]




[4] thestar.com. (2018). *Drone hit commercial plane approaching Quebec City | The Star*. [online] Available at: https://www.thestar.com/news/canada/2017/10/15/drone-collides-with-commercial-plane-in-quebec-city.html [Accessed 28 May 2018].

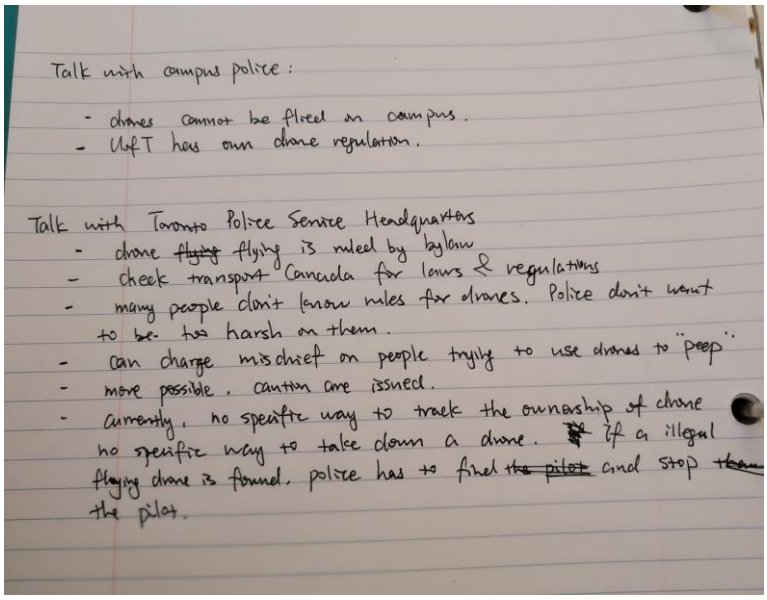
[5]Westoll, N. (2018). *2 injured after near 'mid-air collision' involving Toronto Porter flight, possible drone*. [online] Global News. Available at: https://globalnews.ca/news/3065891/2-injured-after-near-mid-air-collision-involving-toronto-porter-flight-possible-drone/ [Accessed 28 May 2018].

[6]National Post. (2018). *The drones among us: Reports of drone-related incidents are going up and up and up*. [online] Available at: http://nationalpost.com/news/canada/the-drones-among-us-reports-of-drone-related-incidents-are-going-up-and-up-and-up [Accessed 28 May 2018].
[7]Cbc.ca. (2018). *Calgary man criminally charged for flying drone near airport*. [online] Available at: http://www.cbc.ca/news/canada/calgary/calgary-man-drone-airport-criminal-charge-1.3413818 [Accessed 28 May 2018].
[8]Tc.gc.ca. (2018). *Flying your drone safely and legally - Transport Canada*. [online] Available at: http://www.tc.gc.ca/eng/civilaviation/opssvs/flying-drone-safely-legally.html [Accessed 28 May 2018].

## Fly your drone:

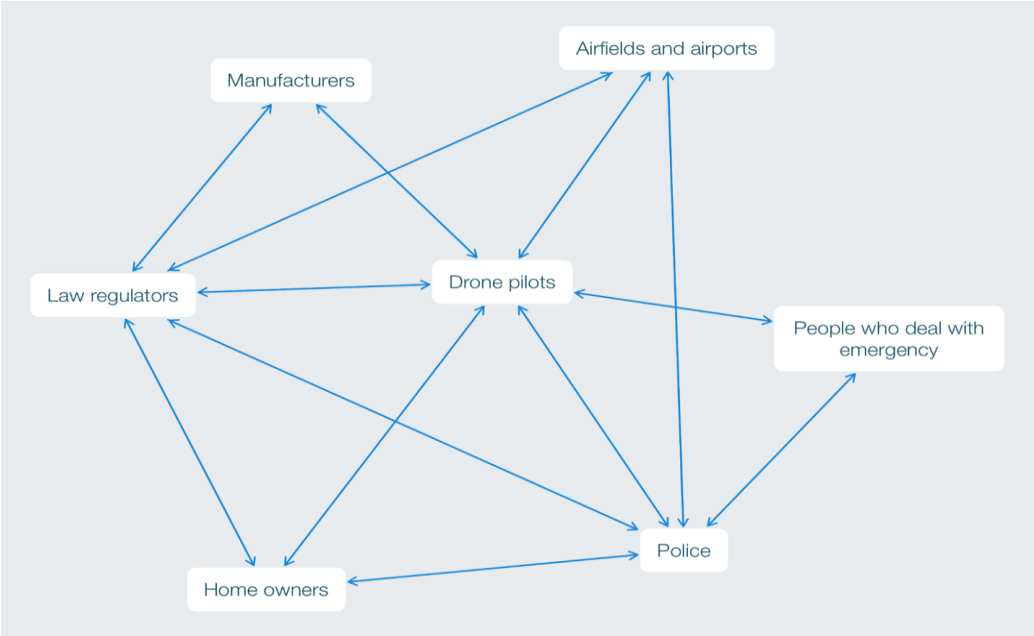
- below 90 m above the ground
- at least 30 m away from vehicles, vessels and the public (if your drone weighs over 250 g and up to 1 kg)
- at least 75 m away from vehicles, vessels and the public (if your drone weighs over 1 kg and up to 35 kg)
- at least 5.5 km away from aerodromes (any airport, seaplane base or area where aircraft take off and land)
- at least 1.8 km away from heliports or aerodromes used by helicopters only
- outside of controlled or restricted airspace
- at least 9 km away from a natural hazard or disaster area
- away from areas where its use could interfere with police or first responders
- during the day and not in clouds
- within your sight at all times
- within 500 m of yourself
- only if clearly marked with your name, address and telephone number

[9] Drone regulations given by police



[10]L. Mckinney, "5 Awesome Ways People Are Defeating Drones", Cracked.com, 2018. [Online]. Available: http://www.cracked.com/blog/5-killer-ways-you-can-take-down-drone/. [Accessed: 29- May- 2018].
[11]"Robin Radar System", Robinradar.com, 2018. [Online]. Available: https://www.robinradar.com/wp-content/uploads/2018/01/RobinRadar_brchr_Dronedetectie.pdf. [Accessed: 29- May- 2018].
[12]"NATS Drone Assist: helping you to fly safely on the App Store", App Store, 2018. [Online]. Available:https://itunes.apple.com/ee/app/nats-drone-assist-helping-you-to-fly-safely/id1172916055?mt=8. [Accessed: 29- May- 2018].

[13]"B4UFLY Mobile App", Faa.gov, 2018. [Online]. Available: https://www.faa.gov/uas/where_to_fly/b4ufly/. [Accessed: 29- May- 2018].
[14]




| | | |
|---|---|---|
| **High interest** | Homeowners<br><br>Airfields and airport<br><br>Drone law regulator<br><br>People who deal with accidents and emergencies | Drone Pilots |
| **Low interest** | Drone manufacturer | Police |
| | **Low influence** | **High influence** |

# EXECUTIVE SUMMARY RUBRIC

**Instructions:** Use the formatting, structure, content, and organization characteristics you identified from yours and your peers' work to create a description for each category.

| Executive Summary | Fails | Below Expectations | Meets Expectations | Exceeds Expectations |
|---|---|---|---|---|
| Audience | | Audience identified but inappropriate for the purpose of the document | | |
| Purpose | | | | |
| Language | | | | |
| Format/Structure | | | | |

# STATUS REPORT RUBRIC FORM

**Instructions:** Use the formatting, structure, content, and organization characteristics you identified from yours and your peers' work to create a description for each category.

| Status Report | Fails | Below Expectations | Meets Expectations | Exceeds Expectations |
|---|---|---|---|---|
| Audience | | | | |
| Purpose | | | | |
| Language | | | Uses technical language a supervisor would know and understand | |
| Format/Structure | | | | |

# SPECIFICATION RUBRIC FORM

**Instructions:** Use the formatting, structure, content, and organization characteristics you identified from yours and your peers' work to create a description for each category.

| Specification Document | Fails | Below Expectations | Meets Expectations | Exceeds Expectations |
|---|---|---|---|---|
| Audience | | | | |
| Purpose | Unclear why information is included in this document | | | |
| Language | | | | |
| Format/Structure | | | | |

# STUDENT WORKSHEET

**Instructions:** Hand out this sheet to students to give an explanation of what each of these components are.

**Executive summary:** This will be read by someone who may only have a general idea of the project, but who needs enough information to make a go/no go type of decision. The reader may or may not have an engineering background but will be familiar with the language of engineering projects. There is an expectation that all necessary information to inform a decision will be included in a concise form. An executive summary stands independent of the accompanying report. It makes no explicit reference to information in the accompanying report.

**Status Report or Status Update:** This may be oral or written. Generally given to a supervisor, project manager, or lab supervisor in the workplace who will most likely be familiar with the project, technically knowledgeable and primarily interested in what has been accomplished, will be accomplished and if there are any problems or risks to successful completion or next steps. There is probably a greater degree of familiarity personally and so the language will be less formal in nature, but not less professional.

**Specification document:** This will be for specific readers to provide the requirements that a design must meet. The document acts as a requirements checklist. Because clarity and precision are essential, technical language is usually preferred over everyday language. There is no room for ambiguity in specification documentation. Rationale for decisions is usually not included.

# Module 8:

# Oral Communication in a Team Context

## Table of Contents

Module 8: Oral Communications in a Team Context

| **Module** | 8 - Oral Communication in a Team Context |
|---|---|
| **Module Learning Outcomes** | |
| By the end of this module students will be able to: | |
| 1. Become aware of oral communication patterns in a team meeting. [CLO 1, 2, 5]<br>2. Understand the difference between interrupting or completing another's idea or comment. [CLO 3, 5]<br>3. Develop an awareness of non-verbal cues in team settings. [CLO 1, 5]<br>4. Develop a vocabulary for talking about team communication dynamics. [CLO 3, 4]<br>5. Identify at least two oral communication strengths and one area for improvement. [CLO 6] | |

| **Resources (Bank)** | |
|---|---|
| **Item** | **Description of how to be used** |
| Design Activity | To be used by teams to guide their 15-minute activity |
| Observation sheet | Used by workshop participants to record observations during the activities |

| **Face to Face Workshop Plan** | |
|---|---|
| **Description of Workshop** | This workshop employs a "fishbowl" structure. One team of four works on a task while another team of four observes them. Although students may be hesitant at first with someone observing them, most of the time the hesitation disappears as students become more involved in the task itself. |
| **Time for Completion** | 60-90 minutes |
| **Materials** | Large room with mobile furniture<br>Observation sheets (one for each student)<br>Team task (one copy per student)<br>Markers<br>Flip chart paper |

| | |
|---|---|
| | Post-its<br>Index cards |
| **Workshop Preparation Instructions** | This activity requires a large room with movable furniture. The groups need enough room to have a shared space with observer chairs around it close enough to hear and see individuals, but not so close as to be "part of the team." Ideally, the facilitator sets up the room before the activity.<br><br>There are two ways to use this workshop. The first is to work with extant teams from a course as either a course activity or an activity offered for the course, but outside of class time. The second way offers the workshop to students but not associate it with any particular team project or course. Since engineering students work in teams in many of their courses, co-op placements or internships, this activity can work at any level. When working with a group that is not already divided into teams, assemble teams randomly at the beginning of the activity. This can be done by distributing sets of numbers, colours or just "counting off." |
| **Procedure** | **Step 1:** (~5 minutes)<br>Begin by quickly putting students into four-person teams. This may be adjusted if there are uneven numbers of students; however, teams should not be more than five as this increases the complexity dynamics and observations.<br><br>**Step 2:** (~10 minutes)<br>Distribute the Observation Sheet. Go over the six categories. Define them and give examples of the behaviours (e.g. someone initiates an interaction by raising their hand, leaning forward into the group and says, "Ummm…"). The observing student need only make a tally mark next to IN for that action.<br><br>*Facilitator Notes:*<br>There may be confusion about the difference between interrupting and completing. It is a judgment call. Usually an interruption cuts someone off before their thought has been completed. The direction or intent of the comment is not picked up, rather, the interrupting speaker takes the incomplete idea in a different direction as opposed to developing or following the first |

| | |
|---|---|
| | speaker's perceived intent. It is also possible to observe the response of the person whose thought has been taken up or interrupted. When someone's idea is being completed or developed there is often non-verbal nodding in agreement, interjections of assent, etc. When someone has been interrupted the non-verbal registers more surprise or something more negative, leaning back from the table or group.<br><br>**Step 3:** (~20 minutes)<br>Pair up the teams, have them flip a coin to see who will observe first and have them take their appropriate seats. Distribute the Design Activity and start the activity. Allow 15 minutes for the activity.<br><br>*Facilitator Notes:*<br>Finishing the activity is not the goal. Becoming engaged in the activity is more important.<br><br>**Step 4:** (~20 minutes)<br>Stop the activity at 15 minutes and have the teams change places. Instruct the first observing team to hold onto their observation sheets until the end of the second round. Ensure the observing team has their clean copies of the observation sheets. Run the activity again for 15 minutes.<br><br>**Step 5:** (~20 minutes)<br>Debrief: The first step in the debrief is to have each team receive the observation sheets from their activity. Ask the teams to put the sheets out where everyone on the team can see them. What patterns, if any, do they see on a first glance.<br><br>*Facilitator Notes:*<br>Give students enough time to notice before using probing questions. Some groups of students may need more or less guidance in seeing patterns.<br><br>Does one category of interaction dominate? Does one person dominate in a category? If someone has been mostly silent (little or nothing in IN, IR, C, Q) what can their gaze and listening behaviours indicate? |

| | |
|---|---|
| | The second step in the debrief is to interpret these observations. What are two possible interpretations of a pattern where one person dominates the IN (initiates) category? What other interpretation could there be? At this point, it is possible to start to more openly explore why someone is hesitant to speak, what wait time means and how silence feels to different team members. How different team members respond to interruptions—being interrupted or doing the interrupting.<br><br>*Facilitator Notes:*<br>Generating alternative interpretations is important because it is not possible to always accurately interpret another's motivation and intention from words and non-verbal behaviours alone. Interpretations need to be confirmed. Asking for this confirmation can allow students to understand just how differently the same actions can be interpreted.<br><br>The third step in the debrief is to try and link the patterns with the progress the team made (or didn't make) during the short activity period and/or the quality of the progress. What happens when one person dominates one or two categories? How that is different from a more evenly distributed set of interactions. How could learning to wait an additional five seconds change the opportunity for more team members to participate?<br><br>*Facilitator Notes:*<br>The third step may be a step too far for some teams, especially if the facilitator is not working with extant teams. A rich discussion in the second step of the debrief that supports students becoming aware of how they interpret others' actions and how their own actions may be interpreted can lead to implications for their own behaviours ( e.g. I am hesitant to speak because I don't think I have anything to offer, but if I know what the goal of a meeting is ahead of time, I can prepare and then feel more confident that I can make a contribution or I see that I feel as if I am waiting a very long time, but it is really on a couple of seconds. If I wait and tolerate "silence" five more seconds, others may feel that they have time to "pull their thoughts together.") |
| **Supplemental Materials** | No supplemental materials for this module are needed. |

| | |
|---|---|
| **Assessment** | Individually, students write down three things they learned about themselves in a team context from this activity. Students next write down one thing they believe they do well and should continue to develop in their team communication practices and one thing that they don't do very well and need to improve. This concluding reflection should give some indication of what insights students may have gained about their own and others' oral communication in a team context. |


# Resources

# DESIGN ACTIVITY

The Marshmallow Tower challenge has been adapted from:

https://dschool.stanford.edu/resources/spaghetti-marshmallow-challenge

Provide each team with the following supplies:

20 sticks of dry spaghetti (any style)
1 meter of string
1 meter of tape
1 marshmallow
Scissors

Instructions:

Build the tallest freestanding tower possible with these supplies in 10 minutes.

This can be altered with the constraint of build the tallest tower possible that will support the marshmallow or build the tallest freestanding tower possible that will support the marshmallow on the top of the tower.

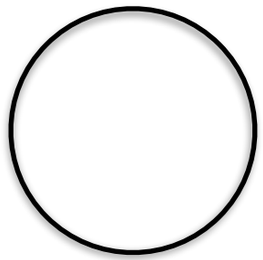
Additional challenges which can be used in the same way may be found at:

https://frugalfun4boys.com/awesome-stem-challenges/

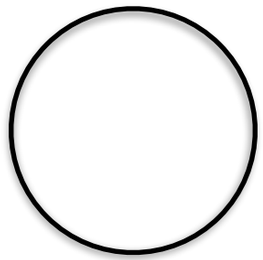
# Team Behaviour Observer Recording Sheet

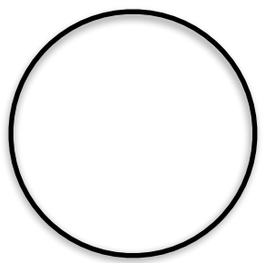
When you observe a particular behaviour by a particular individual, add a mark in the corresponding box

| IN | | IR | | C | | Q | | L | |
|---|---|---|---|---|---|---|---|---|---|

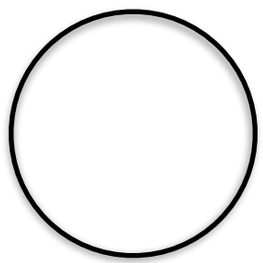


| IN | | IR | | C | | Q | | L | |
|---|---|---|---|---|---|---|---|---|---|





| IN | | IR | | C | | Q | | L | |
|---|---|---|---|---|---|---|---|---|---|



| IN | | IR | | C | | Q | | L | |
|---|---|---|---|---|---|---|---|---|---|

| | |
|---|---|
| **IN** | **Initiates**: individual initiates an interaction, verbally or non-verbally |
| **IR** | **Interrupts**: individual cuts off another's utterance without verbal or non-verbal acknowledgement or permission |
| **C** | **Completes** (expands or explains, builds): individual completes another's utterance with explicit verbal or non-verbal acknowledgement |
| **Q** | **Questions**: individual asks a question to confirm, clarify, seek information |
| **L** | **Listens**: individual follows interactions with gaze, non-verbal responses (facial expression, private language, note-taking) |
| **G** | **Gaze**: where does the individual's gaze predominantly rest: on an individual, on a device or notebook in front of them, on one other person, on the person who is currently speaking, in the distance<br>**Indicate the direction of gaze with arrows between the circles** |