Module 3:

Reading Through Concepts

Table of Contents

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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] 2. Read in chunks rather than word by word. [CLO 1, 5] 3. Connect content with engineering concepts. [CLO 1, 2] 4. Articulate their understanding of read information in their own words. [CLO 5, 6] 5. Paraphrase intermediate level text. [CLO 5, 6]	

Resources (Bank)	
Item	**Description of how to be used**
Inspection Request (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. (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 Flip chart paper Markers Copies of a blank grid/table to be filled in 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. 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

	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. 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. 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. 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.

	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. Workshop Procedure **Step 1:** (~10 minutes) 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. **Step 2:** (~10 minutes) Distribute the Concept Vocabulary Grid and have each student fill in the second column (Forms) and the third column (Phrases) of the provided table. 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. *Facilitator Notes:* 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. **Step 3:** (~20 minutes) 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.

	Step 4: (~5 minutes) 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. *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. **Step 5:** (~20 minutes) 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 …) *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. If time permits, use Step 6. **Step 6:** (~10 minutes) 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.

<u>Nice to have</u>

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]

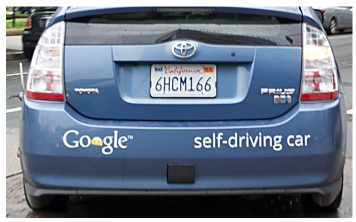

Figure 1: Google self-driving car [2]

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]

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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