Module 2: Comprehension and communication (written)

EE 350
Technical Communications

Part 1: Comprehension

<u>Lecture Plan (combined for all sections):</u>

Jan 25 (Tuesday): Basic methodology for reading comprehension passages, Types of questions, Examples based on short passages

Jan 27 (Thursday): Moodle quiz based on one long passage, Discussion on the passage and the questions

<u>Tutorial Plan (for individual sections):</u>

Jan 31 (Monday): Moodle quiz based on several passages, followed by discussion

Motivation for Teaching Comprehension

1. Develop the ability to understand scientific articles fast

2. Develop logical-thinking abilities

3. Develop the ability to summarize long passages and essays in 2–3 sentences only

Prerequisites

1. Decent knowledge of grammar (covered in Module 1)

2. Basic comprehension/ logical reasoning skill

Not Prerequisites

1. Prior technical knowledge about the topic of the essay not needed

2. No mathematical skill needed

Deductive vs Inductive Logic

Deductive Logic:

The final conclusion can be derived completely from the given premises, without making any assumption, taking note of an exception, etc.

Example:

Premise: John bought ten eggs from the market.

Conclusion: If he eats two eggs a day, he will take five days to finish them.

Deductive vs Inductive Logic

Inductive Logic:

Certain assumptions are made while deriving a conclusion. The success of this logical method relies on the validity of the assumption.

Example:

Premise: John bought ten eggs from the market.

Conclusion: John doesn’t need to go the market to buy eggs for another week.

(The assumption here is that John (and others for whom he bought the eggs, if they exist) will eat only 1–2 eggs per day.)

Deductive vs Inductive Logic in Scientific Articles

- Mathematics, Theoretical Computer Science: Deductive logic mostly
- Theoretical Physics, Theories in Electrical Engineering, etc.: Mathematical derivations use deductive logic, connecting the mathematics with physical quantities often use inductive logic
- Experimental Sciences: More inductive logic

Basic methodology to be followed while reading a passage

1. Quickly scan through a dense passage and develop the big picture/ understand the main idea

2. Then fit details into the big picture, but do not get obsessed with details

3. Make your own interpretations/ guess the underlying assumptions made in the passage, based on the questions asked

4. Understand the writer's purpose in writing the passage

Type 1 question: Title of the Passage

Come up with a suitable title for the passage, or choose from possible options.

This is a big-picture question.

Reading the passage only once, you should be able to answer this question.

Type 1 question: Title of the Passage (An Example)

In a time some humans call the third century B.C., in the greatest metropolis of the age, the Egyptian city of Alexandria, there lived a man named Eratosthenes who calculated the circumference of the earth. To do so, Eratosthenes asked himself how, at the same moment, a stick in Syene could cast no shadow and a stick in Alexandria, far to the north, could cast a pronounced shadow. Consider a map of ancient Egypt with two vertical sticks of equal length, one stuck in Alexandria, the other in Syene. Suppose that, at a certain moment, each stick casts no shadow at all. This is perfectly easy to understand—provided the Earth is flat. The Sun would then be directly overhead. If the two sticks cast shadows of equal length, that also would make sense on a flat Earth: the Sun's rays would then be inclined at the same angle to the two sticks. But how could it be that at the same instant there was no shadow at Syene and a substantial shadow at Alexandria?

The only possible answer, he saw, was that the surface of the Earth is curved. Not only that: the greater the curvature, the greater the difference in the shadow lengths. The Sun is so far away that its rays are parallel when they reach the Earth. Sticks placed at different angles to the Sun's rays cast shadows of different lengths. For the observed difference in the shadow lengths, the distance between Alexandria and Syene had to be about seven degrees along the surface of the Earth; that is, if you imagine the sticks extending down to the center of the Earth, they would there intersect at an angle of seven degrees. Seven degrees is something like one-fiftieth of three hundred and sixty degrees, the full circumference of the Earth. Eratosthenes knew that the distance between Alexandria and Syene was approximately 800 kilometers, because he hired a man to pace it out. Eight hundred kilometers times 50 is 40,000 kilometers: so that must be the circumference of the Earth.

Adapted from Carl Sagan's "Cosmos"

Type 1 question: Title of the Passage (An Example)

Choose a suitable title for the following passage from the following options (multiple options may be correct):

1. The first known calculation of earth’s circumference

2. A historical method for calculating the earth’s circumference

3. The contribution of Eratosthenes to modern science

4. Eratosthenes

5. An argument why the earth isn’t flat

Type 1 question: Title of the Passage (An Example)

Correct options are underlined:

1. The first known calculation of earth's circumference

2. <u>A historical method for calculating the earth's circumference</u>

3. <u>The contribution of Eratosthenes to modern science</u>

4. Eratosthenes

5. An argument why the earth isn't flat

Type 2 Question: Details

A specific question is asked with respect to a certain detail in the passage. The answer is there in the passage only.

No assumption/ inductive logic typically needed.

Deductive logic to be used mostly for most cases

Type 2 Question: Details (An Example)

In a time some humans call the third century B.C., in the greatest metropolis of the age, the Egyptian city of Alexandria, there lived a man named Eratosthenes who calculated the circumference of the earth. To do so, Eratosthenes asked himself how, at the same moment, a stick in Syene could cast no shadow and a stick in Alexandria, far to the north, could cast a pronounced shadow. Consider a map of ancient Egypt with two vertical sticks of equal length, one stuck in Alexandria, the other in Syene. Suppose that, at a certain moment, each stick casts no shadow at all. This is perfectly easy to understand—provided the Earth is flat. The Sun would then be directly overhead. If the two sticks cast shadows of equal length, that also would make sense on a flat Earth: the Sun's rays would then be inclined at the same angle to the two sticks. But how could it be that at the same instant there was no shadow at Syene and a substantial shadow at Alexandria?

The only possible answer, he saw, was that the surface of the Earth is curved. Not only that: the greater the curvature, the greater the difference in the shadow lengths. The Sun is so far away that its rays are parallel when they reach the Earth. Sticks placed at different angles to the Sun's rays cast shadows of different lengths. For the observed difference in the shadow lengths, the distance between Alexandria and Syene had to be about seven degrees along the surface of the Earth; that is, if you imagine the sticks extending down to the center of the Earth, they would there intersect at an angle of seven degrees. Seven degrees is something like one-fiftieth of three hundred and sixty degrees, the full circumference of the Earth. Eratosthenes knew that the distance between Alexandria and Syene was approximately 800 kilometers, because he hired a man to pace it out. Eight hundred kilometers times 50 is 40,000 kilometers: so that must be the circumference of the Earth.

Adapted from Carl Sagan's "Cosmos"

Type 2 Question: Details (An Example)

Which of the following known (to many) facts/ ideas was NOT used by Eratosthenes while doing his calculation? (multiple options possible)

1. The distance between Alexandria and Syene was 800 kilometers.

2. The angle corresponding to the circumference of the earth was 360 degrees if the earth was nearly spherical.

3. If the sticks at Alexandria and Syene could extend all the way to the centre of the earth, they would make an angle of 7 degrees with each other.

4. The earth was spherical and not flat since people could go round the earth and get back to the same place they started from.

Type 2 Question: Details (An Example)

Correct options are underlined:

<u>1. The distance between Alexandria and Syene was 800 kilometers.</u>

2. The angle corresponding to the circumference of the earth was 360 degrees if the earth was nearly spherical.

<u>3. If the sticks at Alexandria and Syene could extend all the way to the centre of the earth, they would make an angle of 7 degrees with each other.</u>

<u>4. The earth was spherical and not flat since people could go round the earth and get back to the same place they started from.</u>

Type 3 question: Interpretation/ Underlying assumption

1. Interpret a certain portion of the passage to make your own conclusion **(use both deductive logic and inductive logic)**

Type 3 question: Interpretation/ Underlying assumption

2. Identify the underlying assumption behind a conclusion the author has reached in a passage (**use both deductive logic and inductive logic).**

Questions are typically as follows: *will an evidence in support of the following idea strengthen the author's argument? The correct answer is usually the assumption you just identified*

Type 3 question (An example)

There were only six planets known in Kepler's time: Mercury, Venus, Earth, Mars, Jupiter and Saturn. Kepler wondered why only six? Why not twenty, or a hundred? Why did they have the spacing between their orbits that Copernicus had deduced? No one had ever asked such questions before. There were known to be five regular or "platonic" solids, whose sides were regular polygons, as known to the ancient Greek mathematicians after the time of Pythagoras. Kepler thought the two numbers were connected, that the reason there were only six planets was because there were only five regular solids, and that these solids, inscribed or nested one within another, would specify the distances of the planets from the Sun. In these perfect forms, he believed he had recognized the invisible supporting structures for the spheres of the six planets. He called his revelation The Cosmic Mystery. The connection between the solids of Pythagoras and the disposition of the planets could admit but one explanation: the Hand of God, Geometer.

Adapted from Carl Sagan's "Cosmos"

Type 3 question (An example)

Which of the following events, if they happened after Kepler made the conjecture mentioned in the passage, would have further supported his conjecture?

(multiple options may be correct)

1. People couldn’t come up with more than five regular solids, and no new planet was discovered.

2. The number of new planets discovered was in accordance with the number of new regular solids.

3. Distances of the planets from the sun, as measured using advanced telescopes, matched with that of the regular solids inscribed within one another.

4. Three new planets (Uranus, Neptune, and Pluto) were discovered through advanced telescopes.

Type 3 question (An example)

Correct options underlined:

1. People couldn’t come up with more than five regular solids, and no new planet was discovered.

2. The number of new planets discovered was in accordance with the number of new regular solids.

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4. Three new planets (Uranus, Neptune, and Pluto) were discovered through advanced telescopes.

Type 4 Question: Purpose

What is the author’s purpose behind writing the passage?

Possible options (often it can be multiple):

Explaining an idea

Describing some facts/ events

Advocating for an idea/ theory

Repudiating/ challenging an idea/ theory

Comparing two opposing ideas/ theory without taking any particular side

Type 4 Question: Purpose (An Example)

Perhaps the most influential person ever associated with Samos was Pythagoras, a contemporary of Polycrates in the sixth century B.C. He or his disciples discovered the Pythagorean theorem: the sum of the squares of the shorter sides of a right triangle equals the square of the longer side. Pythagoras did not "simply enumerate examples of this theorem; he developed a method of mathematical deduction to prove the thing generally. The modern tradition of mathematical argument, essential to all of science, owes much to Pythagoras. It was he who first used the word Cosmos to denote a well-ordered and harmonious universe, a world amenable to human understanding.

Excerpt From: Carl Sagan. "Cosmos." iBooks.

Type 4 Question: Purpose (An Example)

Which of the following is the author's main purpose in writing the passage? (choose the most suitable option)

1. State and explain the Pythagorean theorem

2. Advocate for the importance of mathematical deductions in science

3. Describe the contributions made by Pythagoras to mathematics and science

4. Challenge the contributions made by Pythagoras to mathematics and science

Type 4 Question: Purpose (An Example)

Correct answer underlined:

1. State and explain the Pythagorean theorem

2. Advocate for the importance of mathematical deductions in science

3. <u>Describe the contributions made by Pythagoras to mathematics and science</u>

4. Challenge the contributions made by Pythagoras to mathematics and science

Type 4 Question: Purpose (Another Example)

The Pythagoreans were fascinated by the regular solids, symmetrical three-dimensional objects all of whose sides are the same regular polygon. The cube is the simplest example, having six squares as sides. There are an infinite number of regular polygons, but only five regular solids. For some reason, knowledge of a solid called the dodecahedron having twelve pentagons as sides seemed to them dangerous. It was mystically associated with the Cosmos. The other four regular solids were identified, somehow, with the four "elements" then imagined to constitute the world; earth, fire, air and water. The fifth regular solid must then, they thought, correspond to some fifth element that could only be the substance of the heavenly bodies. (This notion of a fifth essence is the origin of our word quintessence.) Ordinary people were to be kept ignorant of the dodecahedron.

In love with whole numbers, the Pythagoreans believed all things could be derived from them, certainly all other numbers. A crisis in doctrine arose when they discovered that the square root of two (the ratio of the diagonal to the side of a square) was irrational, that $\sqrt{2}$ cannot be expressed accurately as the ratio of any two whole numbers, no matter how big these numbers are. Ironically this discovery was made with the Pythagorean theorem as a tool. "Irrational" originally meant only that a number could not be expressed as a ratio. But for the Pythagoreans it came to mean something threatening, a hint that their world view might not make sense, which is today the other meaning of "irrational." Instead of sharing these important mathematical discoveries, the Pythagoreans suppressed the knowledge of irrational numbers and the dodecahedron. The outside world was not to know. Even today there are scientists opposed to the popularization of science: the sacred knowledge is to be kept within the cult, unsullied by public understanding.

Excerpt From: Carl Sagan's "Cosmos"

Type 4 Question: Purpose (Another Example)

Which of the following is the author’s main purpose in writing the passage? (choose the most suitable option)

1. Describe the contributions made by Pythagoras to mathematics and science

2. Criticize the Pythogorians for their tendency to suppress scientific and mathematical discoveries

3. Explain how Pythagorians contradicted themselves

4. Undermine the importance of the study of solids and numbers in science

Type 4 Question: Purpose (Another Example)

Correct answer underlined:

1. Describe the contributions made by Pythagoras to mathematics and science

2. <u>Criticize the Pythogorians for their tendency to suppress scientific and mathematical discoveries</u>

3. Explain how Pythagorians contradicted themselves

4. Undermine the importance of the study of solids and numbers in science